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Test 1: Key Concepts in Biology

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Which of these parts is **not** found in a bacterial cell?

A Nucleus

B Cell membrane

C Ribosomes

[1]

2. Diffusion is where particles spread out from...

A ... an area of lower concentration to an area of higher concentration.

B ... an area of higher concentration to an area of lower concentration.

[1]

3. Chloroplasts...

A ... strengthen a plant cell.

B ... store all the genetic material of a cell.

C ... absorb light energy to make glucose.

[1]

4. If the concentration of water inside a cell is lower than outside the cell, what will the net movement of water molecules be?

A Into the cell

B Out of the cell

[1]

5. When using a light microscope to view a slide, which lens should be selected to start with?

A Lowest-powered objective lens

B Highest-powered objective lens

[1]

6. At 37 °C it took amylase 80 seconds to break down all of the starch in a solution. What was the rate of reaction?

A $20\ s^{-1}$

B $0.08\ s^{-1}$

C $12.5\ s^{-1}$

[1]

7. Why is the shape of an enzyme important for its function?

A So that it can squeeze through small gaps.

B So that it can enter the cells of the body.

C So that it fits the substance involved in the reaction it is catalysing.

[1]

8. Proteases catalyse the breakdown of...

A ... lipids into glycerol.

B ... proteins into amino acids.

C ... carbohydrates into simple sugars.

[1]

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9. Explain what is meant by an enzyme being 'denatured'.

.....

.....

[1]

10. Explain why the structure of the egg cell membrane changes after fertilisation.

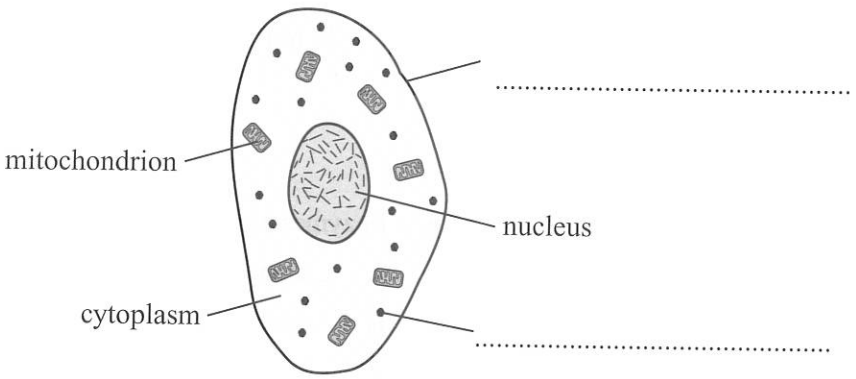
.....

.....

.....

[2]

11. Complete this diagram of an animal cell.



Describe the roles of the following parts of a cell:

Mitochondria .....

.....

Nucleus .....

.....

[4]

15

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Test 2: Key Concepts in Biology

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. What is the name for the process where perfume particles spread out in the air?

A Active transport

B Osmosis

C Diffusion

[1]

2. What is a vacuole?

A The space in a plant cell which is filled with cell sap.

B The space in a plant cell which contains chlorophyll.

[1]

3. Which of the following is a function of plant cell walls?

A To carry out protein synthesis.

B To control the cell's activities.

C To strengthen and support the cell.

[1]

4. A ribosome is 0.000021 mm in diameter. What is the diameter in nanometres?

A 0.021 nm

B 210 nm

C 21 nm

[1]

5. True or False? "An increase in pH will always increase enzyme activity."

A True

B False

[1]

6. Enzymes are biological catalysts that...

A ... slow down reactions in the body.

B ... speed up reactions in the body.

C ... are used up in reactions in the body.

[1]

7. What is the function of cilia on ciliated epithelial cells?

A Producing chemicals that kill bacteria.

B Moving substances along the surface of the tissue.

C Absorbing nutrients.

[1]

8. Which type of microscope has a higher magnification?

A Electron microscope

B Light microscope

[1]

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9. Explain one way in which a sperm cell is adapted to carry out its specialised function.

.....

.....

[1]

10. Electron microscopes have a higher resolution than light microscopes.
Give one reason why this is beneficial when viewing cells with an electron microscope.

.....

.....

[1]

11. What is active transport?

.....

.....

.....

[2]

12. Describe what happens to an enzyme if the temperature is too high.

.....

.....

.....

.....

[3]

15

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Test 3: Cells and Control

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Which is the correct pathway for stimuli along a reflex arc?

A relay neurone → sensory neurone → motor neurone

B sensory neurone → motor neurone → relay neurone

C sensory neurone → relay neurone → motor neurone

[1]

2. The 25th percentile on a percentile growth chart of mass for babies shows...

A ... the mass that 25% of babies will have reached at a certain age.

B ... the age at which 25% of babies will have reached a certain mass.

[1]

3. What happens inside a cell during the interphase stage of mitosis?

A The number of subcellular structures increases.

B The arms of chromosomes are pulled to opposite ends of the cell.

C The cytoplasm divides.

[1]

4. Plants grow via the processes of...

A ... cell division and cell elongation only.

B ... cell division and cell differentiation only.

C ... cell division, cell differentiation and cell elongation.

[1]

5. Which of the following diseases is caused by uncontrolled cell division?

A Cardiovascular disease

B Cancer

C Cholera

[1]

6. True or False? "Mitosis results in two cells that are genetically different."

A True

B False

[1]

7. What is a cell called when it has differentiated?

A An unspecialised cell.

B A specialised cell.

C A stem cell.

[1]

8. What is the central nervous system made up of?

A The brain and receptors

B The brain and the spinal cord

C The spinal cord and receptors

[1]

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9. What is an embryonic stem cell?

.....

.....

.....

[2]

10. Describe how electrical impulses are transferred from neurone to neurone.

.....

.....

.....

[2]

11. Give three uses of mitosis in multicellular organisms.

1. .....

2. .....

3. .....

[3]

15

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Test 4: Genetics

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. What effect do mutations have on variation?

A They decrease it.

B They increase it.

C There is no effect.

[1]

2. True or False? "Some gametes are genetically identical to each other."

A True

B False

[1]

3. What sex chromosomes does someone who is biologically male have?

A XY

B XXX

C XX

[1]

4. True or False? "A mutation always has an effect on a species."

A True

B False

[1]

5. What structure does DNA have?

A A long, single, straight chain

B A triple helix structure

C A double helix structure

[1]

6. What is an organism's genotype?

A The characteristics that the organism has.

B The alleles that the organism has.

[1]

7. Complementary base pairing means that in DNA...

A ... A always pairs with T and C always pairs with G.

B ... A always pairs with C and G always pairs with T.

C ... A always pairs with G and T always pairs with C.

[1]

8. Which of the following describes an organism that has two different alleles for a trait.

A Homozygous

B Heterozygous

C Haploid

[1]

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9. What does a single nucleotide consist of?

.....

.....

.....

[3]

10. A tall pea plant with two dominant 'T' alleles and a dwarf pea plant with two recessive 't' alleles are crossed to produce a pea plant with the genotype Tt. What will the new plant's phenotype be? Explain your answer.

.....

.....

.....

[2]

11. A student is extracting DNA from kiwi fruit. She mashes the kiwis up and adds them to a beaker containing a solution of detergent and salt. Explain why the detergent and salt are used in this process.

Detergent: .....

.....

Salt: .....

.....

[2]

15

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Test 5: Natural Selection & Genetic Modification

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "It's completely random which organisms survive and pass on their genes to the next generation."

A True

B False

[1]

2. How are genes 'cut out' from chromosomes in genetic engineering?

A Using restriction enzymes

B Using bacteria

C Using ligase

[1]

3. If a farmer wants to increase the meat yield of his cattle, he would breed from...

A ... the biggest cows.

B ... the cows that produce the most milk.

C ... those with a gentle temperament.

[1]

4. The three domain system is made up of which three domains?

A Plants, Animals and Fungi

B Eukarya, Archaea and Bacteria

C Eukarya, Prokaryotes and Protists

[1]

5. How old is the fossil hominid 'Ardi'?

A 1.6 million years old

B 3.2 thousand years old

C 4.4 million years old

[1]

6. In genetic engineering, what is the enzyme ligase used for?

A To join two pieces of DNA together.

B To cut DNA at a specific sequence.

C To break down the DNA.

[1]

7. The five kingdom classification system is made up of which five kingdoms?

A Animals, Plants, Insects, Bacteria and Eukaryotes

B Animals, Plants, Fungi, Prokaryotes and Protists

C Fish, Amphibians, Reptiles, Birds and Mammals

[1]

8. The increase in complexity of stone tools over time provides evidence for the evolution of increased...

A ... leg length in humans.

B ... brain size in humans.

C ... hand size in humans.

[1]

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9. Give one way that stone tools can be dated.

.....

.....

[1]

10. Give two risks of selective breeding.

1. .....

.....

2. .....

.....

[2]

11. What is genetic engineering?

.....

.....

.....

[2]

12. Explain how antibiotic resistance in bacteria is evidence for the theory of natural selection.

.....

.....

.....

.....

[2]

15

Test 6: Health, Disease & the Development of Medicines

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Diseases that can be passed from one person to another are known as...

A ... communicable diseases.

B ... non-communicable diseases.

C ... cardiovascular diseases.

[1]

2. True or False? "When treating cardiovascular disease, surgical procedures are often recommended before lifestyle changes because there are fewer risks involved."

A True

B False

[1]

3. Chalara ash dieback causes...

A ... damage to the liver.

B ... leaf loss and bark lesions.

C ... AIDS.

[1]

4. What is the first stage of testing a new medicinal drug?

A The drug is tested on human cells and tissues in the lab.

B The drug is tested on human volunteers in a clinical trial.

[1]

5. How does the stomach help to defend the body against pathogens?

A It secretes hydrochloric acid to kill pathogens.

B It contains hairs to trap pathogens.

C It secretes antibodies to kill pathogens.

[1]

6. What is an organism that causes a communicable disease called?

A An antibody

B An antigen

C A pathogen

[1]

7. True or False? "Antibiotics can kill viruses."

A True

B False

[1]

8. Which of the following measures can reduce the spread of *Chlamydia*?

A Having access to a clean water supply.

B Using insect repellent.

C Wearing a condom when having sex.

[1]

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9. Describe how cholera is spread.

.....

[1]

10. Explain how mosquito nets help to prevent the spread of malaria.

.....

.....

.....

[2]

11. Give one physical barrier in the nose that helps to defend the body against disease.

.....

[1]

12. Explain how immunisation can protect against a disease.

.....

.....

.....

.....

[3]

15

Test 7: Health, Disease & the Development of Medicines

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "Preclinical trials test drugs on healthy volunteers."

A True

B False

[1]

2. What do white blood cells produce to help defend against pathogens?

A Antigens

B Antibiotics

C Antibodies

[1]

3. Which of the following diseases is caused by a protist?

A Cholera

B Malaria

C Chalara ash dieback

[1]

4. How is the pathogen *Mycobacterium tuberculosis* spread?

A By contaminated water

B By air

C By a vector

[1]

5. Which of the following is a non-communicable human disease?

A Cancer

B Tuberculosis

C Ebola

[1]

6. True or False? "Pathogens include bacteria, protists and fungi only."

A True

B False

[1]

7. Health is...

A ... the state of physical well-being only.

B ... the state of mental and emotional well-being.

C ... the state of physical, mental and social well-being.

[1]

8. True or False? "Making changes to a patient's lifestyle can reduce their risk of developing cardiovascular disease."

A True

B False

[1]

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9. A person has a mass of 89.1 kg and is 1.80 m tall. Calculate their BMI.

.....

.....

..... $kg\ m^{-2}$

[2]

10. Give one example of a chemical defence of the human body.

.....

[1]

11. Give two ways in which the spread of HIV can be prevented.

1. .....

.....

2. .....

.....

[2]

12. Name a bacterial disease and give one symptom of this disease.

.....

.....

[2]

15

Test 8: Biology 1 Mixed Topics

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "Immunisations usually involve injecting small amounts of dead or inactive pathogens into the body."

A True

B False

[1]

2. What is a fertilised egg cell also known as?

A A zygote

B A gamete

C A daughter cell

[1]

3. True or False? "An organism's phenotype can only be determined by the genes it has inherited."

A True

B False

[1]

4. If you place a slice of potato in a solution that has a higher sugar concentration than the fluid inside the potato, the potato will...

A ... release water and decrease in mass.

B ... absorb water and increase in mass.

[1]

5. What is the fossil hominid found 3.2 million years ago known as?

A Ardi

B Lucy

C Turkana boy

[1]

6. If human body cells have 46 chromosomes, how many chromosomes does a gamete have?

A 46

B 92

C 23

[1]

7. True or False? "Most characteristics are controlled by a single gene."

A True

B False

[1]

8. A reflex arc...

A ... only involves the brain.

B ... only involves the conscious part of the brain.

C ... doesn't involve the conscious part of the brain.

[1]

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9. A student investigates the effect of pH on the reaction rate of amylase on starch solution. Give one example of a variable that must be controlled in this investigation.

.....

How could this variable be controlled?

.....

[2]

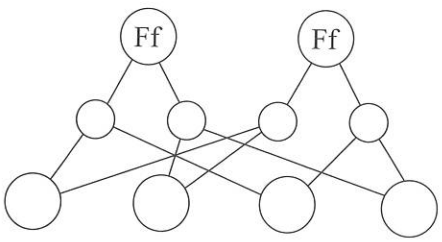
10. Complete this equation for magnification.

$$\text{magnification} = \frac{\text{.....}}{\text{.....}}$$

[1]

11. Cystic fibrosis is a genetic disorder caused by a recessive allele. Rachael and Henry are about to have a child. Both of them carry the cystic fibrosis allele, but do not have the disease. Complete the genetic diagram to show the possible genotypes of the child.

Use **F** to represent the dominant allele and **f** to represent the recessive allele.



What is the chance that their child will have cystic fibrosis?
Explain your answer.

.....

.....

.....

.....

[4]

15

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Test 9: Biology 1 Mixed Topics

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Which process allows glucose to move from a higher concentration in the gut to a lower concentration in the blood?

A Active transport

B Osmosis

C Diffusion

[1]

2. What is a gene?

A An amino acid

B A protein

C A section of DNA

[1]

3. True or False? "Having a disease can lead to greater susceptibility to other diseases."

A True

B False

[1]

4. If a dog with long hair (Hh) was bred with a dog with short hair (hh), what possible combinations of alleles could be produced?

A hh

B HH

C Hh, hh

[1]

5. True or False? "Synapses connect receptors."

A True

B False

[1]

6. What are alleles?

A Male sex chromosomes

B Two gametes fused together

C Different versions of the same gene

[1]

7. Which scientist found hominid fossils that were 1.6 million years old?

A Darwin

B Leakey

C Wallace

[1]

8. What type of pathogen causes cholera?

A A fungus

B A virus

C A bacterium

[1]

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9. A 7.8 g potato cylinder was placed in a sucrose solution for an hour. Afterwards, the mass of the cylinder was 6.6 g. Calculate the percentage change in mass.

.....

.....

.....%

[2]

10. Give one risk factor for cardiovascular disease.

.....

[1]

11. Explain one medical application of the information collected by the Human Genome Project.

.....

.....

.....

[2]

12. Give the two processes by which animals grow.

1. .....

2. .....

[2]

15

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Test 10: Plant Structures and Their Functions

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. What do phloem tubes transport?

A Oxygen

B Sucrose

C Minerals

[1]

2. What is the name of the cells that control the opening and closing of stomata?

A Palisade cells

B Guard cells

C Meristem cells

[1]

3. True or False? "As the level of carbon dioxide increases, the rate of photosynthesis will always increase."

A True

B False

[1]

4. Other than oxygen, what does photosynthesis produce?

A Carbon dioxide

B Water

C Glucose

[1]

5. What would you expect to happen to the volume of oxygen produced by pondweed if light intensity increased, and it was the limiting factor?

A It would increase.

B It would stay the same.

C It would decrease.

[1]

6. What group of organisms are the main producers of biomass on Earth?

A Photosynthetic organisms

B Primary consumers

C Animals

[1]

7. Which of the following processes requires energy from respiration?

A Translocation

B Transpiration

[1]

8. On which of the following days is a plant's water uptake likely to be the greatest?

A A cold day

B A still day

C A sunny day

[1]

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9. Describe one way in which a root hair cell is adapted to absorb water and mineral ions from the soil.

.....

[1]

10. Explain what happens to the rate of photosynthesis if a plant is put in a dark place.

.....

.....

.....

[2]

11. Explain how increasing air movement around a plant's leaves would affect the rate of transpiration.

.....

.....

.....

.....

.....

.....

[4]

15

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Test 11: Animal Coordination, Control & Homeostasis

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. What is the hormone that controls the 'fight or flight' response?

A Thyroxine

B Adrenaline

C Glucagon

[1]

2. The gland which releases thyroxine is...

A ... the pituitary gland.

B ... the adrenal gland.

C ... the thyroid gland.

[1]

3. What is secreted by the pancreas when the blood glucose level falls?

A Glucose

B Insulin

C Glucagon

[1]

4. When the body detects that the level of a substance has gone above or below the normal level it triggers a response to bring the level back to normal again. This is called...

A ... negative feedback.

B ... positive feedback.

[1]

5. Which of the following is a barrier method of contraception?

A Diaphragm

B Contraceptive patch

C Combined pill

[1]

6. True or False? "Even when used correctly, hormonal contraceptives are less effective than barrier methods."

A True

B False

[1]

7. Which of the following is a function of oestrogen?

A Inhibiting the release of FSH and LH.

B Causing the lining of the uterus to thicken.

C Stimulating a follicle to mature.

[1]

8. Which of the following hormones causes the liver to turn glucose into glycogen?

A Thyroxine

B Glucagon

C Insulin

[1]

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9. Explain how adrenaline affects the body's blood sugar level.

.....

.....

[2]

10. Describe how hormones are used in *in vitro* fertilisation (IVF).

.....

.....

.....

[2]

11. What is the role of progesterone in the menstrual cycle?

.....

[1]

12. Explain what Type 1 diabetes is, and why it is dangerous.

.....

.....

.....

[2]

15

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Test 12: Exchange and Transport in Animals

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Which of these are **not** features of arteries?

A Elastic fibres

B Thick walls

C Valves

[1]

2. Which of these is **not** a chamber of the heart?

A Left ventricle

B Right atrium

C Vena cava

[1]

3. What is the function of white blood cells?

A They deliver nutrients around the body.

B They transport deoxygenated blood around the body.

C They defend the body against microorganisms.

[1]

4. True or False? "Blood flows to the organs through veins."

A True

B False

[1]

5. True or False? "Aerobic respiration occurs in plants and animals all the time."

A True

B False

[1]

6. Which type of respiration transfers more energy?

A Aerobic respiration

B Anaerobic respiration

[1]

7. Which of the following substances do animals need to take in from the environment?

A Urea

B Oxygen

C Carbon dioxide

[1]

8. A rhino is represented by a 2 m × 2 m × 4 m block. What is its surface area to volume ratio?

A 2.5 : 1

B 4 : 1

C 1.5 : 1

[1]

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9. What is the function of valves in the heart?

.....

[1]

10. Calculate the cardiac output of a person with an average stroke volume of 88 cm^3 and a heart rate of 80 bpm.

.....

.....

..... $cm^3\ min^{-1}$

[2]

11. Give two components of blood that are carried in the blood plasma.

1. .....

2. .....

[2]

12. Name the blood vessel that carries blood from the lungs to the heart.

.....

Name the blood vessel that carries blood from the heart to the body.

.....

[2]

15

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Test 13: Exchange and Transport in Animals

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Respiration is an...

A ... exothermic reaction.

B ... endothermic reaction.

[1]

2. Which of these characteristics makes the alveoli efficient at gas exchange?

A They have thick walls.

B They have a large surface area.

C They don't have a good blood supply.

[1]

3. Aerobic respiration produces...

A ... glucose.

B ... carbon dioxide only.

C ... water and carbon dioxide.

[1]

4. True or False? "Anaerobic respiration requires oxygen."

A True

B False

[1]

5. What is cardiac output?

A The number of times the heart beats per minute.

B The total volume of blood pumped by a ventricle every minute.

C The volume of blood pumped by one ventricle each time it contracts.

[1]

6. Which of the following is **not** a way that red blood cells are specialised for their function?

A They have a biconcave disc shape to give a large surface area.

B They don't have a nucleus to allow more room to carry oxygen.

C They contain lots of mitochondria so that they have energy to move around the body.

[1]

7. Capillaries are able to exchange substances with cells in the body because...

A ... they have valves.

B ... they have permeable walls.

C ... they have a large lumen.

[1]

8. Which of the following is a product of anaerobic respiration in animals?

A Ethanol

B Lactic acid

C Hydrochloric acid

[1]

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9. Explain why the left ventricle of the heart has a thicker wall than the right ventricle.

.....

.....

.....

[2]

10. Give two differences between arteries and veins.

1. .....

.....

2. .....

.....

[2]

11. Explain why multicellular organisms need transport systems.

.....

.....

.....

.....

.....

[3]

15

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Test 14: Ecosystems and Material Cycles

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "Reforestation can help to increase biodiversity."

A True

B False

[1]

2. What is a quadrat?

A A line through a habitat along which distribution is studied.

B A square frame enclosing a known area.

C A piece of apparatus that measures water uptake in plants.

[1]

3. How can you study the distribution of organisms in a way that will give reproducible results?

A Always take the sample from the same place.

B Use a small sample size.

C Use a large sample size.

[1]

4. What is meant by 'a population'?

A All the organisms of different species in a habitat.

B All the organisms of one species in a habitat.

C A community of organisms and all the abiotic conditions.

[1]

5. True or false? "Communities are affected by both abiotic and biotic factors."

A True

B False

[1]

6. What role do nitrogen-fixing bacteria play in the nitrogen cycle?

A They turn ammonia into nitrites and then nitrates.

B They turn nitrates into nitrogen gas.

C They turn atmospheric nitrogen into ammonia.

[1]

7. What is a species that doesn't naturally occur in an area known as?

A An indigenous species

B A native species

C A non-indigenous species

[1]

8. Desalination...

A ... removes salt from sea water.

B ... is a type of precipitation.

C ... increases the salt concentration of potable water.

[1]

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9. How does respiration contribute to the carbon cycle?

.....

[1]

10. Suggest two biotic factors that might cause a decrease in the population of a species.

1. .....

2. .....

[2]

11. Describe the relationship between a parasite and its host.

.....

.....

.....

[2]

12. Give two ways in which fish farming decreases biodiversity.

1. .....

.....

2. .....

.....

[2]

15

Test 15: Ecosystems and Material Cycles

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "To study the effect of an abiotic factor on the distribution of an organism, you could use a transect."

A True

B False

[1]

2. Competition is an example of...

A ... a biotic factor.

B ... an abiotic factor.

[1]

3. If a new predator arrives in an area, will the size of the prey population increase or decrease?

A Increase

B Decrease

[1]

4. Which of the following processes removes carbon dioxide from the air?

A Respiration

B Decomposition

C Photosynthesis

[1]

5. It's important to maintain a high level of global biodiversity because...

A ... it protects the human food supply.

B ... it will decrease the amount of waste.

C ... it will increase global warming.

[1]

6. True or False? "In the water cycle, water falls from clouds in a process called evaporation."

A True

B False

[1]

7. All the organisms of different species living in a habitat are know as...

A ... a population.

B ... a genus.

C ... a community.

[1]

8. Which of the following does **not** add nitrates back into the soil?

A Using artificial fertilisers

B Harvesting crops

C Crop rotation

[1]

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9. What is interdependence?

.....

.....

[1]

10. What is mutualism?

.....

.....

[2]

11. Explain how excess nitrates from fertilisers can cause eutrophication if they get into rivers and lakes.

.....

.....

.....

.....

.....

.....

[4]

15

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Test 16: Biology 2 Mixed Topics

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "Prokaryotic organisms can be multicellular."

A True

B False

[1]

2. Which of the following may be used to control type 2 diabetes?

A Taking injections of glucagon.

B Avoiding all forms of exercise.

C Eating a healthy diet.

[1]

3. An ecosystem is...

A ... the individuals of a species that live in a habitat.

B ... a community of living organisms.

C ... a community of living organisms and the non-living conditions of their environment.

[1]

4. A plant cutting lost 0.15 cm^3 of water in 20 minutes. What is its transpiration rate?

A 7.5×10^{-3} cm^3 min^{-1}

B 0.13 cm^3 min^{-1}

C 1.21×10^{-2} cm^3 min^{-1}

[1]

5. Which of the following is **not** a role of LH in the menstrual cycle?

A To stimulate the remains of the follicle to develop into a corpus luteum.

B To stimulate ovulation.

C To cause the uterus lining to thicken.

[1]

6. Why do alveoli need a good blood supply?

A To maintain the concentration gradients of oxygen and carbon dioxide.

B To increase their surface area.

C To minimise the distances the gases have to move.

[1]

7. How is a decrease in temperature likely to affect water uptake by a plant?

A It will increase water uptake.

B It will decrease water uptake.

C It will have no overall effect.

[1]

8. Which of the following hormones increases blood flow to the muscles?

A Oestrogen

B Insulin

C Adrenaline

[1]

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9. Give three substances that plants need to take in from the environment.

1. .....

2. .....

3. .....

[3]

10. Explain how clomifene therapy works.

.....

.....

.....

[2]

11. Explain why a person's waist-to-hip ratio is linked to their likelihood of developing type 2 diabetes.

.....

.....

.....

.....

[2]

15

Test 17: Biology 2 Mixed Topics

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. The right ventricle pumps blood to...

A ... the muscles.

B ... the brain.

C ... the lungs.

[1]

2. Hormones are transported in the blood from...

A ... target organs to endocrine glands.

B ... endocrine glands to target organs.

C ... the heart to endocrine glands.

[1]

3. True or False? "Quadrats can be used with transects."

A True

B False

[1]

4. What effect does adrenaline have on blood pressure?

A It has no effect.

B It decreases it.

C It increases it.

[1]

5. Enzymes only work with one substrate, so they are said to...

A ... have low specificity.

B ... have high specificity.

C ... be complementary.

[1]

6. What does a respirometer measure?

A The amount of oxygen consumed by organisms in a given time.

B The amount of carbon dioxide produced by organisms in a given time.

C The amount of glucose consumed by organisms in a given time.

[1]

7. When is TSH released from the pituitary gland?

A After the release of TRH is stimulated.

B After the release of TRH is inhibited.

C When the blood thyroxine level is higher than normal.

[1]

8. True or False? "If taken every day, oestrogen can be used to prevent the release of an egg from the ovaries."

A True

B False

[1]

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9 Complete the equation for photosynthesis.

..... energy

..... + water ⟶ ..... + oxygen

[2]

10. What is the function of xylem vessels?

.....

Give one way in which they're adapted for this function.

.....

.....

[2]

11. Complete the formula that links light intensity and distance.

$$\text{light intensity} \propto \frac{\text{.....}}{\text{.....}}$$

[1]

12. A biologist used a quadrat with an area of 0.25 m^2 to randomly sample limpets on a beach. The mean number of limpets per quadrat was 22. The area of the beach was 1800 m^2. Estimate the population of limpets on the beach.

.....

.....

..... limpets

[2]

15

Test 18: Key Concepts in Chemistry

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Magnesium has 12 electrons.
What will its electronic configuration be?

A 6.6

B 8.4

C 2.8.2

[1]

2. Which of the following is a typical physical property of non-metals?

A Good conductor of electricity

B Shiny

C Low boiling point

[1]

3. What type of bond is formed when two hydrogen atoms form a molecule?

A An ionic bond

B A compound bond

C A covalent bond

[1]

4. True or False? "One mole of oxygen contains more molecules than one mole of hydrogen."

A True

B False

[1]

5. What name is given to the total number of protons and neutrons in an atom?

A Isotopic abundance

B Atomic number

C Mass number

[1]

6. True or False? "A group is a vertical column in the periodic table."

A True

B False

[1]

7. True or False? "Ionic compounds conduct electricity when dissolved in water but not when molten."

A True

B False

[1]

8. Which of the following features is present in metallic bonding?

A Delocalised electrons

B A shared pair of electrons

C Two oppositely charged ions

[1]

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9. In the modern periodic table, what do the electronic configurations of elements in the same group have in common?

.....

[1]

10. Balance the following chemical equation:

$$\text{.....Li} + \text{.....}H_2O \rightarrow \text{.....LiOH} + \text{.....}H_2$$

[1]

11. 66 g of carbon are burnt completely in oxygen to produce CO_2.

The equation for the reaction is: $C + O_2 \rightarrow CO_2$.

Calculate the mass of CO_2 produced.

Relative atomic masses (A_r): C = 12, O = 16

.....

.....

.....

.....

..... g

[3]

12. Describe the bonding in an O_2 molecule.

.....

.....

.....

[2]

15

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Test 19: Key Concepts in Chemistry

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Giant covalent structures have...

A ...high melting points.

B ...low melting points.

[1]

2. True or False? "Simple molecular substances are generally good conductors of electricity."

A True

B False

[1]

3. When calcium is burned in an open container, it reacts with oxygen in the air to form calcium oxide. The reactant in excess is...

A ...calcium.

B ...oxygen.

C ...calcium oxide.

[1]

4. Why do ionic compounds have high boiling points?

A The forces between the ions are weak.

B It takes a lot of energy to overcome the forces between the ions.

[1]

5. The molecular formula of butanoic acid is $C_4H_8O_2$. What is its empirical formula?

A C_2H_4O

B CH_2O

C CHO

[1]

6. True or False? "During a chemical reaction no atoms are created or destroyed."

A True

B False

[1]

7. What is the relative formula mass (M_r) of KOH? Relative atomic masses (A_r):
H = 1, O = 16, K = 39

A 39

B 28

C 56

[1]

8. Mendeleev used his periodic table to predict the properties of elements that hadn't been discovered at the time.
He based his predictions on properties of...

A ...elements in the same row.

B ...elements in the same column.

C ...elements with the same atomic mass.

[1]

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9. What are isotopes?

.....

.....

[1]

10. 0.00025 kg of NaOH is dissolved in 0.5 dm^3 of water.
What is the concentration of the solution, in g dm^{-3}?

.....

.....

.....

..... g dm^{-3}
[2]

11. Solid sodium chloride has a giant ionic lattice structure. Describe this structure.

.....

.....

.....
[2]

12. Explain why graphite can conduct electricity.

.....

.....

.....
[2]

15

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Test 20: States of Matter and Mixtures

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Which of the following is used to separate mixtures in fractional distillation?

A Differences in melting point

B Differences in boiling point

C Differences in solubility

[1]

2. In which state of matter are the particles furthest apart?

A Solid

B Liquid

C Gas

[1]

3. What technique (or techniques) would be best for separating a mixture of salt, water and sand?

A Evaporation

B Filtration and crystallisation

C Chromatography

[1]

4. True or False? "Air is a chemically pure substance."

A True

B False

[1]

5. Which stage of the water treatment process involves removing large, solid impurities?

A Filtration

B Sedimentation

C Chlorination

[1]

6. In paper chromatography...

A ...the solvent is the stationary phase.

B ...the solvent is the mobile phase.

C ...the solvent is the mixture of substances being analysed.

[1]

7. A liquid turns into a solid. What is this process called?

A Condensation

B Sublimation

C Freezing

[1]

8. Which of the following processes could be used to make sea water potable?

A Distillation

B Filtration

C Chlorination

[1]

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9. Describe how the arrangement and motion of particles in a substance change as the substance turns from a liquid into a gas.

.....

.....

.....

[2]

10. A student is using fractional distillation to separate a mixture of two liquid compounds. Some information about the compounds is shown in the table below.

Compound	Boiling point (°C)
Compound 1	97
Compound 2	65

The student puts the mixture in a flask, with a fractionating column attached. A condenser is attached to the top of the column. The student heats the flask, so that the mixture boils. The temperature at the top of the fractionating column is 70 °C. Describe how fractional distillation separates the two compounds.

.....

.....

.....

.....

.....

.....

[3]

11. Explain how the pattern of spots produced in a paper chromatography experiment can be used to distinguish a pure substance from an impure substance.

.....

.....

[2]

15

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Test 21: States of Matter and Mixtures

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "Paper chromatography can be used to separate out the different elements within a compound."

A True

B False

[1]

2. When a substance changes from a gas into a liquid...

A ...the particles gain energy and move around faster.

B ...the particles move further apart.

C ...the particles lose energy and move closer together.

[1]

3. When using fractional distillation to separate a mixture of liquids in the lab, which liquid will be collected first?

A The liquid with the lowest boiling point.

B The liquid with the highest boiling point.

C The most abundant liquid.

[1]

4. How many different phases are used in paper chromatography?

A 1

B 2

C 3

[1]

5. Which of these changes of state does **not** take place at the boiling point of a substance?

A Freezing

B Condensing

C Boiling

[1]

6. True or False? "Water used to dilute a substance for chemical analysis should not contain any dissolved salts."

A True

B False

[1]

7. Which of the following processes can be used to obtain a sample of solid sugar from a water and sugar solution?

A Filtration

B Chromatography

C Crystallisation

[1]

8. What is meant by a chemically pure substance?

A A mixture in which all substances are in the same state of matter.

B A substance that contains only one element or chemical compound.

C A substance that is clear and transparent.

[1]

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9. A student carries out paper chromatography on a pure substance. The solvent travelled 4.9 cm up the chromatography paper. The substance left a spot 3.2 cm up the paper. What is the R_f value of the substance? Give your answer to 2 significant figures.

$$R_f = \frac{\text{distance travelled by solute}}{\text{distance travelled by solvent}}$$

.....

.....

R_f = ...

[2]

10. Look at the table below. Which substance is a gas at 90 °C?

	Melting point (°C)	Boiling point (°C)
Ethanol	−114	78
Water	0	100
Iodine	114	184

.....

[1]

11. A student wants to use paper chromatography to determine the number of dyes used in an ink. Describe how the student should set up this experiment.

.....

.....

.....

.....

.....

[3]

12. A scientist is testing the melting point of water using a block of ice. They take samples of the ice, and find that the samples they test reach their melting points over a range of temperatures. Suggest why this is.

.....

[1]

15

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Test 22: Chemical Changes

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. What does a pH of 7 indicate?

A An acidic solution

B An alkaline solution

C A neutral solution

[1]

2. True or False? "An insoluble base will react with an acid."

A True

B False

[1]

3. What is an alkali?

A A soluble base

B A soluble acid

C An insoluble base

[1]

4. In electrolysis, at the cathode, positively charged ions...

A ...are oxidised.

B ...are reduced.

C ...dissolve.

[1]

5. How does the concentration of hydrogen ions in a solution change as the pH increases from 2 to 3?

A It increases by a factor of 10.

B It decreases by a factor of 10.

C It increases by a factor of 1.5.

[1]

6. A solution of potassium hydroxide reacts with nitric acid to produce...

A ...carbon dioxide and water.

B ...a metal oxide and water.

C ...a salt and water.

[1]

7. What are the products in the electrolysis of molten potassium bromide?

A Potassium metal and oxygen

B Hydrogen gas and bromine gas

C Potassium metal and bromine gas

[1]

8. True or False? "Hydroxide ions make solutions acidic."

A True

B False

[1]

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9. Name the two substances formed in the electrolysis of sodium chloride solution. Explain your reasoning for each one.

1. .....

.....

2. .....

.....

[4]

10. Give the ionic equation for the reaction between hydrogen ions and hydroxide ions when an acid reacts with an alkali. Include state symbols in your answer.

.....

[1]

11. Copper sulfate is a soluble salt produced in the reaction between copper oxide and sulfuric acid. Give **one** reason why excess copper oxide is added to the sulfuric acid during the production of copper sulfate.

.....

.....

[1]

12. How can limewater be used to test for carbon dioxide?

.....

.....

[1]

15

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Test 23: Chemical Changes

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Which of the following reactions does **not** produce water?

A Hydrochloric acid with magnesium.

B Sulfuric acid with magnesium oxide.

C Nitric acid with magnesium carbonate.

[1]

2. How can a solid salt be obtained from a salt solution?

A By adding an indicator.

B By adding a catalyst.

C By crystallisation of the salt solution.

[1]

3. True or False? "The higher the concentration of hydrogen ions in a solution, the lower the pH."

A True

B False

[1]

4. Which of the following is an electrolyte?

A A molten or dissolved ionic compound.

B An electric current running through a solution.

C A positively charged electrode.

[1]

5. Which of the following compounds is insoluble in water?

A Potassium chloride

B Calcium carbonate

C Sodium sulfate

[1]

6. What colour is litmus in alkaline solutions?

A Red

B Purple

C Blue

[1]

7. During electrolysis, anions migrate towards the...

A ...positively charged electrode.

B ...negatively charged electrode.

[1]

8. A weak acid is defined as...

A ...an acid with a low pH.

B ...an acid with a low concentration.

C ...an acid that does not fully ionise in solution.

[1]

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9. Name the two products formed in the reaction between sulfuric acid and zinc oxide.

1. .....

2. .....

[2]

10. A student adds a few drops of methyl orange to some dilute hydrochloric acid.
She then slowly adds calcium oxide powder to the solution, until no more will react.
Describe the colour change that the student will observe in the solution.

.....

[1]

11. A solution of copper sulfate is electrolysed using copper electrodes.
Write a half equation for the reaction that occurs at the anode.

.....

[1]

12. When calcium chloride solution is added to magnesium sulfate solution,
a precipitate of calcium sulfate is formed.
Describe the next steps required to obtain a pure, dry sample of calcium sulfate.

.....

.....

.....

.....

.....

[3]

15

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Test 24: Extracting Metals and Equilibria

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Which reaction shows the oxidation of iron?

A $Zn + FeSO_4 \rightarrow ZnSO_4 + Fe$

B $4Fe + 3O_2 \rightarrow 2Fe_2O_3$

C $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$

[1]

2. True or False? "All metals are found in the ground as ores."

A True

B False

[1]

3. True or False? "Metals below carbon in the reactivity series can be extracted by reduction using carbon."

A True

B False

[1]

4. The main goal of a life-cycle assessment is to assess...

A ...the total environmental impact of a product.

B ...the economic cost of a product.

C ...how long a product will be in use.

[1]

5. What effect will decreasing the temperature have on the yield of the exothermic reaction in a reversible reaction?

A Increase it

B Decrease it

C Have no effect

[1]

6. When a reversible reaction occurs in a sealed reaction vessel, when is dynamic equilibrium reached?

A When all the reactants are used up.

B When the amounts of products and reactants are equal.

C When the rates of the forward and reverse reactions are equal.

[1]

7. Which of the following is an advantage of using bacterial methods to extract copper from its ore?

A They're quicker than electrolysis.

B They're slower than reduction with carbon.

C They can be used on low-grade ores.

[1]

8. True or False? "The Haber process is carried out at a very low temperature."

A True

B False

[1]

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9. Name a metal that is extracted from its ore by electrolysis, and explain why it is extracted this way.

Metal: .....

Explanation: .....

.....

[2]

10. A student added pieces of magnesium and iron to two beakers of hydrochloric acid. She noticed that magnesium reacted faster than iron. Describe what the student saw that led her to this conclusion, and explain why magnesium reacts faster than iron.

.....

.....

.....

.....

.....

[3]

11. The reaction used to produce ammonia is: $N_2 + 3H_2 \rightleftharpoons 2NH_3$

Suggest a source for each of the two reactants in this reaction.

.....

.....

.....

[2]

15

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Test 25: Extracting Metals and Equilibria

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. In a reversible reaction, increasing the concentration of reactants will favour the reaction that forms...

A ...more product until equilibrium is reached again.

B ...less product until equilibrium is reached again.

[1]

2. What is phytoextraction?

A A process that uses displacement reactions to extract copper.

B A process that uses bacteria to separate metals from low-grade ores.

C A process that uses plants to separate metals from low-grade ores.

[1]

3. Decreasing the pressure of a gaseous reversible reaction at equilibrium will cause the equilibrium to...

A ...move in the direction where there are fewer molecules of gas.

B ...move in the endothermic direction.

C ...move in the direction where there are more molecules of gas.

[1]

4. The reaction between magnesium and copper(II) sulfate is:

$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$

Which metal gains electrons during this reaction?

A Magnesium

B Copper

[1]

5. Which of the following metals is most easily oxidised?

A Sodium

B Silver

C Aluminium

[1]

6. Which of the following is used as a catalyst in the Haber process?

A Iron

B Vanadium pentoxide

C Aluminium oxide

[1]

7. Iron is usually extracted from its ores by reduction with carbon rather than by electrolysis. This is because...

A ...reduction with carbon doesn't produce CO_2.

B ...iron can't be produced from its ores by electrolysis.

C ...reduction with carbon is cheaper.

[1]

8. Two metals, Q and R, are tested for their reactions with water. Metal Q reacted with cold water. Metal R reacted with steam, but not with cold water. Which is the more reactive metal?

A Metal Q

B Metal R

[1]

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9. Give **four** stages of a product's life that are examined during a life cycle assessment.

1. .....

2. .....

3. .....

4. .....

[4]

10. Suggest **two** ways in which recycling metals is better for the environment than extracting new metals from their ores.

1. .....

.....

2. .....

.....

[2]

11. Metal A will displace metal B from an aqueous solution of a salt of metal B.
What does this tell you about metal A?

.....

[1]

15

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Test 26: Chemistry 1 Mixed Topics

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Evaporation is an example of a...

A ...chemical change.

B ...physical change.

[1]

2. In the following example, what physical state is the hydrochloric acid in?

$Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2\,(aq)} + H_{2\,(g)}$

A Solid

B Gas

C Aqueous solution

[1]

3. An acid with a large number of acid molecules compared to the volume of water is said to be...

A ...strong.

B ...dilute.

C ...concentrated.

[1]

4. What is the mass of one mole of $^{12}_{6}C$?

A 18 g

B 6 g

C 12 g

[1]

5. Which of the following is **not** a method used to extract metals from their ores?

A Reduction of ores by carbon

B Oxidation of ores by carbon

C Electrolysis

[1]

6. Which gas is produced when a metal carbonate reacts with dilute acid?

A Carbon dioxide

B Hydrogen

C Oxygen

[1]

7. Which of the following **cannot** be used to show that a sample of a solid, soluble dye is impure?

A Melting point data

B Paper chromatography

C Sedimentation

[1]

8. True or False? "When forming an ionic bond, metal atoms generally lose electrons to form positive ions."

A True

B False

[1]

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9. What is electrolysis?

.....

.....

[1]

10. The equation below shows a reversible reaction, where A, B, C and D are different gases.

$$2A + B \rightleftharpoons C + D$$

Would the forwards or backwards reaction be favoured if the pressure were increased? Explain your answer.

.....

.....

.....

[2]

11. Copper has two stable isotopes, copper-63 and copper-65.
Copper-63 has an abundance of 69.2%. Copper-65 has an abundance of 30.8%.

Calculate the relative atomic mass of copper.
Give your answer to three significant figures.

.....

.....

.....

Relative atomic mass = ...

[2]

12. Some copper chloride solution was electrolysed using inert electrodes.
Identify the product that is formed at the cathode. Explain your answer.

Product: .....

Explanation: .....

.....

[2]

15

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Test 27: Chemistry 1 Mixed Topics

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. An ionic compound is made up of Sr^{2+} ions and Br^- ions. What is its formula?

A $SrBr_2$

B Sr_2Br

C SrBr

[1]

2. An atom of phosphorus has atomic number 15 and mass number 31. Which of the following statements about this atom is true?

A It has 15 protons and 16 electrons.

B It has 15 electrons and 16 neutrons.

C It has 15 neutrons and 16 protons.

[1]

3. In paper chromatography, what is an R_f value?

A The distance travelled by the solvent, measured from the baseline.

B The amount of solute that has travelled above the baseline.

C The ratio between the distance travelled by the solute and the solvent.

[1]

4. Which of the following reactions will produce a precipitate?

A Magnesium and hydrochloric acid

B Sodium carbonate and sulfuric acid

C Lead nitrate and sodium chloride

[1]

5. True or False? "A solution with a pH of 1 is very acidic."

A True

B False

[1]

6. Which is the correct, balanced ionic equation for the displacement of calcium ions by sodium?

A $Na_{(s)} + Ca^{2+}_{(aq)} \rightarrow Na^{+}_{(aq)} + Ca_{(s)}$

B $Na_{(s)} + Ca^{2+}_{(aq)} \rightarrow Na^{2+}_{(aq)} + Ca_{(s)}$

C $2Na_{(s)} + Ca^{2+}_{(aq)} \rightarrow 2Na^{+}_{(aq)} + Ca_{(s)}$

[1]

7. What pressure is used in the Haber process?

A 2 atmospheres

B 20 atmospheres

C 200 atmospheres

[1]

8. Oxidation is...

A ...gain of electrons.

B ...loss of electrons.

[1]

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9. Reversible reactions can reach 'dynamic equilibrium'. What is meant by this?

.....

.....

[1]

10. Soluble salts can be prepared from an acid and an alkali. A student prepares a soluble salt. Why shouldn't the student add an excess of alkali to the acid?

.....

.....

[1]

11. A student has a mixture of magnesium sulfate and copper filings.
Magnesium sulfate is a solid that is soluble in water.
Outline a method the student could use to obtain a pure sample of the magnesium sulfate.

.....

.....

.....

.....

.....

[3]

12. 1.84 g of ethanol (C_2H_5OH) is burnt completely in oxygen.
Calculate the number of moles of carbon dioxide gas produced.

$$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$$

Relative formula mass (M_r) of $C_2H_5OH = 46$.

.....

.....

.....

..... mol

[2]

15

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Test 28: Groups in the Periodic Table

There are **12 questions** in this test. Give yourself **10 minutes** to answer them all.

1. The first three elements of Group 7 are fluorine, chlorine and bromine. Which is the most reactive?

A Bromine

B Chlorine

C Fluorine

[1]

2. What happens to the boiling points of the elements as you go down Group 0?

A They decrease

B They increase

C They remain constant

[1]

3. When lithium reacts with water, the resulting solution is...

A ...acidic.

B ...alkaline.

C ...neutral.

[1]

4. Which of these is a chemical test for chlorine?

A It burns with a squeaky pop.

B It turns damp blue litmus paper white.

C It turns bromine water colourless.

[1]

5. True or False? "Alkali metals are soft."

A True

B False

[1]

6. Which Group 7 element is a dark grey crystalline solid at room temperature?

A Fluorine

B Bromine

C Iodine

[1]

7. How do the melting points of the alkali metals compare with those of other metals?

A They are higher than other metals.

B They are lower than other metals.

C They are the same as other metals.

[1]

8. Which of the following halogens has the lowest melting point?

A Bromine

B Chlorine

C Iodine

[1]

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9. When chlorine is added to potassium bromide, the following reaction occurs:

$$Cl_2 + 2KBr \rightarrow Br_2 + 2KCl$$

Identify the substance that is reduced and the substance that is oxidised in this reaction.

Reduced: .....

Oxidised: .....

[2]

10. Why do Group 1 elements become more reactive as you go down the group?

.....

.....

.....

[2]

11. Explain, in terms of reactivity, why a displacement reaction can occur when a halogen is added to a halide salt.

.....

.....

[1]

12. Explain, in terms of electronic configuration, why the noble gases are inert.

.....

.....

.....

[2]

15

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Test 29: Rates of Reaction and Energy Changes

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. To break a chemical bond...

A ...energy must be supplied.

B ...energy must be released.

[1]

2. How does a catalyst increase a reaction's rate?

A It shifts the position of equilibrium.

B It increases the energy of the reactants.

C It decreases the activation energy needed.

[1]

3. True or False? "The rate of reaction can be found by measuring the amount of reactant used over a period of time."

A True

B False

[1]

4. True or False? "In a reaction between gases, increasing the pressure of the reaction mixture will increase the reaction rate."

A True

B False

[1]

5. The rate of a reaction doesn't depend on the...

A ...frequency of collisions.

B ...volume of solution.

C ...temperature of the reactants.

[1]

6. Which of the following can be used to measure the energy change when a chemical reaction takes place?

A Change in colour

B Change in mass

C Change in temperature

[1]

7. Which of the following affects the proportion of collisions that have enough energy for particles to react?

A Gas pressure

B Temperature

C Concentration

[1]

8. What is the activation energy of a reaction?

A The total energy of the reactants.

B The minimum amount of energy needed by the particles to react.

C The maximum amount of energy needed by the particles to react.

[1]

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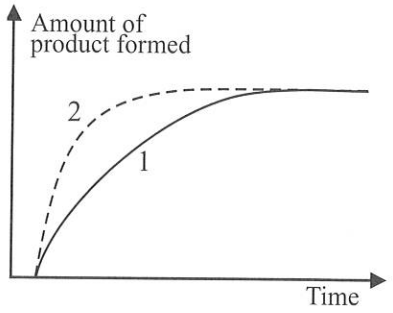
9. The diagram shows the results of the same reaction carried out in two different experiments.

Suggest **one** way in which the conditions in experiment 2 could have been different to those in experiment 1. Explain your answer.



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.....

[2]

10. Marble chips react with hydrochloric acid to form calcium chloride, water and carbon dioxide. Describe how you could determine the average rate of this reaction.

.....

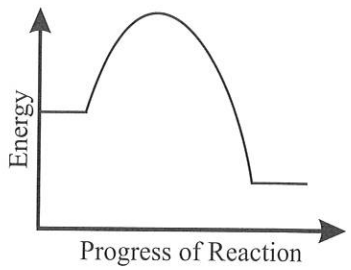
.....

.....

.....

[3]

11. Does the reaction profile on the right show an exothermic or an endothermic reaction? Explain your answer.



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[2]

15

Test 30: Rates of Reaction and Energy Changes

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. If the surroundings increase in temperature during a reaction...

A ...the reaction is endothermic.

B ...the reaction is exothermic.

C ...no new chemical bonds have formed.

[1]

2. True or False? "A catalyst will always be chemically changed when it is used to increase the rate of a reaction."

A True

B False

[1]

3. In a reaction between marble and hydrochloric acid, using small marble chips instead of a large piece of marble will produce...

A ...no difference in the rate of reaction.

B ...a faster rate of reaction.

C ...a slower rate of reaction.

[1]

4. In an endothermic reaction, the products are at...

A ...a lower energy than the reactants.

B ...a higher energy than the reactants.

[1]

5. In an endothermic reaction, the energy released when bonds are formed is...

A ...less than the energy used in breaking old bonds.

B ...greater than the energy used in breaking old bonds.

[1]

6. On a graph showing the quantity of product formed against time, a tangent to the curve can be used to find the...

A ...concentration of the product.

B ...mean rate of reaction.

C ...rate of reaction at a specific time.

[1]

7. True or False? "The progress of a reaction between hydrochloric acid and sodium thiosulfate can be determined by the colour change of the reaction mixture."

A True

B False

[1]

8. Which of the following is a reason why increasing the temperature increases the rate of a reaction?

A The higher temperature reduces the activation energy.

B The reactant particles move faster so they collide more frequently.

C The reactant particles expand so they collide more frequently.

[1]

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9. Explain, in terms of particle collisions, why increasing the concentrations of reacting solutions increases the rate of a reaction.

.....

.....

.....

[2]

10. The equation below shows the combustion of methane.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

The structures of methane, oxygen, carbon dioxide and water are shown below.

Using the bond energies below, work out the overall energy change for the combustion of methane.

C–H: 413 kJ mol^{-1}, O=O: 496 kJ mol^{-1}, C=O: 803 kJ mol^{-1}, O–H: 464 kJ mol^{-1}

.....

.....

.....

.....

.....

..... kJ mol^{-1}

[4]

11. State the function of yeast in the fermentation process used to produce alcoholic drinks.

.....

.....

[1]

15

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Test 31: Fuels and Earth Science

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Crude oil is...

A ...a renewable resource.

B ...a finite resource.

C ...an infinite resource.

[1]

2. Why might sulfur impurities be removed from a fuel before it is burnt?

A So the fuel produces less soot when it burns.

B To reduce the cost of the fuel.

C To reduce emissions which cause acid rain.

[1]

3. Which of these gases is **not** a greenhouse gas?

A Water vapour

B Methane

C Nitrogen

[1]

4. Carbon monoxide is...

A ...a toxic gas.

B ...a hydrocarbon.

C ...a fuel.

[1]

5. Which technique is used to separate the components of crude oil?

A Cracking

B Filtration

C Fractional distillation

[1]

6. Which of the following is **not** a use of the fuel oil fraction of crude oil?

A Fuel for some power stations

B Fuel for aircraft

C Fuel for large ships

[1]

7. The Earth's oceans were formed by...

A ...melting of prehistoric ice caps.

B ...earthquakes releasing liquid water trapped beneath the Earth's surface.

C ...condensation of water vapour that was present in the early atmosphere.

[1]

8. True or False? "Short-chain hydrocarbons are generally more useful than long-chain hydrocarbons."

A True

B False

[1]

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9. Which gas is thought to have made up most of the Earth's early atmosphere?

.....

Name **one** other gas present in the Earth's early atmosphere.

.....

Where are these gases thought to have come from?

.....

[3]

10. Decane and icosane are two alkanes.
Decane has the molecular formula $C_{10}H_{22}$. Icosane has the molecular formula $C_{20}H_{42}$.
Predict which of these two alkanes has the lower viscosity. Explain your answer.

.....

.....

.....

[2]

11. Give **one** human activity that increases the amount of carbon dioxide in the atmosphere.
Explain why it causes an increase.

.....

.....

.....

[2]

15

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Test 32: Fuels and Earth Science

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "Cracking is used to turn long-chain hydrocarbons into short-chain hydrocarbons."

A True

B False

[1]

2. True or False? "All hydrocarbons contain carbon and hydrogen, but some hydrocarbons also contain oxygen."

A True

B False

[1]

3. Which of these is thought to be increasing the average global temperature?

A An increasing amount of greenhouse gases in the atmosphere.

B A decreased amount of water vapour in the atmosphere.

C Large amounts of sulfur dioxide gas being released from burning fuels.

[1]

4. When the oceans formed, the amount of CO_2 in the atmosphere...

A ...increased.

B ...stayed the same.

C ...decreased.

[1]

5. True or False? "Nitrogen oxides can be formed by the chemical reactions in car engines."

A True

B False

[1]

6. Which of the following does **not** vary for different members of the same homologous series of compounds?

A Boiling point

B General formula

C Length of molecule

[1]

7. Which of the following is a crude oil fraction that is used to surface roads?

A Bitumen

B Diesel oil

C Kerosene

[1]

8. Which of these is **not** produced when a hydrocarbon fuel undergoes complete combustion?

A Carbon monoxide

B Carbon dioxide

C Water

[1]

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9. Vaporised crude oil is piped into the bottom of a fractionating column. Explain how it is then separated into different fractions.

.....

.....

.....

.....

.....

[3]

10. Hydrogen gas can be used as a fuel to power vehicles. Give **one** advantage and **one** disadvantage of using hydrogen instead of petrol as a fuel for cars.

Advantage: .....

.....

Disadvantage: .....

.....

[2]

11. Describe how the evolution of green plants affected the composition of Earth's atmosphere. Name the process which caused this change.

.....

.....

.....

[2]

15

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Test 33: Chemistry 2 Mixed Topics

There are **10 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "Argon is not suitable for use in light bulbs because it is highly flammable."

A True

B False

[1]

2. Which of the following will increase the rate of reaction between two aqueous solutions?

A Diluting the solutions.

B Using a bigger reaction vessel.

C Increasing the average energy of the collisions.

[1]

3. Why is cracking of hydrocarbons carried out?

A To purify the fractions of crude oil.

B To generate electricity.

C To convert long alkane molecules into smaller, more useful molecules.

[1]

4. CH_4 and Cl_2 are...

A ...simple molecules.

B ...polymers.

C ...giant covalent structures.

[1]

5. When chlorine displaces iodine from a solution of potassium iodide, chlorine...

A ...gains electrons.

B ...loses electrons.

C ...gains oxygen.

[1]

6. Which of the following is **not** a reason that carbon dioxide levels decreased in the Earth's early atmosphere?

A Lots of carbon dioxide dissolved into the oceans.

B The carbon dioxide reacted with oxygen in the atmosphere.

C Green plants began to photosynthesise.

[1]

7. What colour is bromine at room temperature?

A Red-brown

B Purple

C Cream

[1]

8. Carbon and carbon monoxide can be produced in combustion reactions where...

A ...there is not enough nitrogen.

B ...there is not enough fuel.

C ...there is not enough oxygen.

[1]

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9. 200 g of calcium reacts with exactly 80 g of oxygen gas (O_2) to give calcium oxide. Calcium oxide is an ionic compound and the only product formed in this reaction. Use the masses and relative atomic masses provided to write a balanced symbol equation for this reaction.

Relative atomic masses (A_r): O = 16, Ca = 40

.....

.....

.....

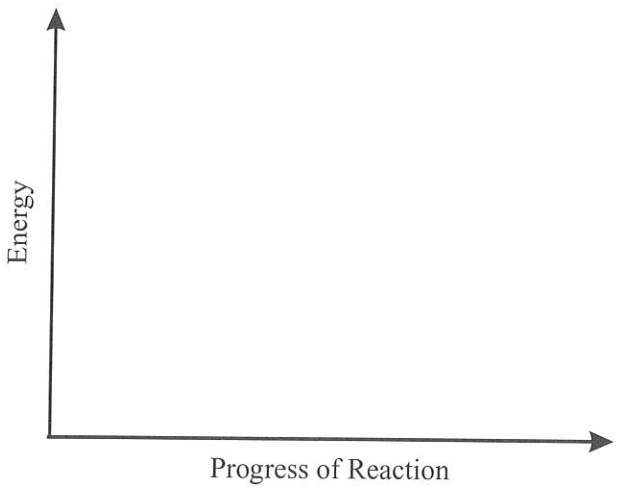
.....

.....

Symbol equation: .....

[4]

10. The equation for the formation of ammonia is: $N_2 + 3H_2 \rightarrow 2NH_3$
The overall energy change of this reaction is -97 kJ mol^{-1}.
Draw and label a reaction profile for this reaction on the axes below.
Label the overall energy change.



[3]

15

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Test 34: Chemistry 2 Mixed Topics

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "Oxygen will relight a glowing splint."

A True

B False

[1]

2. Which of the following statements about acid rain is false?

A It forms when sulfur dioxide mixes with clouds.

B It releases soot into the atmosphere.

C It can damage stone statues.

[1]

3. Which of the following statements about catalysts is true?

A They don't alter the products of a reaction.

B They alter the overall heat change of a reaction.

C They are used up in a reaction.

[1]

4. Hydrogen halides dissolve in water to form...

A ...neutral solutions.

B ...basic solutions.

C ...acidic solutions.

[1]

5. Displacement reactions between a metal and a metal compound...

A ...are exothermic.

B ...are endothermic.

C ...do not involve a change in heat energy.

[1]

6. How many molecules of CO_2 are in one mole?

A 44

B 1

C 6.02×10^{23}

[1]

7. In an exothermic reaction the energy required to break bonds is...

A ...less than the energy released when new bonds form.

B ...greater than the energy released when new bonds form.

[1]

8. Which of the following statements about crude oil is false?

A It is a finite resource.

B It is a mixture of ionic compounds.

C It can be separated by fractional distillation.

[1]

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9. The relative atomic mass of chlorine is 35.5.
Explain why the relative atomic mass of chlorine is not a whole number.

.....

.....

.....

[2]

10. Describe and explain the trend in the reactivity of the halogens down the group.

.....

.....

.....

.....

.....

[3]

11. A student stands a flask containing hydrochloric acid over a black cross. She adds some sodium thiosulfate solution and measures the time taken for the solution to turn cloudy enough for the black cross to disappear.

She repeats the experiment at a higher temperature.
Predict the effect that increased temperature will have on the amount of time taken for the black cross to disappear. Explain your answer.

.....

.....

.....

[2]

15

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Test 35: Motion, Forces and Conservation of Energy

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. The acceleration of an object is...

A ... the change in height over time.

B ... the change in position over time.

C ... the change in velocity over time.

[1]

2. True or False? "Energy can be created but not destroyed."

A True

B False

[1]

3. What happens to the amount of energy in a car's kinetic energy store when the car slows down?

A It remains the same.

B It decreases as some energy is transferred away to different energy stores.

C It decreases as some energy is destroyed.

[1]

4. What is the correct equation to calculate the weight, W, of an object of mass m in a gravitational field of strength g?

A $W = g \div m$

B $W = m \times g$

C $W = m \div g$

[1]

5. How does the speed of a car affect its stopping distance at maximum braking force?

A The speed of the car doesn't matter.

B Higher speed results in a shorter stopping distance.

C Higher speed results in a longer stopping distance.

[1]

6. Object A is travelling to the left and collides with the stationary object B. After the collision, object B moves away to the left. Which of the following is true of object A's momentum after the collision?

A It is the same as it was before the collision.

B It is lower than it was before the collision.

C It is higher than it was before the collision.

[1]

7. Two garages of equal size and shape have walls made of the same material. One garage has thicker walls than the other. They are heated to the same temperature then left to cool. Which garage would cool the fastest?

A The one with thin walls.

B The one with thick walls.

[1]

8. Which of these is a disadvantage of using solar cells to generate electricity?

A Their reliability depends on the weather.

B They produce CO_2 when running.

C They destroy wildlife habitats.

[1]

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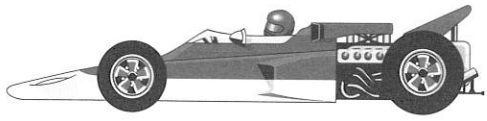
9. A race car travels along a straight length of track at 65 m/s.
The race car and its driver have a combined mass of 580 kg.



car velocity = 65 m/s

Calculate the total energy in the kinetic energy stores of the race car and driver.

.....

.....

Energy = ... J
[2]

10. A planet is moving in a circular orbit around a star. Describe the force that keeps it in this orbit. Explain why the planet's speed is constant, but its velocity is not.

.....

.....

.....
[2]

11. A car is travelling at a speed of 13 m/s. The driver applies the brakes and the car comes to rest after travelling a further 26 m. What is the deceleration of the car?

$$(\text{final velocity})^2 - (\text{initial velocity})^2 = 2 \times \text{acceleration} \times \text{distance}$$

.....

.....

.....

Deceleration = ... m/s^2
[3]

15

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Test 36: Motion, Forces and Conservation of Energy

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. 800 J of energy is supplied to a toaster with an efficiency of 25%. How much energy is usefully transferred by the toaster?

A 200 J

B 775 J

C 1000 J

[1]

2. Which type of energy store is most of the dissipated energy transferred to when an electric motor is used to lift a load?

A gravitational potential

B kinetic

C thermal

[1]

3. A force of 40 N is applied to an object, causing the object to accelerate at 0.8 m/s^2. What is the inertial mass of the object?

A 32 kg

B 50 kg

C 400 kg

[1]

4. Roughly how far would a sound wave travel through the air in 3 s?

A 110 m

B 330 m

C 990 m

[1]

5. What is the name of a system in which there is no net change in the total energy?

A A closed system

B An open system

C A mechanical system

[1]

6. A ball hits a wall with a force of 5 N. What is the force exerted on the ball by the wall?

A 0 N

B –5 N

C –10 N

[1]

7. An apple with a mass of 0.1 kg hangs 2 m above the ground. Assuming the gravitational field strength is 10 N/kg, how much energy will the apple lose from its gravitational potential energy store if it falls to the ground?

A 0.5 J

B 2 J

C 5 J

[1]

8. Which of the following pairs of quantities are both scalar quantities?

A momentum and energy

B speed and weight

C distance and mass

[1]

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9. Suggest two environmental disadvantages of using tidal-powered turbines to generate electricity.

1. .....

.....

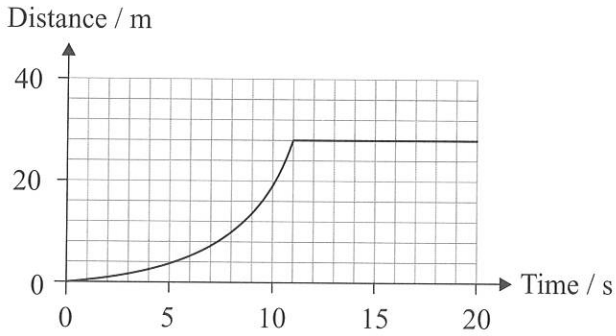
2. .....

.....

[2]

10. The graph on the right shows the motion of a unicyclist.

Use the graph to find the speed of the unicyclist at 8 s.



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.....

.....

Speed = ... m/s

[2]

11. A cyclist decelerates from 5.8 m/s to 3.2 m/s in 7 s. The total mass of the cyclist and their bike is 90 kg. What is the average braking force required for this deceleration? Give your answer to 3 significant figures.

$$F = \frac{mv - mu}{t}$$

.....

.....

Average braking force = ... N

[3]

15

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Test 37: Waves and the Electromagnetic Spectrum

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Which of these processes does **not** produce a type of electromagnetic radiation?

A Oscillations in electrical circuits

B Changes in atoms and nuclei

C Vibrations of air particles

[1]

2. What units are used for wave speed?

A Metres, m

B Metres per second, m/s

C Hertz, Hz

[1]

3. Waves can change direction as they cross a boundary between two different substances. What is this called?

A Absorption

B Reflection

C Refraction

[1]

4. Which of the following is a use of radio waves?

A Disinfecting water

B Airport security scanners

C Television broadcasts

[1]

5. Which of the following statements about electromagnetic (EM) waves is correct?

A All EM waves travel through a vacuum at the same speed.

B The higher the frequency of an EM wave, the faster it travels through a vacuum.

C The higher the frequency of an EM wave, the slower it travels through a vacuum.

[1]

6. The amplitude of a wave is...

A ... the length of a full cycle of the wave.

B ... the number of complete cycles of the wave passing a point per second.

C ... the maximum displacement from the rest position, e.g. to a crest or a trough.

[1]

7. Which of these is an example of a longitudinal wave?

A Ripples on the surface of water

B Sound waves

C X-rays

[1]

8. True or False? "Waves transfer matter."

A True

B False

[1]

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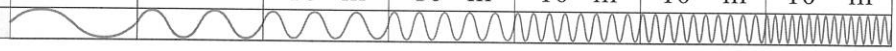
9. The diagram below shows the different regions of the electromagnetic spectrum and their wavelengths, λ. Name the regions labelled **A** and **D** in the diagram below.

Region	Radio waves	**A**	**B**	Visible light	**C**	**D**	Gamma rays
λ (m)	$1 - 10^{4}$ m	10^{-2} m	10^{-5} m	10^{-7} m	10^{-8} m	10^{-10} m	10^{-15} m
							

A: ..... **D**: .....

[2]

10. Name **two** types of electromagnetic radiation that can cause harm. State a potential harmful effect of each one.

1. Type of radiation: .....

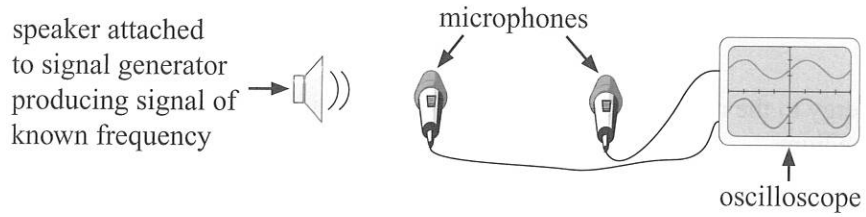
Harmful effect: .....

2. Type of radiation: .....

Harmful effect: .....

[2]

11. Describe how the apparatus shown below can be used to measure the velocity of sound in air.



.....

.....

.....

.....

.....

[3]

15

Test 38: Waves and the Electromagnetic Spectrum

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. The different types of electromagnetic waves...

A ... all have the same wavelength.

B ... all have the same frequency.

C ... form a continuous spectrum.

[1]

2. In a longitudinal wave, the vibrations are...

A ... parallel to the direction of energy transfer.

B ... perpendicular to the direction of energy transfer.

[1]

3. Which of these is a use of gamma radiation?

A Cooking food

B Communications

C Cancer treatment

[1]

4. X-rays are...

A ... electromagnetic waves.

B ... sound waves.

C ... radio waves.

[1]

5. Refraction is the process in which light...

A ... bounces back as it hits a new medium.

B ... changes direction as it enters a new medium.

C ... transfers its energy to the medium as it enters that new medium.

[1]

6. What is the frequency of a wave?

A The number of waves passing a point per second.

B The distance travelled by the wave each second.

C The distance from one crest on a wave to the next adjacent crest.

[1]

7. How does the potential danger of electromagnetic radiation change as the frequency of the radiation increases?

A It stays the same.

B It increases.

C It decreases.

[1]

8. An electromagnetic wave slows down as it enters a different medium at an angle to the normal. What happens to the wave's direction?

A It bends away from the normal.

B It bends towards the normal.

C It continues travelling at the same angle to the normal.

[1]

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9. Give **three** different uses of infrared radiation.

1. .....

2. .....

3. .....

[3]

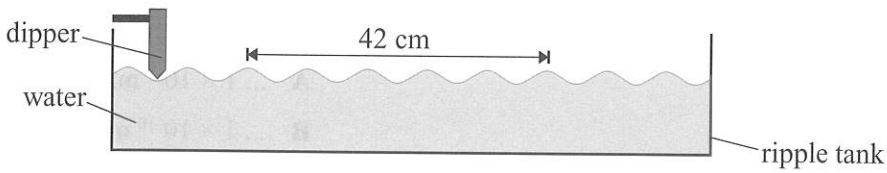
10. A student drops a small rubber duck into a tank of water. They observe that ripples form on, and move across, the water's surface. State a second observation they could make that would provide evidence that it is the wave and not the water that is moving.

.....

.....

[1]

11. A student uses a dipper to set up water waves in a ripple tank.
She measures the distance shown in the diagram to be 42 cm.
The time taken for the peak of one wave to travel this distance is 3.2 s.



Calculate the speed of the waves. Give your answer to 2 significant figures.

.....

.....

.....

Wave speed = ... m/s

[3]

15

Test 39: Radioactivity

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. What is the name for atoms with the same number of protons but different numbers of neutrons?

A Ions

B Isomers

C Isotopes

[1]

2. The count rate of a radioactive sample falls from 130 Bq to 65 Bq in 15 minutes. What is its half-life?

A 15 minutes

B 30 minutes

C 1 hour

[1]

3. True or False? "Any exposure to ionising radiation will kill living cells."

A True

B False

[1]

4. True or False? "The results of the alpha scattering experiment led to the development of the plum pudding model of the atom."

A True

B False

[1]

5. Which type of radiation can penetrate the furthest into materials?

A Alpha

B Beta

C Gamma

[1]

6. The typical size of an atom is approximately...

A ... 1×10^{-8} m.

B ... 1×10^{-10} m.

C ... 1×10^{-12} m.

[1]

7. True or False? "When a radioactive nucleus emits a beta-minus particle, its atomic number increases."

A True

B False

[1]

8. True or False? "It is not possible to predict when a particular unstable nucleus will decay."

A True

B False

[1]

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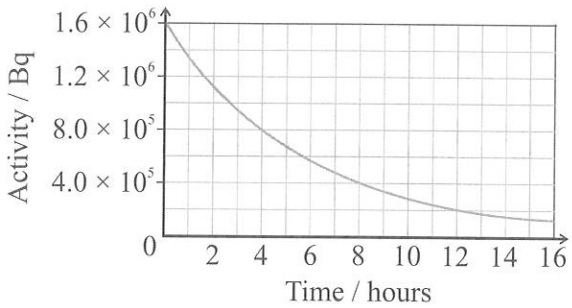
9. The decay of phosphorus-32 is shown below.

$$^{32}_{15}\mathrm{P} \rightarrow {}^{32}_{\ldots\ldots}\mathrm{S} + {}^{0}_{-1}\mathrm{e}$$

Complete the equation by writing in the missing atomic number of the product.

[1]

10. Use this graph to work out the half-life of the radioactive sample.



Half-life = ... hours

[2]

11. Ionising radiation is used in some medical treatments. Explain why it's important to minimise any unnecessary exposure of a patient to ionising radiation.

.....

.....

A doctor giving a medical treatment needs to take precautions to minimise their exposure to ionising radiation. State one precaution the doctor could take and explain how it can help reduce the amount of ionising radiation the doctor is exposed to.

Precaution: .....

.....

Explanation: .....

.....

.....

[4]

15

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Test 40: Radioactivity

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "The longer the half-life of a radioactive sample, the sooner it will stop being radioactive."

A True

B False

[1]

2. True or False? "The plum pudding model suggested that an atom was a sphere of positively charged mass with small negative electrons stuck in it."

A True

B False

[1]

3. In β^+ decay, a proton changes into...

A ...a neutron and an electron.

B ...a neutron and a positron.

C ...a positron and an electron.

[1]

4. What is the unit of activity of a radioactive isotope?

A Joule, J

B Hertz, Hz

C Becquerel, Bq

[1]

5. Which of these statements is correct?

A Background radiation is around us all the time.

B People must be shielded from all background radiation.

C Background radiation is only caused by fallout from nuclear weapons tests.

[1]

6. Which type of radiation is the same as a helium nucleus?

A Alpha

B Beta

C Gamma

[1]

7. Which of the following gives the number of neutrons in the nucleus of an atom?

A The mass number

B The mass number + the atomic number

C The mass number – the atomic number

[1]

8. Which of these is **not** found in the nucleus of an atom?

A Electrons

B Neutrons

C Protons

[1]

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9. A student has a source of radiation that emits one of α, β or γ radiation. She places the source opposite a Geiger-Müller tube and detector and records the count rate. She then places a sheet of paper between the source and the detector and records the count rate, and then repeats this with a sheet of aluminium instead of paper. Describe how her results will allow her to work out which type of radiation is emitted by the source.

.....

.....

.....

.....

.....

[3]

10. Describe how the orbit of an electron around an atom's nucleus changes when the electron absorbs electromagnetic radiation. Explain how in some cases this may lead to the formation of a positive ion.

.....

.....

.....

.....

[2]

11. Describe the difference between irradiation and contamination.

.....

.....

.....

[2]

15

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Test 41: Physics 1 Mixed Topics

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. How much energy is there in the kinetic energy store of a trolley with a mass of 0.5 kg travelling at a velocity of 2.0 m/s?

A 0.5 J

B 1.0 J

C 2.0 J

[1]

2. Which of these is true in the current model of the atom?

A The nucleus in the atom is uncharged.

B The atom is a ball of positive charge with electrons evenly distributed throughout.

C Almost all of the mass of the atom is concentrated at its centre.

[1]

3. True or False? "Energy transfers can increase or decrease the total energy of a closed system."

A True

B False

[1]

4. True or False? "If an object's slowing down, there must be a non-zero resultant force acting on it."

A True

B False

[1]

5. The wavelength of a wave is...

A ... the distance travelled by the wave each second.

B ... the maximum displacement from the rest position, e.g. to a crest or a trough.

C ... the length of a full cycle of the wave, e.g. from crest to crest.

[1]

6. What happens to a nucleus when it emits a gamma ray?

A Its mass decreases

B Its charge decreases

C Its mass and charge remain unchanged

[1]

7. Which of the following equations correctly shows the relationship between the momentum, p, mass, m, and velocity, v, of a body?

A $p = m \times v$

B $p = m \div v$

C $p = v \div m$

[1]

8. Which of these is a typical value for a person's reaction time?

A 0.04 s

B 0.4 s

C 4 s

[1]

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9. A light wave crosses a boundary between two materials and is refracted away from the normal. State how the speed of the wave changes as it crosses the boundary and give a reason for this change.

.....

.....

.....

[2]

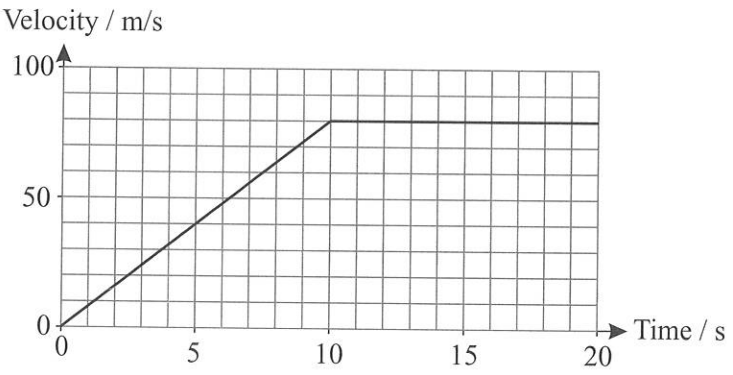
10. The equation below shows the alpha decay of an isotope of americium. Complete the equation by writing the missing atomic number and mass number of the product.

$$^{241}_{95}\text{Am} \rightarrow \,^{\ldots\ldots}_{\ldots\ldots}\text{Np} + {}^{4}_{2}\text{He}$$

[2]

11. A velocity-time graph for a racing car is shown on the right.

Calculate the distance travelled by the car in the first 15 s of its journey.



.....

.....

.....

Distance = ... m

[3]

15

Test 42: Physics 1 Mixed Topics

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Which type of radiation can induce oscillations in electrical circuits?

A Radio waves

B Infrared

C X-rays

[1]

2. When a planet orbits a star it continuously accelerates due to a force acting...

A ... away from the centre of the star.

B ... in the direction it's travelling in.

C ... towards the centre of the star.

[1]

3. True or False? "Gamma rays are more strongly ionising than alpha particles."

A True

B False

[1]

4. True or False? "Two isotopes of carbon will have the same number of neutrons but a different number of protons."

A True

B False

[1]

5. Which of these is an environmental problem caused by generating electricity using hydro-electric power?

A It could result in a loss of habitat for some species.

B It results in the release of sulfur dioxide, which causes acid rain.

C The waste produced is dangerous and difficult to get rid of.

[1]

6. Two toy cars with the same mass are pushed with different forces. The car pushed with a greater force has...

A ... a greater acceleration than the other car.

B ... a lower acceleration than the other car.

C ... the same acceleration as the other car.

[1]

7. A cyclist travels at 4.5 m/s for 6.0 s. How far do they move in this time?

A 1.3 m

B 10.5 m

C 27 m

[1]

8. Which of the following types of electromagnetic radiation can carry the most energy?

A Ultraviolet

B Microwaves

C X-rays

[1]

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9. State **one** factor that can cause a driver's reaction time to increase.

.....

[1]

10. An electric pencil sharpener has an efficiency of 75%. Calculate the amount of energy that is usefully transferred by the pencil sharpener if 560 J in total is supplied to it.

.....

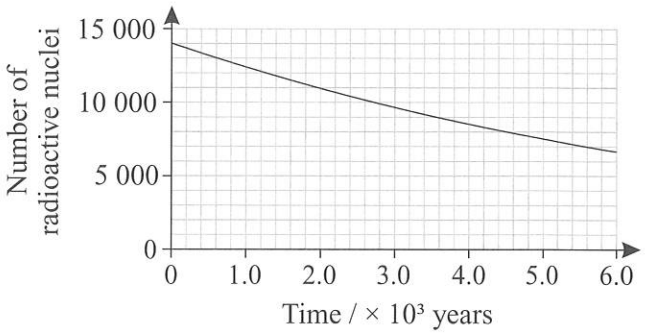
.....

.....

Energy = ... J

[3]

11. The graph on the right shows the number of radioactive nuclei in an archaeological sample over time.
Use the graph to calculate the half-life of the radioactive sample and calculate the number of radioactive nuclei left in the sample after 16.8×10^3 years.



.....

.....

.....

.....

Half-life = ... years

Number of nuclei = ...

[3]

15

Test 43: Forces and Energy

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. When a racket hits a ball, energy is transferred from the racket's kinetic energy store to the ball's kinetic energy store. This energy is transferred...

A ... by heating.

B ... electrically.

C ... by forces doing work.

[1]

2. Assuming there is no air resistance, which of these statements is false?

A When an object falls, work is done against gravity.

B When an object falls, energy is lost from its gravitational potential energy store.

C When an object is lifted, work is done against gravity.

[1]

3. Electric heater A has a power of 1 kW. Electric heater B has a power of 880 W. Which transfers the most energy in 2 hours?

A Heater A

B Heater B

[1]

4. A teapot, weighing 10 N, is sat stationary on a table. What is the normal contact force applied to the teapot by the table?

A 0 N

B –10 N

C –20 N

[1]

5. What unit is the joule equivalent to?

A N/kg

B N/m

C Nm

[1]

6. Which of the following is a contact force?

A Gravitational force

B Friction

C Electrostatic force

[1]

7. An electric kettle is supplied with 750 000 J of energy from the mains. It usefully transfers 570 000 J of energy to boil the water inside it. What is the efficiency of the kettle?

A 24%

B 76%

C 132%

[1]

8. True or False? "Work done is equal to energy transferred."

A True

B False

[1]

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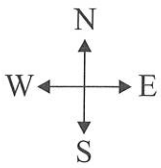
9. Give the **two** energy stores that energy is usefully transferred to in a hairdryer.

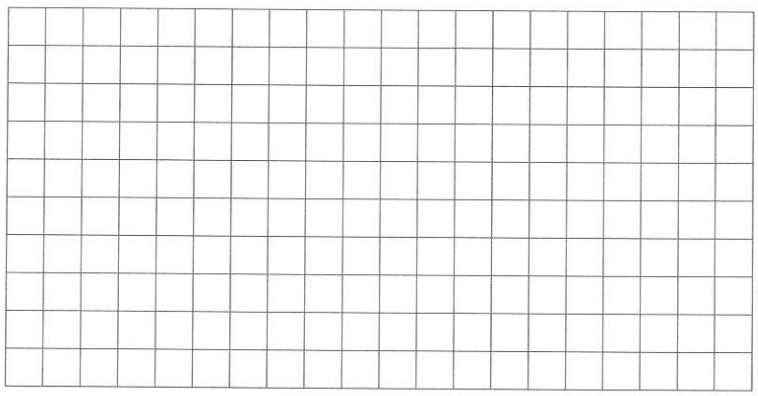
1. .....

2. .....

[1]

10. A boat has a driving force of 800 N east. The wind produces a force on the boat of 350 N north. Draw a scale diagram to find the magnitude of the resultant force on the boat.





Magnitude = ... N

[3]

11. A robot has a power output of 50 W. How much energy does it transfer in 2 minutes?

.....

.....

.....

Energy = ... J

[3]

15

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Test 44: Electricity and Circuits

There are **10 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "The resistance of a thermistor is higher in hot conditions than in the cold."

A True

B False

[1]

2. What is the unit of power?

A Joule, J

B Ohm, Ω

C Watt, W

[1]

3. True or False? "Potential difference is the work done per ampere of current passing between two points."

A True

B False

[1]

4. Which type of current is supplied by a battery?

A Direct current (dc)

B Alternating current (ac)

C Cell current (cc)

[1]

5. Electric current is...

A ... the driving force that pushes charges around a circuit.

B ... a measure of how much charges slow down as they flow through a circuit.

C ... the flow of electrical charge.

[1]

6. A current of 2 A passes through a device with a resistance of 8 Ω. What is the power of the device?

A 16 W

B 32 W

C 128 W

[1]

7. A current of 0.2 A passes through an electric motor over a period of 3 minutes. What is the total charge transferred through the motor in this time?

A 9.0 C

B 15 C

C 36 C

[1]

8. Which of these statements about the live and neutral wires of an electrical appliance is correct?

A Current flows into the appliance through both the live and neutral wires.

B Current flows in through the live wire and out through the neutral wire.

C Current flows in through the neutral wire and out through the live wire.

[1]

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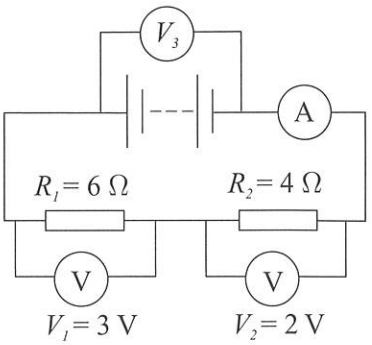
9. The circuit diagram below shows two resistors connected in series with a battery.



Find the reading on voltmeter V_3.

.....

Potential difference = ... V

Find the total resistance, R, of the circuit.

.....

Resistance = ... Ω

Find the reading on the ammeter.

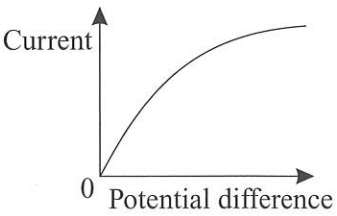
.....

.....

Current = ... A

[4]

10. The current-potential difference graph of a filament lamp is shown on the right.



Explain why the graph curves as the current increases.

.....

.....

.....

.....

[3]

15

Test 45: Electricity and Circuits

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "The UK mains electricity supply is direct current."

A True

B False

[1]

2. True or False? "An ammeter must be connected in parallel with a component to measure the current through the component."

A True

B False

[1]

3. A current is flowing through a diode in a circuit. How would the current flowing change if the direction of the diode was reversed?

A The current would not flow any more.

B The current would not change.

C The current would increase.

[1]

4. In the UK, what is the typical potential difference between the live wire and earth wire in an electrical appliance?

A 0 V

B 12 V

C 230 V

[1]

5. Adding resistors in parallel decreases the total resistance of the circuit because...

A ... it increases the total current that can flow around the circuit.

B ... it decreases the potential difference across the circuit.

C ... it decreases the charge that can flow through the circuit.

[1]

6. Which of these is needed for a current to flow in a closed circuit?

A A potential difference

B Resistance

C A switch

[1]

7. A 0.5 A and a 1.5 A current flow into a junction. Current leaves the junction through one wire. What is the current in this wire?

A 1 A

B 2 A

C 3 A

[1]

8. Components connected in a parallel circuit will usually receive...

A ... a fraction of the supply potential difference.

B ... the same current as any other component in the circuit.

C ... the full supply potential difference.

[1]

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9. Most electrical appliances have a fuse connected to their live wire. How does the fuse work to ensure the safety of an appliance if the current through the appliance becomes dangerously high?

.....

.....

[1]

10. Explain why a resistor typically heats up as current flows through it, and how this causes the resistance of the resistor to increase.

.....

.....

.....

.....

.....

[3]

11. 1 062 600 J of energy was transferred by an electric iron drawing a current of 11 A from a 230 V mains electricity supply. Calculate the length of time the iron was turned on.

energy transferred = current × potential difference × time

.....

.....

.....

Time = ... s

[3]

15

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Test 46: Magnetic Fields

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Induced magnets produce a magnetic field...

A ... all the time.

B ... only while they are in another magnetic field.

C ... only if they experience a change in electric field.

[1]

2. True or False? "Transmitting electricity at a high potential difference and a low current is more energy efficient than transmitting at a low potential difference and a high current."

A True

B False

[1]

3. True or False? "The magnetic field of a bar magnet is strongest at the poles."

A True

B False

[1]

4. The force between the north poles of two bar magnets is...

A ... attractive.

B ... repulsive.

[1]

5. A plotting compass can be used to get information about...

A ... the strength of a magnetic field only.

B ... the direction of a magnetic field only.

C ... the strength and direction of a magnetic field.

[1]

6. The magnetic field produced when current flows through a wire...

A ... is parallel to the wire.

B ... is only at each end of the wire.

C ... goes round the wire in circles centred on the wire.

[1]

7. If an electrical conductor moves through a magnetic field...

A ... the magnetic field disappears.

B ... the magnetic field reverses.

C ... a potential difference is induced in the conductor.

[1]

8. True or False? "A changing magnetic field in the iron core of a transformer induces an alternating potential difference across the secondary coil."

A True

B False

[1]

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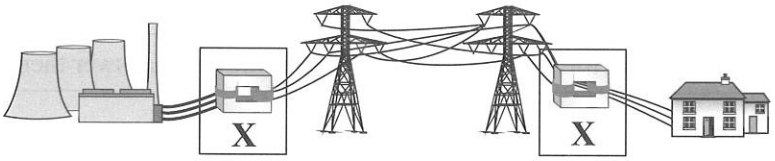
9. The image below shows the national grid.



State the name given to the electrical devices labelled X, and describe their purpose in the national grid.

.....

.....

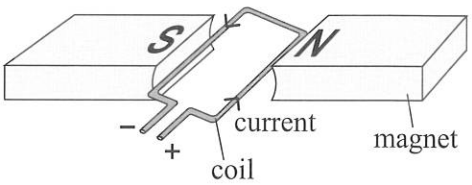
.....

.....

.....

[3]

10. In which direction will this coil turn, clockwise or anticlockwise?



.....

[1]

11. A current-carrying wire is placed between the north and south poles of two bar magnets at 90° to the magnetic field between the poles. The magnets exert a force of 176 μN on the wire. The length of wire within the magnetic field of the bar magnets is 1.1 cm. The current flowing through the wire is 0.80 A.
What is the magnetic field strength of the magnetic field caused by the two bar magnets?

force = magnetic field strength × current × length

.....

.....

.....

Magnetic field strength = ... T

[3]

15

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Test 47: Matter

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. True or False? "Liquids are generally denser than solids and gases."

A True

B False

[1]

2. What are the units for density?

A kg/m^2

B kg/m^3

C m^3/kg

[1]

3. How much force is needed to elastically stretch a spring with a spring constant of 30 N/m by 0.03 m?

A 0.001 N

B 0.027 N

C 0.9 N

[1]

4. Which of the following is **not** caused by heating a liquid?

A Increase in energy in the particles' kinetic energy stores

B Boiling

C Condensing

[1]

5. True or False? "More than one force must be applied to compress an object."

A True

B False

[1]

6. What happens to the mass of a substance when it changes from a solid to a liquid?

A It increases

B It decreases

C It stays the same

[1]

7. What quantity gives the energy released when 1 kg of a liquid becomes a solid with no change in temperature?

A Specific freezing energy

B Specific latent heat

C Specific heat capacity

[1]

8. Which of these temperatures on the Celsius scale is known as absolute zero?

A –273 °C

B –237 °C

C 0 °C

[1]

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9. Describe how the arrangement of particles in a solid is different to the arrangement of particles in a gas.

.....

.....

[1]

10. Ethanol has a specific latent heat of vaporisation of 855 kJ/kg.
Calculate the minimum energy required to boil 0.60 kg of ethanol.

thermal energy for a change of state = mass × specific latent heat

.....

.....

.....

Energy = ... J

[3]

11. 2925 J of energy is needed to increase the temperature of 500 g of copper by 15 °C.

Calculate the specific heat capacity of copper.

change in thermal energy = mass × specific heat capacity × temperature change

.....

.....

.....

.....

Specific heat capacity = ... J/kg°C

[3]

15

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Test 48: Matter

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. Changes of state are different to chemical changes because...

A ... changes of state can be reversed to recover the original properties of the material.

B ... changes of state result in the creation of new substances.

C ... changes of state cannot happen to gases.

[1]

2. What is the specific heat capacity of a substance?

A The energy released by a substance when it freezes.

B The total energy stored by the particles in a system.

C The energy needed to raise the temperature of 1 kg of a substance by 1°C.

[1]

3. Which of the following statements about gas particles is **not** true?

A Gas particles generally travel at higher speeds than liquid and solid particles.

B Gas particles travel in random directions.

C Gas particles generally have less energy than liquid and solid particles.

[1]

4. In which type of deformation does an object **not** return to its original shape and length after the deforming force is removed?

A Elastic deformation

B Inelastic deformation

C Linear deformation

[1]

5. True or False? "Gas pressure is caused by the particles of the gas colliding with one another."

A True

B False

[1]

6. What will happen to the pressure of a fixed volume of gas if its temperature is increased?

A It will increase

B It will decrease

C It will stay the same

[1]

7. True or False? "After a substance is condensed, it can be sublimated to recover its original properties."

A True

B False

[1]

8. What is 25 °C in kelvin?

A –248 K

B 25 K

C 298 K

[1]

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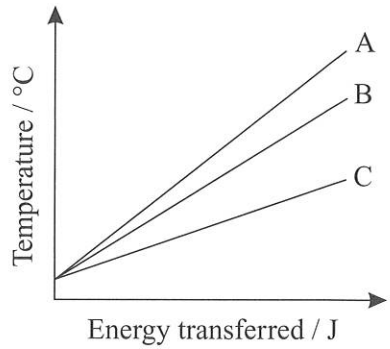
9. A piece of gold has a volume of 2.00×10^{-5} m^3 and a mass of 0.386 kg.
Calculate the density of gold.

.....

.....

Density = ... kg/m^3
[2]

10. A student uses a heater to provide energy to three 0.5 kg blocks made from different materials. The student supplies the same amount of energy to each block.
She measures their temperatures at regular intervals for five minutes.
The graph on the right shows her results.
State and explain which block of material has the highest specific heat capacity.



.....

.....

.....
[2]

11. 0.45 J of work is done in stretching a spring, causing it to extend by 34 mm.
Assuming the spring's limit of proportionality has not been reached, calculate the spring constant of the spring.

energy transferred in stretching = 0.5 × spring constant × (extension)^2

.....

.....

.....

.....

Spring constant = ... N/m
[3]

15

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Test 49: Physics 2 Mixed Topics

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. The amount of energy needed to raise the temperature of 1 kg of a substance by 1 °C is...

A ... its boiling point.

B ... its specific heat capacity.

C ... its change in heat capacity.

[1]

2. What is the power of a device that transfers 20 J in five seconds?

A 4 W

B 20 W

C 100 W

[1]

3. True or False? "If a resistor is added to a circuit in parallel, the total resistance of the circuit will increase."

A True

B False

[1]

4. To travel at a constant speed, the driving force of a car engine must...

A ... be less than the frictional forces.

B ... balance the frictional forces.

C ... exceed the frictional forces.

[1]

5. Which is the correct equation for density?

A density = mass × volume

B density = volume ÷ mass

C density = mass ÷ volume

[1]

6. An object is in equilibrium if...

A ... no forces are acting on it.

B ... all the forces acting on it act in the same direction.

C ... all the forces acting on it cancel so there is no resultant force.

[1]

7. Electricity is transferred across step-up transformers to...

A ... increase its potential difference for transmission from power stations.

B ... increase its potential difference for domestic use.

C ... increase its current for transmission from power stations.

[1]

8. In Fleming's left-hand rule, the directions of which variables are represented by your thumb and first two fingers?

A Force, current and magnetic field

B Current and magnetic field only

C Force, magnetic field and induced potential difference

[1]

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9. State the approximate direction in which a compass will point if it is not near to any magnetised materials, and explain why the compass points in this direction.

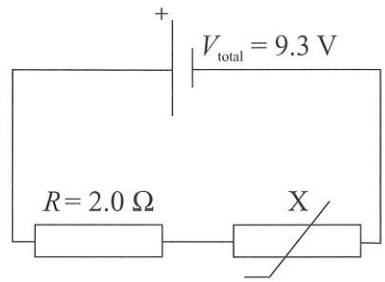
.....

.....

.....

[2]

10. A circuit diagram is shown on the right.



Identify component X.

.....

Calculate the current passing through the circuit when component X has a resistance of 3.0 Ω.

.....

.....

.....

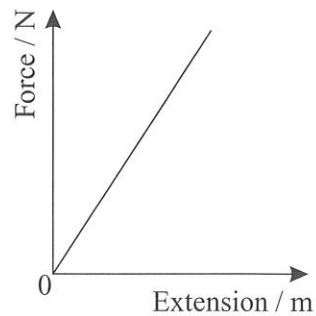
Current = ... A

[4]

11. A student suspends a spring from a clamp and hangs different weights from it. She plots the force exerted by each weight against the extension of the spring that it produces on the graph on the right. What is the gradient of this graph equal to?

.....

[1]



15

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Test 50: Physics 2 Mixed Topics

There are **11 questions** in this test. Give yourself **10 minutes** to answer them all.

1. A speaker is connected to a 2 V battery. How much energy is transferred to the speaker when 80 C of charge passes through it?

A 40 J

B 82 J

C 160 J

[1]

2. True or False? "The pressure of a gas held at constant volume decreases if the temperature is decreased."

A True

B False

[1]

3. The magnetic field inside a solenoid is...

A ... weak and uniform.

B ... strong and uniform.

C ... strong and irregular.

[1]

4. What is 100 °C in kelvin?

A –173 K

B 100 K

C 373 K

[1]

5. Which of these will cause a change in the direction of the force acting on a conductor at 90° to a magnetic field?

A Reversing the current through the conductor.

B Increasing the length of the conductor.

C Reducing the magnetic flux density of the magnetic field.

[1]

6. If a fault allows the live wire of an electrical appliance to touch its metal case...

A ... a large current will flow through the case and out through the earth wire.

B ... a large current will flow through the case and out through the neutral wire.

C ... current will stop flowing in the appliance.

[1]

7. 5000 J of energy was supplied to an electric motor with an efficiency of 0.68. How much energy was usefully transferred by the motor?

A 5000 J

B 3400 J

C 1600 J

[1]

8. A skydiver has a weight of 750 N. The drag acting upwards on the skydiver is 600 N. What is the resultant vertical force acting on the skydiver?

A 150 N upwards

B 150 N downwards

C 750 N downwards

[1]

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9. A lawnmower with a power of 1.5 kW is plugged into a 230 V mains supply. Calculate the current through the lawnmower.

.....

.....

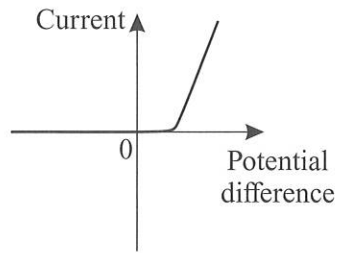
.....

.....

Current = ... A

[3]

10. An *I-V* graph for a circuit component is shown on the right.



Identify the component and give a reason for your answer.

Component: .....

Reason: .....

.....

[2]

11. The potential difference across the primary coil of a transformer is 54.0 V and the potential difference across the secondary coil is 32.0 V. The current in the primary coil is a 8.00 A. Calculate the current in the secondary coil.

$$V_P \times I_P = V_S \times I_S$$

where V_P = potential difference across primary coil, I_P = current in primary coil, V_S = potential difference across secondary coil and I_S = current in secondary coil.

.....

.....

Current in secondary coil = ... A

[2]

15

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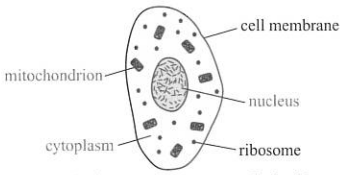
Answers

Key Concepts in Biology

Test 1: Key Concepts in Biology
Pages 2–3

1. A *[1 mark]*
2. B *[1 mark]*
3. C *[1 mark]*
4. A *[1 mark]*
5. A *[1 mark]*
6. C *[1 mark]*
7. C *[1 mark]*
8. B *[1 mark]*
9. The shape of the enzyme's active site has changed so the substrate won't fit anymore *[1 mark]*.
10. To prevent further sperm cells from entering the egg *[1 mark]* which makes sure the offspring has the correct amount of DNA *[1 mark]*.
11. 

[1 mark for each correct label]
Mitochondria are where most of the reactions for aerobic respiration take place *[1 mark]*. The nucleus contains the genetic material that controls the activities of the cell *[1 mark]*.

Test 2: Key Concepts in Biology
Pages 4–5

1. C *[1 mark]*
2. A *[1 mark]*
3. C *[1 mark]*
4. C *[1 mark]*
5. B *[1 mark]*
6. B *[1 mark]*
7. B *[1 mark]*
8. A *[1 mark]*
9. E.g. it has a long tail so it can swim to the egg. / It has lots of mitochondria in order to provide energy for swimming. / It has an acrosome which contains enzymes needed to digest the egg cell membrane. / It has a haploid nucleus so that the fertilised egg has the correct number of chromosomes. *[1 mark]*
10. E.g. a higher resolution means that cells/subcellular structures can be studied in more detail *[1 mark]*.
11. It is the movement of particles across a membrane against a concentration gradient *[1 mark]* using energy transferred during respiration *[1 mark]*.
12. Some of the bonds holding the enzyme together break *[1 mark]*. This changes the shape of the enzyme's active site *[1 mark]*. The enzyme will not be able to bind to the substrate so it won't catalyse the reaction *[1 mark]*.

Biology Paper 1

Test 3: Cells and Control
Pages 6–7

1. C *[1 mark]*
2. A *[1 mark]*
3. A *[1 mark]*
4. C *[1 mark]*
5. B *[1 mark]*
6. B *[1 mark]*
7. B *[1 mark]*
8. B *[1 mark]*
9. An undifferentiated cell found in early human embryos *[1 mark]* that has the potential to differentiate into any kind of cell *[1 mark]*.
10. Electrical impulses are transferred from neurone to neurone by neurotransmitters *[1 mark]* which diffuse across the synapse *[1 mark]*.
11. E.g. repair/replacing damaged cells. Growth. Asexual reproduction. *[1 mark for each]*

Test 4: Genetics
Pages 8–9

1. B *[1 mark]*
2. B *[1 mark]*
3. A *[1 mark]*
4. B *[1 mark]*
5. C *[1 mark]*
6. B *[1 mark]*
7. A *[1 mark]*
8. B *[1 mark]*
9. A single nucleotide consists of one sugar *[1 mark]*, one phosphate group *[1 mark]* and one base *[1 mark]*.
10. The plant will be tall *[1 mark]*, as the tall allele (T) is dominant over the recessive dwarf allele (t) *[1 mark]*.
11. Detergent: The detergent will break down the membranes of the kiwi cells to release the DNA *[1 mark]*. Salt: The salt will make the DNA stick together *[1 mark]*.

Test 5: Natural Selection & Genetic Modification
Pages 10–11

1. B *[1 mark]*
2. A *[1 mark]*
3. A *[1 mark]*
4. B *[1 mark]*
5. C *[1 mark]*
6. A *[1 mark]*
7. B *[1 mark]*
8. B *[1 mark]*
9. E.g. by looking at the structural features of the tools. / Using stratigraphy/the study of rock layers. / Using carbon-14 dating to date carbon-containing material found with the tools. *[1 mark]*
10. Any two from: e.g. it reduces the gene pool/number of alleles in a population. / It can cause health problems. / The population may have an increased susceptibility to disease. *[2 marks]*
11. The modification of the genome of an organism *[1 mark]* to introduce desirable characteristics *[1 mark]*.
12. Because it makes the bacteria better adapted to an environment in which antibiotics are present *[1 mark]*. As a result, antibiotic resistance becomes more common in a population over time *[1 mark]*.

Test 6: Health, Disease & the Development of Medicines
Pages 12–13

1. A *[1 mark]*
2. B *[1 mark]*
3. B *[1 mark]*
4. A *[1 mark]*
5. A *[1 mark]*
6. C *[1 mark]*
7. B *[1 mark]*
8. C *[1 mark]*
9. Cholera is spread via contaminated water sources *[1 mark]*.
10. Mosquitoes are vectors of the protist/pathogen that causes malaria *[1 mark]*. Mosquito nets help to stop people from being bitten by mosquitoes, which stops them from being infected with the protist/pathogen *[1 mark]*.
11. E.g. mucus *[1 mark]*.
12. The injected dead or inactive pathogens carry antigens/are antigenic *[1 mark]*. The antigens trigger memory lymphocytes to be made *[1 mark]*. If live pathogens of the same type appear after that, there will already be memory lymphocytes that can cause a fast secondary immune response *[1 mark]*.

Test 7: Health, Disease & the Development of Medicines
Pages 14–15

1. B *[1 mark]*
2. C *[1 mark]*

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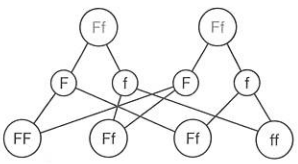
Answers

3. B *[1 mark]* 4. B *[1 mark]*
5. A *[1 mark]* 6. B *[1 mark]*
7. C *[1 mark]* 8. A *[1 mark]*
9. BMI = mass ÷ height^2
$= 89.1 \div 1.80^2 = 89.1 \div 3.24$
$= 27.5$ kg m^{-2}
[2 marks for correct answer, or 1 mark for correct working]
10. E.g. lysozyme / hydrochloric acid *[1 mark]*
11. Any two from: e.g. using a condom when having sex. / Drug users avoiding sharing needles. / Using medication to reduce the risk of an infected individual passing on the virus. *[2 marks]*
12. E.g. Disease: Cholera / Tuberculosis *[1 mark]*
Symptoms: For Cholera: diarrhoea
For Tuberculosis: coughing / lung damage *[1 mark]*

Test 8: Biology 1 Mixed Topics
Pages 16–17

1. A *[1 mark]* 2. A *[1 mark]*
3. B *[1 mark]* 4. A *[1 mark]*
5. B *[1 mark]* 6. C *[1 mark]*
7. B *[1 mark]* 8. C *[1 mark]*
9. E.g. temperature *[1 mark]*.
By using an electric water bath / a Bunsen burner and a beaker of water *[1 mark]*.
10. $\text{magnification} = \dfrac{\text{size of image}}{\text{size of real object}}$ *[1 mark]*
11.



[1 mark for the gametes' alleles being correct and 1 mark for the offspring's genotypes being correct]
As the cystic fibrosis allele is recessive, for the child to have the disease they will need two recessive alleles *[1 mark]*. The diagram shows that the chance the child will have cystic fibrosis is 25% / 1 in 4 *[1 mark]*.

Test 9: Biology 1 Mixed Topics
Pages 18–19

1. C *[1 mark]* 2. C *[1 mark]*
3. A *[1 mark]* 4. C *[1 mark]*
5. B *[1 mark]* 6. C *[1 mark]*
7. B *[1 mark]* 8. C *[1 mark]*
9. Percentage change $= \dfrac{6.6 - 7.8}{7.8} \times 100$
$= -15.384...$
$= -15\%$ (2 s.f.)
[2 marks for correct answer, 1 mark for correct answer without minus sign]
10. E.g. smoking *[1 mark]*
11. E.g. it allows scientists to better predict and prevent disease *[1 mark]* by knowing what genes predispose people to certain diseases *[1 mark]*. / Scientists are able to identify genes suspected of causing an inherited disorder more quickly *[1 mark]*, which means people can be tested for the inherited disorder / it may be possible to develop better treatments for the inherited disorder *[1 mark]*. / Understanding the genetic variation between people *[1 mark]* could allow doctors to give individually tailored treatment *[1 mark]*. / Understanding how a disease affects us on a molecular level *[1 mark]* could make it possible to design new and better treatments with fewer side-effects *[1 mark]*.
12. Cell division *[1 mark]*.
Cell differentiation *[1 mark]*.

Biology Paper 2

Test 10: Plant Structures and Their Functions
Pages 20–21

1. B *[1 mark]* 2. B *[1 mark]*
3. B *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. A *[1 mark]*
7. A *[1 mark]* 8. C *[1 mark]*
9. E.g. it has a large surface area *[1 mark]*.
10. It will slow down *[1 mark]* because there will be less light present to transfer the energy needed for photosynthesis *[1 mark]*.
11. Increasing air movement would increase the rate of transpiration *[1 mark]* because water vapour surrounding the leaf would be swept away *[1 mark]*. This would increase the concentration gradient between water inside and outside the leaf *[1 mark]*, meaning that more water would diffuse out of the leaf *[1 mark]*.

Test 11: Animal Coordination, Control & Homeostasis
Pages 22–23

1. B *[1 mark]* 2. C *[1 mark]*
3. C *[1 mark]* 4. A *[1 mark]*
5. A *[1 mark]* 6. B *[1 mark]*
7. B *[1 mark]* 8. C *[1 mark]*
9. It increases the blood sugar level *[1 mark]* by stimulating the liver to break down its glycogen stores to release glucose *[1 mark]*.
10. LH and FSH are given to a woman *[1 mark]* to stimulate several eggs to mature and be ready for collection *[1 mark]*.
11. E.g. it maintains the lining of the uterus *[1 mark]*.
12. Type 1 diabetes is a condition where the pancreas produces little or no insulin *[1 mark]*. This is dangerous because it means that a person's blood sugar level can rise to a level that can kill them *[1 mark]*.

Test 12: Exchange and Transport in Animals
Pages 24–25

1. C *[1 mark]* 2. C *[1 mark]*
3. C *[1 mark]* 4. B *[1 mark]*
5. A *[1 mark]* 6. A *[1 mark]*
7. B *[1 mark]* 8. A *[1 mark]*
9. To prevent backflow of blood in the heart *[1 mark]*.
10. cardiac output
= heart rate × stroke volume
= 88 × 80 *[1 mark]*
= 7040 cm^3 min^{-1} *[1 mark]*
11. Any two from: e.g. red blood cells / white blood cells / platelets *[2 marks]*.
12. Pulmonary vein *[1 mark]*
Aorta *[1 mark]*

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Answers

Test 13: Exchange and Transport in Animals
Pages 26–27

1. A *[1 mark]* 2. B *[1 mark]*
3. C *[1 mark]* 4. B *[1 mark]*
5. B *[1 mark]* 6. C *[1 mark]*
7. B *[1 mark]* 8. B *[1 mark]*
9. The left ventricle needs more muscle to pump blood around the whole body *[1 mark]*, whereas the right ventricle only has to pump blood to the lungs *[1 mark]*.
10. Any two from: e.g. arteries carry blood away from the heart, whilst veins carry blood to the heart. / Arteries have thick walls, whilst veins have thin walls. / Veins contain valves, but arteries don't. *[2 marks]*
11. Multicellular organisms have a small surface area compared to their volume *[1 mark]*. This makes it difficult to exchange enough substances across their outside surface to supply their entire volume *[1 mark]*. So they need transport systems to move substances between exchange surfaces and the rest of the body *[1 mark]*.

Test 14: Ecosystems and Material Cycles
Pages 28–29

1. A *[1 mark]* 2. B *[1 mark]*
3. C *[1 mark]* 4. B *[1 mark]*
5. A *[1 mark]* 6. C *[1 mark]*
7. C *[1 mark]* 8. A *[1 mark]*
9. It releases carbon dioxide into the air *[1 mark]*.
10. E.g. an increase in the number of predators *[1 mark]*. An increase in competition *[1 mark]*.
11. Parasites live very closely with / in / on a host species *[1 mark]*. The parasite takes what it needs to survive from the host but the host doesn't benefit from the relationship *[1 mark]*.
12. Any two from: Food and waste that leak into open water can cause eutrophication and result in the death of wild species. / Fish farms can be breeding grounds for parasites, which can infect and kill wild animals. / Predators can get trapped in the fish farm nets and die. / Farmed fish can get out and reduce populations of indigenous species via competition/predation/ introducing disease. *[2 marks]*

Test 15: Ecosystems and Material Cycles
Pages 30–31

1. A *[1 mark]* 2. A *[1 mark]*
3. B *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. B *[1 mark]*
7. C *[1 mark]* 8. B *[1 mark]*
9. Interdependence is where organisms in a community depend on each other to survive and reproduce *[1 mark]*.
10. A relationship between two organisms *[1 mark]* from which both organisms benefit *[1 mark]*.
11. The excess nitrates cause algae to grow fast and block out the light *[1 mark]*. Plants can't photosynthesise due to lack of light and start to die and decompose *[1 mark]*. With more food available, microorganisms that feed on decomposing plants increase in number and use up oxygen in the water *[1 mark]*. Organisms that need oxygen for aerobic respiration also die *[1 mark]*.

Test 16: Biology 2 Mixed Topics
Pages 32–33

1. B *[1 mark]* 2. C *[1 mark]*
3. C *[1 mark]* 4. A *[1 mark]*
5. C *[1 mark]* 6. A *[1 mark]*
7. B *[1 mark]* 8. C *[1 mark]*
9. Any three from: oxygen / carbon dioxide / water / mineral ions *[3 marks]*.
10. Taking clomifene causes more FSH and LH to be released by the body *[1 mark]*, which stimulates egg maturation and ovulation *[1 mark]*.
11. A person's waist-to-hip ratio indicates how much fat is stored around the abdomen *[1 mark]*. Storing a lot of fat around the abdomen is associated with an increase risk of developing type 2 diabetes *[1 mark]*.

Test 17: Biology 2 Mixed Topics
Pages 34–35

1. C *[1 mark]* 2. B *[1 mark]*
3. A *[1 mark]* 4. C *[1 mark]*
5. B *[1 mark]* 6. A *[1 mark]*
7. A *[1 mark]* 8. A *[1 mark]*
9. $\text{carbon dioxide} + \text{water} \xrightarrow{\text{light energy}} \text{glucose} + \text{oxygen}$
   [2 marks for whole equation completed correctly, 1 mark for one or two gaps filled correctly.]
10. Function: Xylem vessels transport water and mineral ions from the roots to the leaves *[1 mark]*. Adaptation: The cells form hollow tubes to allow water and mineral ions to pass through. / The tubes are strengthened by lignin. *[1 mark]*
11. light intensity $\propto \frac{1}{\text{distance}^2}$ *[1 mark]*
12. Mean number of limpets per m^2 = $(1 \div 0.25) \times 22 = 88$
    Total population = 88×1800
    $= 158\,400$ limpets
    [2 marks for correct answer or 1 mark for correct working]

Key Concepts in Chemistry

Test 18: Key Concepts in Chemistry
Pages 36-37

1. C *[1 mark]* 2. C *[1 mark]*
3. C *[1 mark]* 4. B *[1 mark]*
5. C *[1 mark]* 6. A *[1 mark]*
7. B *[1 mark]* 8. A *[1 mark]*
9. They have the same number of outer electrons/electrons in their outer shell *[1 mark]*.
10. $2Li + 2H_2O \rightarrow 2LiOH + H_2$ *[1 mark]*
11. Number of moles of C = $66\text{ g} \div 12 = 5.5$. From balanced equation, 5.5 moles of CO_2 are produced *[1 mark]*.
    Relative formula mass (M_r) of CO_2 = $12 + (2 \times 16) = 44$ *[1 mark]*.

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Answers

Mass of CO_2 = moles × M_r
= 5.5 × 44 = 242 g *[1 mark]*
[Or 3 marks for the correct answer via any other method.]

12. The two oxygen atoms share two pairs of electrons *[1 mark]*. This forms a double covalent bond *[1 mark]*.

Test 19: Key Concepts in Chemistry
Pages 38-39

1. A *[1 mark]* 2. B *[1 mark]*
3. B *[1 mark]* 4. B *[1 mark]*
5. A *[1 mark]* 6. A *[1 mark]*
7. C *[1 mark]* 8. B *[1 mark]*
9. Isotopes are atoms of the same element, which have the same number of protons but a different number of neutrons *[1 mark]*.
10. 0.00025 kg × 1000 = 0.25 g
Concentration = mass ÷ volume
= 0.25 ÷ 0.5 *[1 mark]*
= 0.5 g dm^{-3} *[1 mark]*
[Or 2 marks for the correct answer via any other method.]
11. The structure is made up of positive (sodium) ions and negative (chloride) ions in a regular arrangement *[1 mark]*. The structure is held together by ionic bonds/ electrostatic forces between the oppositely charged ions *[1 mark]*.
12. Graphite contains delocalised electrons *[1 mark]* which are free to move *[1 mark]*.

Chemistry Paper 1

Test 20: States of Matter and Mixtures
Pages 40–41

1. B *[1 mark]* 2. C *[1 mark]*
3. B *[1 mark]* 4. B *[1 mark]*
5. A *[1 mark]* 6. B *[1 mark]*
7. C *[1 mark]* 8. A *[1 mark]*
9. The particles change from being in a close, irregular arrangement (in the liquid state) to being far apart (in the gas state) *[1 mark]*. The particles also move faster *[1 mark]*.
10. Vapour from the boiling mixture rises through the fractionating column. Any vapour of compound 1 will condense before it reaches the top of the column as its boiling point is higher than 70 °C *[1 mark]*. The vapour of compound 2 will not condense in the column, as its boiling point is lower than 70 °C *[1 mark]*. This means only the vapour of compound 2 will reach the condenser and be collected, separating compound 2 from compound 1 in the flask *[1 mark]*.
11. A pure substance will always leave a single spot on the chromatography paper *[1 mark]*. An impure substance will usually leave multiple spots *[1 mark]*.

Test 21: States of Matter and Mixtures
Pages 42–43

1. B *[1 mark]* 2. C *[1 mark]*
3. A *[1 mark]* 4. B *[1 mark]*
5. A *[1 mark]* 6. A *[1 mark]*
7. C *[1 mark]* 8. B *[1 mark]*
9. R_f = 3.2 ÷ 4.9 = 0.6530... *[1 mark]*
= 0.65 (to 2 s.f.) *[1 mark]*
10. Ethanol (it boils at 78°C) *[1 mark]*
11. Place a spot of the ink on a starting line, marked in pencil, near the bottom of a strip of filter paper *[1 mark]*. Place the bottom of the filter paper in a beaker containing a small amount of solvent *[1 mark]* so the ink is above the solvent level *[1 mark]*.
12. E.g. the ice/water is impure *[1 mark]*.

Test 22: Chemical Changes
Pages 44–45

1. C *[1 mark]* 2. A *[1 mark]*
3. A *[1 mark]* 4. B *[1 mark]*
5. B *[1 mark]* 6. C *[1 mark]*
7. C *[1 mark]* 8. B *[1 mark]*
9. Hydrogen gas *[1 mark]*, because e.g. sodium is more reactive than hydrogen *[1 mark]*. Chlorine gas *[1 mark]*, because e.g. chloride ions are present in the solution *[1 mark]*.
10. $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$ *[1 mark]*
11. E.g. to make sure all the acid has reacted / to make sure there is no leftover acid in the product *[1 mark]*.
12. Bubble the gas through the limewater. If the gas is carbon dioxide, the limewater will turn cloudy white/milky *[1 mark]*.

Test 23: Chemical Changes
Pages 46–47

1. A *[1 mark]* 2. C *[1 mark]*
3. A *[1 mark]* 4. A *[1 mark]*
5. B *[1 mark]* 6. C *[1 mark]*
7. A *[1 mark]* 8. C *[1 mark]*
9. zinc sulfate *[1 mark]*, water *[1 mark]*
10. The solution will change from red to yellow *[1 mark]*.
11. $Cu \rightarrow Cu^{2+} + 2e^-$ *[1 mark]*
12. E.g. filter out the precipitate from the solution using filter paper and a filter funnel *[1 mark]*. Rinse the precipitate and filter paper with deionised water *[1 mark]*. Leave the calcium sulfate to dry in an oven/ desiccator *[1 mark]*.

Test 24: Extracting Metals and Equilibria
Pages 48–49

1. B *[1 mark]* 2. B *[1 mark]*
3. A *[1 mark]* 4. A *[1 mark]*
5. A *[1 mark]* 6. C *[1 mark]*
7. C *[1 mark]* 8. B *[1 mark]*
9. Metal: Any metal that's above carbon in the reactivity series, e.g. aluminium *[1 mark]*.
Explanation: It's extracted by electrolysis because it's too reactive to be extracted by reduction with carbon/ it is above carbon in the reactivity series *[1 mark]*.
10. The reaction of magnesium with hydrochloric acid would produce a lot of bubbles/effervescence *[1 mark]*. The reaction of iron with hydrochloric acid would be less vigorous/produce fewer bubbles than with magnesium *[1 mark]*. Magnesium reacts faster than iron because magnesium is more reactive/higher in the reactivity series than iron *[1 mark]*.
11. E.g. nitrogen gas (N_2) can be obtained from the air *[1 mark]*.

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Answers

Hydrogen gas (H_2) can be produced from natural gas *[1 mark]*.

Test 25: Extracting Metals and Equilibria
Pages 50–51

1. A *[1 mark]* 2. C *[1 mark]*
3. C *[1 mark]* 4. B *[1 mark]*
5. A *[1 mark]* 6. A *[1 mark]*
7. C *[1 mark]* 8. A *[1 mark]*
9. E.g. getting the raw materials *[1 mark]*, manufacturing the product *[1 mark]*, using the product *[1 mark]*, disposal of the product *[1 mark]*.
10. Any two from: e.g. recycling doesn't require new ore to be mined, which would damage the landscape/destroy habitats. / Recycling is likely to reduce the amount of metal which takes up space in landfill and can pollute the surroundings. / Recycling generally uses less energy than extracting from ores, and the energy used to extract from ores is often produced by burning fossil fuels. *[2 marks]*
11. Metal A is more reactive than metal B *[1 mark]*.

Test 26: Chemistry 1 Mixed Topics
Pages 52–53

1. B *[1 mark]* 2. C *[1 mark]*
3. C *[1 mark]* 4. C *[1 mark]*
5. B *[1 mark]* 6. A *[1 mark]*
7. C *[1 mark]* 8. A *[1 mark]*
9. The breaking down of a substance/electrolyte using electricity *[1 mark]*.
10. The forwards reaction would be favoured. The right hand side of the equation contains fewer molecules of gas *[1 mark]*, so the equilibrium would move towards the right/products to reduce the pressure *[1 mark]*.
11. E.g. Relative atomic mass = [sum of (relative isotopic mass × isotopic abundance)] ÷ (sum of abundances)
$= \frac{((63 \times 69.2) + (6.5 \times 30.8))}{(69.2 + 30.8)}$
[1 mark]
$= 63.616 = 63.6$ (to 3 s.f.) *[1 mark]*
12. Copper *[1 mark]*. Copper is less reactive than hydrogen, so it will be produced at the cathode (instead of hydrogen gas) *[1 mark]*.

Test 27: Chemistry 1 Mixed Topics
Pages 54–55

1. A *[1 mark]* 2. B *[1 mark]*
3. C *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. C *[1 mark]*
7. C *[1 mark]* 8. B *[1 mark]*
9. The forward and backward reactions are occurring at exactly the same rate *[1 mark]*.
10. The salt is soluble, so would be contaminated by the excess alkali *[1 mark]*.
11. E.g. add water to the mixture to dissolve the soluble magnesium sulfate *[1 mark]*. Filter the mixture to remove the insoluble copper filings *[1 mark]*. Crystallise the remaining solution to obtain a pure sample of the magnesium sulfate *[1 mark]*.
12. Find the number of moles in 1.84 g of ethanol: moles = mass ÷ M_r
$= 1.84 \div 46 = 0.04$ moles *[1 mark]*
1 mole of ethanol reacts to form 2 moles of carbon dioxide, so 0.04 moles of ethanol reacts to form $0.04 \times 2 = 0.08$ moles of carbon dioxide *[1 mark]*
[Or 2 marks for the correct answer via any other method.]

Chemistry Paper 2

Test 28: Groups in the Periodic Table
Pages 56–57

1. C *[1 mark]* 2. B *[1 mark]*
3. B *[1 mark]* 4. B *[1 mark]*
5. A *[1 mark]* 6. C *[1 mark]*
7. B *[1 mark]* 8. B *[1 mark]*
9. Reduced: Cl_2/chlorine *[1 mark]*
Oxidised: Br^-/bromide ions *[1 mark]*
10. As you move down the group, the outer electron is further away from the nucleus *[1 mark]*. So it is less strongly attracted to the nucleus and is lost more easily *[1 mark]*.
11. A displacement reaction will occur if the halogen is more reactive than the halogen in the halide salt *[1 mark]*.
12. The noble gases have a full outer shell of electrons *[1 mark]*, so they don't easily lose or gain electrons *[1 mark]*.

Test 29: Rates of Reaction and Energy Changes
Pages 58–59

1. A *[1 mark]* 2. C *[1 mark]*
3. A *[1 mark]* 4. A *[1 mark]*
5. B *[1 mark]* 6. C *[1 mark]*
7. B *[1 mark]* 8. B *[1 mark]*
9. E.g. Experiment 2 could have been carried out at a higher temperature / with a greater concentration of reactants / at a higher pressure (with gases) / with a catalyst / with solid reactants crushed into smaller parts *[1 mark]*. This would have increased the rate of reaction, as shown by the steeper gradient of the line *[1 mark]*.
10. E.g. carry out the reaction on a mass balance and record the decrease in mass *[1 mark]* and the time it takes for the reaction to finish *[1 mark]*. Calculate the average rate of reaction by dividing the decrease in mass by the time taken *[1 mark]*. / Using a gas syringe, record the volume of gas given off *[1 mark]* and the time it takes for the reaction to finish *[1 mark]*. Calculate the average rate of reaction by dividing the volume of gas by the time taken *[1 mark]*.
11. It shows an exothermic reaction. The products are at a lower energy than the reactants *[1 mark]*, so energy is released and the reaction must be exothermic *[1 mark]*.

Test 30: Rates of Reaction and Energy Changes
Pages 60–61

1. B *[1 mark]* 2. B *[1 mark]*
3. B *[1 mark]* 4. B *[1 mark]*
5. A *[1 mark]* 6. C *[1 mark]*
7. A *[1 mark]* 8. B *[1 mark]*
9. Increasing the concentration of a solution increases the number of

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Answers

reactant particles in a given volume / causes the particles to move closer together *[1 mark]* so will increase the frequency of collisions / cause the particles to collide more often *[1 mark]*.

10. E.g. Find the energy required to break the bonds:
$4(C–H) + 2(O=O)$
$= (4 \times 413) + (2 \times 496)$
$= 2644\ kJ\,mol^{-1}$ *[1 mark]*
Find the energy released when forming new bonds:
$2(C=O) + 4(O–H)$
$= (2 \times 803) + (4 \times 464)$
$= 3462\ kJ\,mol^{-1}$ *[1 mark]*
So the energy change
$= 2644 - 3462$ *[1 mark]*
$= -818\ kJ\,mol^{-1}$ *[1 mark]*

11. The yeast produces enzymes which serve as a catalyst for the fermentation reaction *[1 mark]*.

Test 31: Fuels and Earth Science
Pages 62–63

1. B *[1 mark]* 2. C *[1 mark]*
3. C *[1 mark]* 4. A *[1 mark]*
5. C *[1 mark]* 6. B *[1 mark]*
7. C *[1 mark]* 8. A *[1 mark]*
9. Carbon dioxide *[1 mark]*.
E.g. methane / ammonia / water vapour (steam) / nitrogen *[1 mark]*.
From volcanic activity *[1 mark]*.
10. Decane has the lower viscosity, because decane molecules are shorter than icosane molecules *[1 mark]*. This means there are weaker intermolecular forces holding the molecules together and therefore the liquid can flow more easily *[1 mark]*.
11. Any one from: e.g. burning fossil fuels, as combustion of hydrocarbons in the fuels produces carbon dioxide. / Deforestation, as this reduces the number of trees which can remove carbon dioxide from the air. *[1 mark for a correct activity, 1 mark for a correct explanation]*

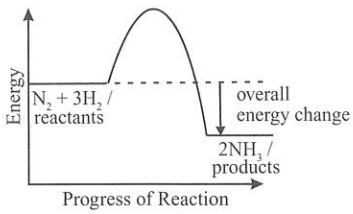
Test 32: Fuels and Earth Science
Pages 64–65

1. A *[1 mark]* 2. B *[1 mark]*
3. A *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. B *[1 mark]*
7. A *[1 mark]* 8. A *[1 mark]*
9. There is a temperature gradient in the column/the column gets cooler as you go up it *[1 mark]*. The fractions have different boiling points *[1 mark]* so they condense and drain out at different levels *[1 mark]*.
10. Advantage: e.g. the only waste product from hydrogen is water so hydrogen fuels cells don't produce pollutants. / Hydrogen can be obtained from water so it is a renewable resource. *[1 mark]*
Disadvantage: e.g. a hydrogen-powered car needs a special, expensive engine. / A lot of energy is needed to extract hydrogen. / Hydrogen is hard to store. / Hydrogen is not widely available. *[1 mark]*
11. Green plants decreased the carbon dioxide level and increased the oxygen level *[1 mark]*. The process that caused this change is photosynthesis *[1 mark]*.

Test 33: Chemistry 2 Mixed Topics
Pages 66–67

1. B *[1 mark]* 2. C *[1 mark]*
3. C *[1 mark]* 4. A *[1 mark]*
5. A *[1 mark]* 6. B *[1 mark]*
7. A *[1 mark]* 8. C *[1 mark]*
9. E.g. Moles of Ca = mass in g $\div A_r$
$= 200 \div 40 = 5$ moles *[1 mark]*
Moles of O_2 = mass in g $\div M_r$
$= 80 \div 32 = 2.5$ moles *[1 mark]*
So 5 moles of Ca reacts with 2.5 moles of O_2.
This simplifies to 2:1 *[1 mark]*.
Since calcium forms Ca^{2+} ions and oxygen forms O^{2-} ions, the formula for calcium oxide is CaO. So the symbol equation is
$2Ca + O_2 \rightarrow 2CaO$ *[1 mark]*.

10.



[1 mark for labelled product line below and to the right of labelled reactant line, 1 mark for correct shape of curve linking reactants to products, 1 mark for correct labelling of overall energy change]

Test 34: Chemistry 2 Mixed Topics
Pages 68–69

1. A *[1 mark]* 2. B *[1 mark]*
3. A *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. C *[1 mark]*
7. A *[1 mark]* 8. B *[1 mark]*
9. Chlorine has more than one isotope *[1 mark]*. Relative atomic mass is an average that takes into account the relative abundances of all the isotopes of an element *[1 mark]*.
10. The halogens decrease in reactivity down the group *[1 mark]*. This is because atomic radius increases down the group / the outer shell of electrons is further from the nucleus *[1 mark]*, so it is harder to attract/ gain an extra electron *[1 mark]*.
11. The amount of time taken for the black cross to disappear will decrease *[1 mark]* because increasing the temperature increases the rate of the reaction *[1 mark]*.

Physics Paper 1

Test 35: Motion, Forces and Conservation of Energy
Pages 70–71

1. C *[1 mark]* 2. B *[1 mark]*
3. B *[1 mark]* 4. B *[1 mark]*
5. C *[1 mark]* 6. B *[1 mark]*
7. A *[1 mark]* 8. A *[1 mark]*
9. $KE = \frac{1}{2} \times m \times v^2$
$= \frac{1}{2} \times 580 \times 65^2$ *[1 mark]*
$= 1\,225\,250$ J
(or 1 200 000 J to 2 s.f.)*[1 mark]*

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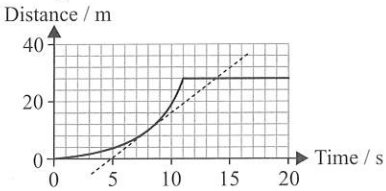
Answers

10. The planet is kept in its orbit by a centripetal force that acts towards the centre of the circle *[1 mark]*. The planet's speed remains constant but the direction of the planet's motion is constantly changing, so its velocity is changing *[1 mark]*.
11. (final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance
or $v^2 - u^2 = 2 \times a \times x$
Rearrange for a:
$a = \frac{v^2 - u^2}{2x}$ *[1 mark]*
$= \frac{0^2 - 13^2}{2 \times 26}$ *[1 mark]*
$= -3.25$ m/s^2
deceleration = 3.25 m/s^2
= 3.3 m/s^2 (to 2 s.f.)
[1 mark]

Test 36: Motion, Forces and Conservation of Energy Pages 72–73

1. A *[1 mark]* 2. C *[1 mark]*
3. B *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. B *[1 mark]*
7. B *[1 mark]* 8. C *[1 mark]*
9. E.g. They can alter the landscape/ spoil the view. They can alter the local habitat for wildlife. *[2 marks]*
10. E.g.



Draw a tangent at 8 s. Tangent passes through (5, 0) and (15, 32), so
change in x = 10
change in y = 32
Speed = gradient
= 32 ÷ 10 = 3.2 m/s
[1 mark for drawing a tangent at 8 s, 1 mark for correctly calculated speed between 3.0 and 3.4 m/s.]

11. $F = \frac{mv - mu}{t}$
$= \frac{(90 \times 3.2) - (90 \times 5.8)}{7}$ *[1 mark]*
$= -33.428...$ *[1 mark]*
$= -33.4$ N (to 3 s.f.) *[1 mark]*

Test 37: Waves and the Electromagnetic Spectrum Pages 74–75

1. C *[1 mark]* 2. B *[1 mark]*
3. C *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. C *[1 mark]*
7. B *[1 mark]* 8. B *[1 mark]*
9. **A**: Microwaves *[1 mark]*
D: X-rays *[1 mark]*
10. Any two from: e.g. microwaves — internal heating of body cells / infrared — skin burns / ultraviolet — damage to surface cells and eyes / skin cancer / eye conditions / X-rays or gamma rays — mutation or damage to cells in the body / cancer *[2 marks]*
11. Place both microphones next to the speaker, then slowly move one away until the two detected waves on the oscilloscope display are aligned, but have moved exactly one wavelength apart *[1 mark]*. Measure the distance between the two microphones to find one wavelength, λ *[1 mark]*. Use the formula $v = f\lambda$, where f is the frequency of the signal generator and so the sound waves, to find the velocity of the sound waves, v, passing through the air *[1 mark]*

Test 38: Waves and the Electromagnetic Spectrum Pages 76–77

1. C *[1 mark]* 2. A *[1 mark]*
3. C *[1 mark]* 4. A *[1 mark]*
5. B *[1 mark]* 6. A *[1 mark]*
7. B *[1 mark]* 8. B *[1 mark]*
9. Any three from: e.g. cooking / thermal imaging / short range communications / optical fibres / television remote controls / security systems *[3 marks]*
10. The ripples don't carry the water away to the edge of the tank with them. / The ripples don't carry the rubber duck away with them, the rubber duck stays in the same place. *[1 mark]*
11. wave speed = distance ÷ time
distance = 42 cm = 0.42 m
wave speed = 0.42 ÷ 3.2 *[1 mark]*
= 0.13125 m/s *[1 mark]*
= 0.13 m/s (to 2 s.f.) *[1 mark]*

Test 39: Radioactivity Pages 78–79

1. C *[1 mark]* 2. A *[1 mark]*
3. B *[1 mark]* 4. B *[1 mark]*
5. C *[1 mark]* 6. B *[1 mark]*
7. A *[1 mark]* 8. A *[1 mark]*
9. $^{32}_{16}S$ *[1 mark]*
10. Half-life = 4 hours
[2 marks for a correct answer, otherwise 1 mark for an attempt to find the half-life using a correct method.]
11. Exposure to ionising radiation can damage cells *[1 mark]*, which could cause mutations that could lead to cancer / which could kill the cells *[1 mark]*.
E.g. Precaution: Standing behind barriers when using radioactive sources *[1 mark]*. Explanation: The barriers absorb ionising radiation, reducing the amount that reaches the doctor *[1 mark]*. / Precaution: Wearing photographic film badges to monitor exposure to radiation *[1 mark]*. Explanation: Using the badges to monitor the doctor's exposure means that the exposure can be limited *[1 mark]*.

Test 40: Radioactivity Pages 80–81

1. B *[1 mark]* 2. A *[1 mark]*
3. B *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. A *[1 mark]*
7. C *[1 mark]* 8. A *[1 mark]*
9. E.g. If the count-rate reduces significantly when the paper is used, then the source emits alpha radiation *[1 mark]*. If the count rate is greatly reduced by the aluminium but not the paper, then the source emits beta-minus radiation *[1 mark]*. If the count rate isn't greatly reduced by either sheet then the source emits gamma radiation *[1 mark]*.

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Answers

10. When an electron in an atom absorbs an electromagnetic wave, the electron will orbit further from the nucleus *[1 mark]*. If an outer electron absorbs radiation with enough energy, it can move so far from the nucleus that it leaves the atom, making the atom into a positive ion *[1 mark]*.
11. Irradiation is when an object is exposed to radiation emitted by a radioactive source *[1 mark]* while contamination is when (unwanted) atoms of a radioactive source get on/inside another object *[1 mark]*.

Test 41: Physics 1 Mixed Topics
Pages 82–83

1. B *[1 mark]* 2. C *[1 mark]*
3. B *[1 mark]* 4. A *[1 mark]*
5. C *[1 mark]* 6. C *[1 mark]*
7. A *[1 mark]* 8. B *[1 mark]*
9. The speed of the wave increases *[1 mark]*, as the material it is travelling into is less (optically) dense than the material it is leaving *[1 mark]*.
10. $^{241}_{95}\text{Am} \rightarrow {}^{237}_{93}\text{Np} + {}^{4}_{2}\text{He}$
[1 mark for correct mass no. and 1 mark for correct atomic no.]
11. The distance is equal to the area under the graph. Area under the graph from 0 s to 10 s is:
$0.5 \times 10 \times 80 = 400$ m *[1 mark]*
and area from 10 s to 15 s is
$5 \times 80 = 400$ m *[1 mark]*
so the distance travelled is
$400 + 400 = 800$ m *[1 mark]*

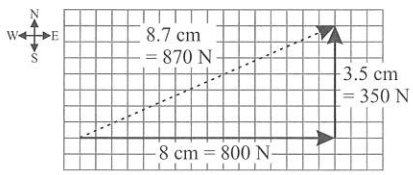
Test 42: Physics 1 Mixed Topics
Pages 84–85

1. A *[1 mark]* 2. C *[1 mark]*
3. B *[1 mark]* 4. B *[1 mark]*
5. A *[1 mark]* 6. A *[1 mark]*
7. C *[1 mark]* 8. C *[1 mark]*
9. E.g. tiredness / alcohol / drugs / distractions *[1 mark]*
10. 75% = 0.75
efficiency = useful energy transferred by the device ÷ total energy supplied to the device
Rearrange the equation:
useful energy transferred by the device = efficiency × total energy supplied to the device *[1 mark]*
$= 0.75 \times 560$ *[1 mark]*
$= 420$ J *[1 mark]*
11. There are initially 14 000 radioactive nuclei, so after one half-life there will be 7000 radioactive nuclei.
Reading from graph:
half-life = 5.6×10^3 years *[1 mark]*
16.8×10^3 years is
$(16.8 \times 10^3) \div (5.6 \times 10^3)$
= 3 half-lives *[1 mark]*
Number of radioactive nuclei left after 2 half-lives
$= 7000 \div 2 = 3500$
Number of radioactive nuclei left after 3 half-lives
$= 3500 \div 2 = 1750$ *[1 mark]*

Physics Paper 2

Test 43: Forces and Energy
Pages 86–87

1. C *[1 mark]* 2. A *[1 mark]*
3. A *[1 mark]* 4. B *[1 mark]*
5. C *[1 mark]* 6. B *[1 mark]*
7. B *[1 mark]* 8. A *[1 mark]*
9. The thermal energy store of the hairdryer heater/air and the kinetic energy store of the fan blades/air. *[1 mark for both correct]*
10. E.g. using scale 1 cm = 10 N



Magnitude = 870 N
[1 mark for drawing vertical force and horizontal force correctly, 1 mark for drawing resultant force correctly, 1 mark for giving magnitude of force between 860 and 890 N.]
11. 2 mins = $2 \times 60 = 120$ s *[1 mark]*
power = work done ÷ time taken
Rearrange the formula:
work done = power × time taken
$= 50 \times 120$ *[1 mark]*
$= 6000$ J *[1 mark]*

Test 44: Electricity and Circuits
Pages 88–89

1. B *[1 mark]* 2. C *[1 mark]*
3. B *[1 mark]* 4. A *[1 mark]*
5. C *[1 mark]* 6. B *[1 mark]*
7. C *[1 mark]* 8. B *[1 mark]*
9. In a series circuit, the supply potential difference is shared, so:
$V_3 = V_1 + V_2 = 3 + 2 = 5$ V *[1 mark]*
Resistances add up, so:
$R = R_1 + R_2 = 6 + 4 = 10\ \Omega$ *[1 mark]*
The ammeter will measure the total current. The current can be calculated using the supply potential difference and the total resistance of the circuit. (Alternatively, it could be calculated using the potential difference across R_1 or R_2.)
potential difference = current × resistance / $V = I \times R$
$I = V \div R = V_3 \div R$
$= 5 \div 10$ *[1 mark]*$= 0.5$ A *[1 mark]*
10. As more current flows through the lamp, the temperature of the filament increases *[1 mark]*. As the temperature increases, the resistance increases *[1 mark]*. More resistance means that less current can flow for a given potential difference and so the graph gets flatter *[1 mark]*.

Test 45: Electricity and Circuits
Pages 90–91

1. B *[1 mark]* 2. B *[1 mark]*
3. A *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. A *[1 mark]*
7. B *[1 mark]* 8. C *[1 mark]*
9. When the current is too high, the fuse melts, which breaks the circuit and stops the current flow *[1 mark]*.
10. When a current flows through a resistor, the electrons collide with the ions in the lattice that make up the resistor *[1 mark]*. This transfers energy to the ions, causing them to vibrate more and the resistor to heat up *[1 mark]*. Resistance increases because the more the ions vibrate, the more collisions occur between the electrons and the ions, and so the

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Answers

harder it is for the electrons to get through the resistor *[1 mark]*.

11. Energy transferred = current × potential difference × time
or $E = I \times V \times t$
Rearrange the formula:
$t = E \div (I \times V)$ *[1 mark]*
$= 1\,062\,600 \div (11 \times 230)$ *[1 mark]*
$= 420$ s *[1 mark]*

Test 46: Magnetic Fields
Pages 92–93

1. B *[1 mark]* 2. A *[1 mark]*
3. A *[1 mark]* 4. B *[1 mark]*
5. B *[1 mark]* 6. C *[1 mark]*
7. C *[1 mark]* 8. A *[1 mark]*
9. Transformers *[1 mark]*.
Transformers are used to increase the potential difference and decrease the current of electricity for energy-efficient transmission *[1 mark]*.
They are then used to reduce the potential difference to a safe, usable level when it reaches consumers *[1 mark]*.
10. Anticlockwise *[1 mark]*.
(To work this out, choose a side of the coil and then use Fleming's left hand rule. Remember, magnetic fields go north to south.)
11. force = 176 μN = 1.76×10^{-4} N
length = 1.1 cm = 0.011 m *[1 mark]*
Rearrange the formula:
$$\text{magnetic field strength} = \frac{\text{force}}{\text{current} \times \text{length}}$$
$$= \frac{1.76 \times 10^{-4}}{0.80 \times 0.011}$$
[1 mark]
magnetic field strength = 0.020 T *[1 mark]*

Test 47: Matter
Pages 94–95

1. B *[1 mark]* 2. B *[1 mark]*
3. C *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. C *[1 mark]*
7. B *[1 mark]* 8. A *[1 mark]*
9. Particles in a solid are held close together in a regular arrangement, whereas particles in a gas are far apart and are free to move *[1 mark]*.
10. 855 kJ/kg = 855 000 J/kg *[1 mark]*
thermal energy for a change of state = mass × specific latent heat
$= 0.60 \times 855\,000$ *[1 mark]*
$= 513\,000$ J (or 510 000 J to 2 s.f.) *[1 mark]*
11. 500 g = 0.5 kg
Specific heat capacity = change in thermal energy / (mass × temperature change) *[1 mark]*
Specific heat capacity
$= 2925 / (0.5 \times 15)$ *[1 mark]*
$= 390$ J/kg°C
(or 400 J/kg°C to 1 s.f.)
[1 mark]

Test 48: Matter
Pages 96–97

1. A *[1 mark]* 2. C *[1 mark]*
3. C *[1 mark]* 4. B *[1 mark]*
5. B *[1 mark]* 6. A *[1 mark]*
7. B *[1 mark]* 8. C *[1 mark]*
9. density = mass ÷ volume
$= 0.386 \div (2.00 \times 10^{-5})$ *[1 mark]*
$= 19\,300$ kg/m^3 *[1 mark]*
10. Block C *[1 mark]*, as it has the lowest temperature change for the given amount of energy supplied, so it must take the most energy to increase its temperature by 1 °C *[1 mark]*.
11. 34 mm = 0.034 m *[1 mark]*
energy transferred in stretching = $0.5 \times$ spring constant × (extension)^2
or $E = \frac{1}{2} \times k \times x^2$
Rearrange for k:
$k = (2 \times E) \div x^2 = (2 \times 0.45) \div 0.034^2$
[1 mark]
$= 778.5...$ N/m
$= 780$ N/m (to 2 s.f.) *[1 mark]*

Test 49: Physics 2 Mixed Topics
Pages 98–99

1. B *[1 mark]* 2. A *[1 mark]*
3. B *[1 mark]* 4. B *[1 mark]*
5. C *[1 mark]* 6. C *[1 mark]*
7. A *[1 mark]* 8. A *[1 mark]*
9. The compass will point north *[1 mark]*. This is because it aligns with the Earth's magnetic field / the magnetic field generated by the Earth's core *[1 mark]*.
10. Thermistor *[1 mark]*
Total circuit resistance
$= 2.0 + 3.0 = 5.0\ \Omega$ *[1 mark]*
Rearrange $V = I \times R$ for I:
$I = V \div R = 9.3 \div 5.0$ *[1 mark]*
$= 1.86$ A
$= 1.9$ A (to 2 s.f.) *[1 mark]*
11. The spring constant of the spring (in N/m) *[1 mark]*

Test 50: Physics 2 Mixed Topics
Pages 100–101

1. C *[1 mark]* 2. A *[1 mark]*
3. B *[1 mark]* 4. C *[1 mark]*
5. A *[1 mark]* 6. A *[1 mark]*
7. B *[1 mark]* 8. B *[1 mark]*
9. Power = 1.5 kW = 1500 W
Power = current × potential difference
Or $P = I \times V$
Rearrange the formula:
$I = P \div V$ *[1 mark]*
$= 1500 \div 230$ *[1 mark]*
$= 6.521...$
$= 6.5$ A (to 2 s.f.) *[1 mark]*
10. Diode *[1 mark]*. The I-V graph shows that current only flows in one direction / there is a very high resistance in the reverse direction *[1 mark]*.
11. $V_P \times I_P = V_S \times I_S$
$I_S = (V_P \times I_P) \div V_S$ *[1 mark]*
$= (54.0 \times 8.00) \div 32.0$
$= 13.5$ A *[1 mark]*

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