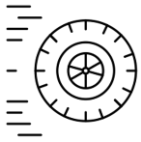


Topic 2 – Motion and forces

Define the term: scalar quantity

Define the term: vector quantity

Explain the difference between vector and scalar quantities

List some vector and scalar quantities

Define the term velocity

State the equation for acceleration

Describe three ways of measuring speed in a classroom.

State the general speeds of wind and sound, and for walking, running, cycling, driving and flying

State the acceleration due to gravity.

State Newton's First law

State Newton's second law. Include the general equation.

Define weight and include the equation.

Describe how weight is measured

Describe how changing mass changes acceleration.

Describe how to measure human reaction times.

State some typical reaction times in humans.

State the equation for stopping distance.

Describe some factors that affect stopping distance.

Describe some factors that affect human reaction time.

3	F = m x a	a	Acceleration	m/s^2
		F	Force	N
		M	Mass	kg

a	F	m
	35	7
	84	6
5		10
7		94
8	64	
10	125	

a	F	m
	4	0.64
	7.1	238
6.8		1237
9.42		0.56
3.5	20.5	
7.25	109	

2	$a = \frac{\Delta v}{t}$	a	Acceleration	m/s^2
		Δv	Change in Velocity	m/s
		t	Time Taken	s

a	Δv	t
	30	10
	40	5
2		30
10		19
6	84	
3	24	

a	Δv	t
	4	5
	8	50
5.3		22
4		6.2
30	9	
5	1250	

1	$d = s \times t$	d	Distance Travelled	m
		s	Speed	m/s
		t	Time Taken	s

d	s	t
	15	28
	7	17
700		35
500		60
200	8	
1700	75	

d	s	t
	0.3	180
	55.5	0.4
450		22
320		16
52 000	64.5	
6400	330	

Topic 3 – Conservation of energy

State the equation for gravitational potential energy.

State the equation for kinetic energy.

Describe the law of conservation of energy.

Describe the meaning of a closed system.

Describe what is meant by wasted energy.

Describe what happens to wasted energy.

Define the term dissipated.

Describe the effect of lubrication on energy dissipation.

Describe the effect of insulation on dissipation.

State the equation for efficiency

Describe how to increase efficiency (lubrication and insulation)

Define non-renewable energy

Define renewable energy

Describe 4 non-renewable energy sources

Describe 6 renewable energies.

4	$W = m \times g$	g	Gravitational Field Strength	N/kg
		m	Mass	Kg
		W	Weight	N

g	m	W	g	m	W
	400	2000		175	1825
	1.9	50		0.4	0.55
1.6		34	9.81		254
10		82	2.5		12 000
10	5		9.81	0.05	
10	90		23	45.3	

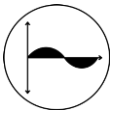
8	$efficiency = \frac{\text{useful energy}}{\text{total input}}$

Efficiency	*Useful Out*	*Total In*	*Efficiency*	*Useful Out*	*Total In*
	1500	2000		10	200
	60	300		1050	1500
0.50		2000	6%		50 000
0.20		600	57%		2530
0.90	200		85%	5990	
0.05	4000		35%	2100	

7	Ek = ½ x m x v²	E_K	Kinetic Energy	J
		m	Mass	Kg
		v	Speed	m/s

E_K	m	v	E_K	m	v
	200	9		250	3.5
	10	0.5		0.08	12.3
80		4	9		20
17600		8	279		2.4
1872	208		7.2	0.05	
2000	0.004		640 000	1600	

Topic 4 – Waves



Waves transfer _____ and _____ without transferring _____

Define the term wavelength

Define the term frequency

Define the term amplitude

Define the term period

Define the term wave velocity

Describe longitudinal waves

Describe transverse waves

State whether these are longitudinal or transverse: sound, EM, P waves, S waves and water waves.

State the equation for wave speed when you have frequency and wavelength

State the equation for wave speed when you have distance and time

Define the term refraction

Describe what happens to the wave speed of different wavelengths when travelling through glass.

Describe how to measure angles of light rays

Define the term normal line

Define the term angle of refraction

Define the term angle of incidence.

Topic 5 – Light and the electromagnetic spectrum

State whether EM waves are longitudinal or transverse

State the order of the EM spectrum from high wavelength to low wavelength.

State the order of the visible light spectrum from high to low frequency

State the type of EM wave that can be detected by eyes.

Describe some uses of the EM spectrum.

Describe how frequency can affect energy transfer

Define the term spectrum.

Describe the harmful effects of the three highest frequency EM waves.

9	$V = f \times \lambda$	f	Frequency	Hz
		λ	Wavelength	m
		v	Wave Speed	m/s

f	λ	v	f	λ	v
	0.3	7		1500	400
	0.4	5		7.5×10^{-7}	30 000 000
25		256	525		215
450		330	7×10^{14}		30 000 000
2	12		1.2	256	
125	20		360 000	0.0004	

10	$V = \frac{d}{t}$	d	Distance	m
		t	Time	s
		v	Wave Speed	m/s

d	t	v	d	t	v
	300	500		20	17
	0.25	80		10	15
30 000		750	1062		64
10 680		445	336		14
144 000	720		500	25	
2112	6		59	0.05	

Topic 6 – Radioactivity

Describe the structure of the atom fully, including all masses, charges and locations.

State the size of the nucleus in standard form.

Define the term isotope including the term atomic number and nucleon number.

State the relative masses and relative electric charges of protons, neutrons, electrons and positrons

Describe the result of the absorption or emission of EM radiation.

Define the term emission.

Describe how positive ions are formed

Describe the location of all nuclear radiation source

Describe the term ionisation

Define the term background radiation

Describe the origins of background radiation.

Describe how to use photographic film to detect radiation

Describe how to use a Geiger- Müller tube for measuring radioactivity

Describe the structure of alpha, beta minus, positron and gamma radiation.

Describe alpha, beta and gamma properties including penetration and ionisation capabilities.

Describe how and why the atomic model has changed over time: plum pudding, Rutherford and Bohr

Describe the process of $\beta-$ decay

Describe the process of $\beta+$ decay

Describe the effects on the atomic (proton) number and mass (nucleon) number of radioactive decays

State the unit of nuclear activity

_____

Describe the term half life

_____

Describe the dangers of ionising radiation

_____

Topic 8 – Energy – forces doing work

Describe some changes involved in the way energy is stored when systems change

Define the term closed system

State the different ways that the energy of a system can be changed

Define the term work done

State the equation for calculating work done when you have force and distance moved.

State the equation to calculate the change in gravitational PE when an object is raised above the ground.

State the equation to calculate the amounts of energy associated with a moving object:

Define the term dissipation

Define the term power

State the equation for calculating power when you have the energy transferred and the time taken.

Define the term Watt.

State the equation for efficiency.

11	$W = F \times d$	d	Distance Moved in Direction of Force	m
		F	Force	N
		W	Work Done	J

d	F	W
	50	300
	8	120
1.5		128
150		36 000
12	5	
2.5	50	

d	F	W
	125	100 000
	200	6120
135		4050
0.003		6
0.5	750	
3.75	7.2	

8 $$efficiency = \frac{\text{useful energy}}{\text{total input}}$$

Efficiency	*Useful Out*	*Total In*
	1500	2000
	60	300
0.50		2000
0.20		600
0.90	200	
0.05	4000	

Efficiency	*Useful Out*	*Total In*
	10	200
	1050	1500
6%		50 000
57%		2530
85%	5990	
35%	2100	

12	$P = \frac{E}{t}$	E	Energy Transferred	J
		P	Power	W
		t	Time	s

E	P	t
	50	3
	1000	15
4800		120
7440		14
96	3	
110	550	

E	P	t
	24	54.2
	120.4	7.3
842 240		175
4650		12.4
1311	43	
66 500	536	

Topic 9 – Forces and their effects

Define the term contact force

Define the term non-contact force.

Describe some contact forces

Describe some non-contact force.

State Newton's First Law

Describe how to reduce unwanted energy transfers in mechanical systems.

Describe how to reduce unwanted energy transfers in heated systems.

11	$W = F \times d$	d	Distance Moved in Direction of Force	m
		F	Force	N
		W	Work Done	J

d	F	W
	50	300
	8	120
1.5		128
150		36 000
12	5	
2.5	50	

d	F	W
	125	100 000
	200	6120
135		4050
0.003		6
0.5	750	
3.75	7.2	

8 $$efficiency = \frac{\text{useful energy}}{\text{total input}}$$

Efficiency	*Useful Out*	*Total In*
	1500	2000
	60	300
0.50		2000
0.20		600
0.90	200	
0.05	4000	

Efficiency	*Useful Out*	*Total In*
	10	200
	1050	1500
6%		50 000
57%		2530
85%	5990	
35%	2100	

12	$P = \frac{E}{t}$	E	Energy Transferred	J
		P	Power	W
		t	Time	s

E	P	t
	50	3
	1000	15
4800		120
7440		14
96	3	
110	550	

E	P	t
	24	54.2
	120.4	7.3
842 240		175
4650		12.4
1311	43	
66 500	536	

Topic 10 – Electricity and circuits

Describe the structure of the atom, limited to the position, mass and charge of protons, neutrons and electrons

Draw the symbols that represent cells, including batteries, switches, voltmeters, ammeters, resistors, variable resistors, lamps, motors, diodes, thermistors, LDRs and LEDs

Describe the differences between series and parallel circuits

Describe how to connect a voltmeter over a filament lamp.

Define the term potential difference, include the units, the unit symbol and the equation symbol.

Define the term charge, include the units, the unit symbol and the equation symbol.

State the equation to find the energy transferred when you have the charge and the voltage.

Describe how to connect and ammeter to a circuit.

Define the term current include the units, the unit symbol and the equation symbol.

State the equation for charge when you have current and time.

Describe what conservation of current in a parallel circuit means.

Describe the use of a variable resistor for increasing or decreasing current.

State the equation for voltage when you have current and resistance.

Describe how connecting resistors in series affect resistance

Describe how connecting resistors in parallel affects resistance

Describe the effect of increasing resistance on current in circuits.

Describe the effect of increasing the current in an ohmic resistor

Describe the effect of increasing the current in a filament lamp

Describe the effect of increasing current in a diode.

Describe the effect of changing temperature on a thermistor

Describe the effect of changing light levels on a light dependent resistor.

Define and describe the term resistance, including reference to subatomic particles.

Describe the energy transfers in a resistor when there is an electric current.

Describe the term dissipation

Describe the cause of dissipation in electrical circuits

Describe the effect of using low resistance wires on energy transfers

Describe advantages and disadvantages of the heating effect of electric current.

State the equation to calculate energy when you have voltage, current and time.

Define the term power include the units, the unit symbol and the equation symbol.

Describe the link between voltage, current and power.

State the equation to calculate power when you have voltage and current

State the equation to calculate power when you have resistance and current.

Describe the difference between direct and alternating voltage, include directionality and sources

Describe fully the UK electrical domestic supply.

Describe the function, and properties of the wires in UK domestic plugs.

Describe the function of an earth wire and of fuses or circuit breakers in ensuring safety

14	**E = V x Q**	Q	Charge	**C**
		E	Energy Transferred	**J**
		V	Potential Difference	**V**

Q	E	V
	16800	734
	500 000	2400
2.4		3
3		17
27	15	
0.6	72	

Q	E	V
	0.23	15.1
	175 000	1825
785		5
4.3		1.5
74	239	
30	600	

15	**Q = I x t**	Q	Charge	**C**
		I	Current	**A**
		t	Time	**s**

Q	I	t
	3	57
	13	60
180		18
0.6		36
160	0.4	
40	0.7	

Q	I	t
	0.015	107
	10.2	25.6
0.0155		0.0075
10.8		54.2
0.50	0.04	
560	3.2	

16	**V = I X R**	I	Current	**A**
		V	Potential Difference	**V**
		R	Resistance	**Ω**

I	V	R
	9	3
	2	120
0.5		18
0.25		1.2
2	6	
3	18	

I	V	R
	230	17
	230	19 000
450		33
0.025		1300
0.05	350	
32	42 000	

17	$P = I \times V$	I	Current	A
		P	Electric Power	W
		V	Potential Difference	V

I	P	V
	9000	2
	55	0.5
4	9	
6	225	
1.4		3
0.2		1.25

I	P	V
	15000	250
	24 000	12
0.05	225	
850	17000	
6.1		230
1.2		5.13

18	$P = I^2 \times R$	I	Current	A
		P	Electrical Power	W
		R	Resistance	Ω

I	P	R
	36	4
	6	24
0.8		15
0.4		2
2	1280	
4	53	

I	P	R
	2.4	60
	52.4	1000
0.21		260
0.004		33×10^6
3.2	4813	
0.89	375	

Topic 12 – Magnetism and the motor effect

_____ magnetic poles _____ and _____ magnetic poles repel.

Describe the uses of permanent and temporary magnetic materials including cobalt, steel, iron and nickel

_____

Describe the difference between permanent and induced magnets

_____

Describe the shape and direction of the magnetic field around bar magnets.

_____

Describe the use of plotting compasses to show the shape and direction of the field of a magnet

_____

Describe evidence that the core of the earth must be magnetic

_____

Describe the effect of a current flowing through a long straight conductor.

_____

Describe how to change the strength of this field.

_____

Describe the magnetic field of a solenoid, including reference to field lines.

_____

Topic 13 – Electromagnetic induction

Describe the factors that affect the size and direction of an induced potential difference.

_____

Describe the effect of an alternating current in one circuit on another in a transformer.

_____

Describe the uses of transformers

_____

Describe the need for step up transformers

_____

Describe the advantages of using high voltage power lines

_____

Describe the need for step down transformers

_____

Describe the assumptions made when using the power equation for transformers.

_____

27	$V_{\mathrm{p}} \times I_{\mathrm{p}} = V_{\mathrm{s}} \times I_{\mathrm{s}}$	I_P	Current in the Primary Coil	**A**
		I_S	Current in the Secondary Coil	**A**
		V_P	Potential Difference of the Primary Coil	**V**
		V_S	Potential Difference of the Secondary Coil	**V**

V_{p}	V_{s}	I_{p}	I_{s}	Step-up or step-down?
	1003	3.1	1.3	
	31	0.5	3.45	
922		0.15	2.1	
500	5		2	
110	230		4.1	
128000	230		5.0	
6	24	3		
30	40	20.0		

Topic 14 – Particle model

Describe the differences between solids, liquids and gasses using kinetic theory.

State the equation for density when you have volume and mass

Describe how to find the density of an irregular object

Describe how to find the density of a regular object

Describe how to find the density of a liquid.

Describe the reasons for differences in density between the different states of matter.

Describe what is meant by the conservation of mass

Describe 6 state changes that matter can undertake.

Describe the effect of heating a system, referencing temperature and change of state.

Define the term specific heat capacity

Define the term specific latent heat.

Describe the differences between specific hat capacity and specific latent heat.

Describe the effect of thermal insulation on energy transfers in systems.

Describe an experiment to investigate the specific latent heat of water.

Describe an experiment to investigate the specific latent heat of water.

Describe the cause of gas pressure

Describe the effect of changing the temperature on gas pressure.

Describe what is meant by absolute zero

Describe how to convert from degrees Celsius to degrees kelvin

19	$\rho = \frac{m}{V}$	ρ	Density	kg/m^3
		m	Mass	kg
		V	Volume	m^3

ρ	m	V
	160	0.06
	10 000	0.5
3500		3.38
685		5.3
7700	60	
1900	0.0073	

ρ	m	V
	500	0.185
	0.5	4.1
11×10^3		0.032
1.2		3.5×10^5
2.1×10^9	8.4	
8.52×10^3	613	

28	$E = m \times c \times \theta$	θ	Change in Temperature	°C
		E	Energy Transferred	J
		m	Mass	kg
		c	Specific Heat Capacity	J/kg°C

E	m	c	θ
	2	4200	80
	100	2100	50
7200		900	4
7200		390	4
1600	0.3		35
9 000 000	15		17
450 000	5.8	130	
198 000	8.9	850	

29	$E = m \times L$	E	Energy Transferred	J
		m	Mass	kg
		L	Specific Latent Heat	J/kg

E	m	L
	70	1400
	5	334×10^3
80		500
195 800		1100
634 000	2.3	
950	0.38	

E	m	L
	0.018	2.3×10^6
	0.82	3.3×10^5
512		8540
115 000		22.6×10^3
756	0.03	
1.05×10^7	167	

Topic 15 – Forces and matter

Describe the difference between elastic and inelastic distortion

State the equation for linear elastic distortion when you have the spring constant and the force

State the equation to calculate the energy in stretching a spring when you have the spring constant and the extension.

Describe the difference between linear and non-linear relationships between force and extension

Describe an experiment to discover the spring constant of a given spring.

20	**F = k x e**	e	Extension	**m**
		F	Force Exerted	**N**
		k	Spring Constant	**N/m**

e	F	k
	900	30
	0.5	40
		2.5
0.8		400
180	60	
0.25	10	

e	F	k
	820	0.04
	10.4	28
0.037		43
0.04		30
79	16 000	
3.4×10^{-3}	40	

31	$E = \frac{1}{2} \times k \times e^2$	E	Energy Transferred	**J**
		e	Extension	**m**
		k	Spring Constant	**N/m**

E	e	k
	5	380
	0.015	30 000
320		160
35		1100
250	0.1	
0.3	0.2	

E	e	k
	0.12	53.6
	0.032	0.032
3800		90
17.3		15 600
67 000	7.4	
265	3.8×10^{-3}	