Exam Skills Booklets

Answers

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12 & 13	1	2	3	4											

November 2011

(c) After the 3 seconds, the weight lifter drops the mass.
The velocity of the mass just before it hits the floor is 6.4 m/s.

Calculate the momentum of the mass just before it hits the floor.
State the unit.

(3)

The mass is 240Kg

Question Number	Answer	Acceptable answers	Mark
1(c)	substitution (1) 240 × 6.4 evaluation (1) 1500 Unit (1) kg m/s independent mark	 1536 give (2) marks for correct answer, no working Ns	 **(3)**

March 2012

(b) The mass of one water drop is 0.000 08 kg.

Calculate its weight.

(gravitational field strength is 10 N/kg)

(2)

Question Number	Answer	Acceptable answers	Mark
6 (b)	Substitution weight = 0.00008 x 10 (1) evaluation 0.0008 (N) (1)	8×10^{-4} 1/1250	**(2)**

Question Number	Answer	Acceptable answers	Mark
6 (c)	Substitution speed = 13 / 1.7 (1) evaluation 7.6 (m/s) (1)	An answer which rounds to 7.6 eg 7.647 7.65 7.7	**(2)**

June 2013

(ii) The car now accelerates in a straight line.
Its average acceleration is 12 m/s^2.

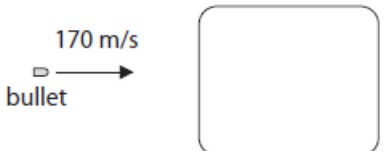
Calculate the increase in velocity of the car in 4.0 s.

(3)

Question Number	Answer	Acceptable answers	Mark
5 (a) (ii)	transposition: (1) {change in) speed= accelerationxtime substitution: (1) speed = 12 x 4 evaluation: (1) 48 (m/s) (1)	transposition and substitution can be in either order substitution mark can be scored when incorrectly transposed word/symbol equation is given Give full marks for correct answer no working	**(3)**

June 2013

4 (a) The diagram shows a bullet moving towards a wooden block.



Question Number	Answer	Acceptable answers	Mark
4(a)(i)	momentum = 0.03 × 170 (1)	Accept 5.1 seen	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	momentum before = momentum after (1) 5.1 = 0.83 × v (1) v = 6.1 (m/s) (1)	allow 5.0 = 0.80 x v for 1 mark max 5.0 = 0.83 x v v = 6.0 (m/s) allow ecf from (a)(i) give full marks for correct answer, no working	**(3)**

velocity = ... m/s

March 2013

2 Andrew skis down a hill.

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	substitution (1) 67 × 31 evaluation (1) 2077 (kg m/s)	 2080, 2100 working backwards using 2000 (v=) 29.85, 30 (m=) 64.52, 65 67 X 31=2000 scores only one mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	substitution (1) 2000 ÷ 2.3 evaluation (1) 870 (N)	 answer to (b)(i)) ÷ 2.3 900, 869.6, 869.5 903	**(2)**

(iii) The child and cart have a total mass of 50 kg. They travel at a velocity of 4 m/s.

Calculate the momentum of the child and cart.

(2)

Question Number	Answer	Acceptable answers	Mark
3 a(iii)	Substitution 50 x 4 (1) Evaluation 200 (kg m/s) (1)	 Allow full marks for correct answer with no working shown	**(2)**

Question Number	Answer	Acceptable answers	Mark
3 a(iv)	Substitution 450 / 1.5 (1) Evaluation 300 (N) (1)	 Allow full marks for correct answer with no working shown Allow (1) for 167 (N) obtained by 450-200 / 1.5	**(2)**

force = ... N

(c) Both vehicles are travelling at 13 m/s.

The driver of the truck then accelerates at 1.2 m/s^2 until both vehicles are travelling at 20 m/s.

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	Substitution (1) 1.2 = (20 – 13) / t Transposition (1) t = (20-13)/1.2 Evaluation 5.8 (s) (1) substitution and transposition can be in either order	1.2 = 7 / t t = 7/1.2 5.833 (etc) Give full marks for correct answer, no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c) (ii)	Substitution 1400 x 1.2 (1) Evaluation 1700 (N) (1)	1680 Allow full marks for correct answer with no working shown	**(2)**

force = ... N

June 2016

(d) When the car and passengers reach E, they have a total momentum of 150 000 kg m/s.

The total mass of the car and passengers is 9500 kg.

Calculate the velocity of the car and passengers at E.

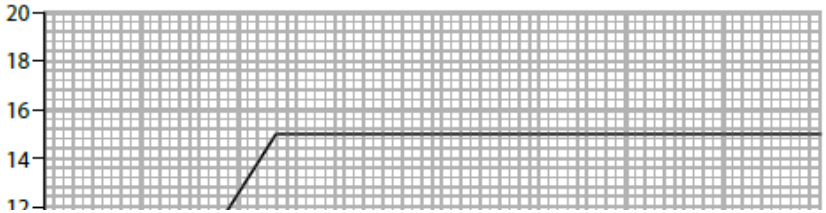
(3)

Question Number	Answer	Acceptable answers	Mark
3(d)	Substitution into $p = m \times v$ (1) 150 000 = 9 500 x v Transposition: (1) v = 150 000 / 9 500 evaluation: (1) 16 (m/s)	 Substitution and transposition can be in either order Answers which round to 16 such as 15.8, 15.79 etc Allow full marks for correct answer with no working shown	**(3)**

June 2016

Forces and motion

6 (a) The graph represents the motion of a cyclist at the start of an Olympic race.



Question Number	Answer	Acceptable answers	Mark
6ai	evidence of calculation of gradient of graph during acceleration: (1) Evaluation: (1) 6.3 (m/s^2)	Allow full marks for correct answer with no working shown accept values from 6.0 to 6.5 inclusive	**(2)**

Question Number	Answer	Acceptable answers	Mark
6aii	Line with smaller initial gradient and then horizontal at 17 m/s (1)	Ignore time at which acceleration stops. Judge horizontal value by eye but do not accept any part of line which goes outside range of 16 to 18	**(1)**

acceleration = ... m/s^2

(ii) Another cyclist has a smaller initial acceleration but then reaches a constant velocity of 17 m/s.
Draw her motion on the graph above.

(1)

5 (b) The mass of the skateboard is 1.8 kg and the mass of the skateboarder is 42 kg.

Calculate the velocity at which the skateboard moves backwards if the skateboarder jumps forwards at a velocity of 0.3 m/s.

5(b)	7	accept –7 for **3** marks allow **2** marks for momentum of skateboarder equals 12.6 **or** $0 = 42 \times 0.3 + (1.8 \times -v)$ **or** allow **1** mark for stating use of conservation of momentum	3	AO2 2.2.2b

.....

Velocity of skateboard = ... m/s

AQA June 2014

1 (b) **Figure 1** shows how ultrasound is used to measure the depth of water below a ship.

1(b)	640	an answer of 1280 gains **2** marks allow **2** marks for the correct substitution ie 1600 × 0.40 provided no subsequent step allow **2** marks for the substitution $\frac{1600 \times 0.80}{2}$ provided no subsequent step allow **1** mark for the substitution 1600 × 0.80 provided no subsequent step allow **1** mark for the identification that time (boat to bed) is 0.4	3	AO2 3.1.2c

Depth of water = ... metres

4 (c) The car did not stop in time. It collided with the stationary car in front, joining the two cars together.

Figure 5 shows both cars, just before and just after the collision.

4(c)(i)	momentum before = momentum after **or** (total) momentum stays the same	accept no momentum is lost accept no momentum is gained ignore statements referring to energy	1	AO1 2.2.2b	**E**

4(c)(ii)	5	allow **2** marks for correctly obtaining momentum before as 12 000 **or** allow **2** marks for 1500 x 8 = 2400 x v **or** allow **1** mark for a relevant statement re conservation of momentum **or** allow **1** mark for momentum before = 1500 x 8	3	AO2 2.2.2a/b	**E**

Velocity = ... m/s

(b) (i)	(average) speed = (total) distance moved / (total) time taken	allow defined symbols ignore 'triangles'	1
(ii)	Substitution; Calculation; Matching unit;	allow both substitution and calculation marks for a correct value without working	3
	e.g. Average speed = 6.1 / (7x 60) = 0.0145 = 0.015 m/s	allow 6.1, or ecf for distance 7 for time	
		allow alternatives with compatible unit, e.g. 1.45 cm/s OR 1.5 cm/s 14.5 mm/s OR 15 mm/s 0.87 m/minutes 87 cm/minute 870 mm/minute Allow for 1 mark 6 / 7 or 0.9	

(b) The speed of light in a vacuum is 300 000 km/s.

(b)	rearrangement and correct substitution; factor of 2 taken into account; value given to at least 2 significant figures; e.g. Time to reach moon = ½ x 2.6 = 1.3 (s) Distance = time x speed = 1.3 x 300 000 = 390 000 (km) OR Total distance = 2.6 x 300 000 = 780 000 So distance to moon = ½ x 780 000 = 390 000 (km)	working must be shown Reverse argument (starting with 400000 km) allow 2 max	3

iGCSE June 2013

4 A lorry carries a load of hot asphalt – a runny mixture of small stones and tar.

Question		Answer	Notes	Marks
4 (a) (i)		Momentum = mass x velocity	Allow abbreviations and rearrangements e.g. p=mv, mass = momentum / velocity	1
(ii)		Substitution into correct equation; Calculation; e.g. 17 000 x 13 220 000 (kg m/s)	Allow 221 000	2

(ii) Calculate the total momentum of the lorry and its load.

(2)

momentum = ... kg m/s

(b) A car travels at 20 m/s.

The mass of the car is 1500 kg.

(i) State the equation linking momentum, mass and velocity.

(1)

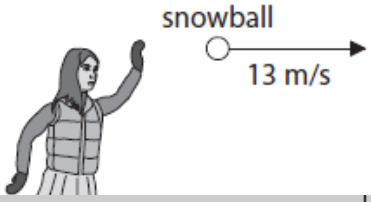
(c) In a crash test, a car runs into a wall and stops.

(b)	(i)	Momentum = mass x velocity;	Allow equivalent rearrangement or symbols p= m x v	1
	(ii)	Substitution into correct equation; Calculation; e.g. 1500 x 20 30 000 (kg m/s)	Allow 3×10^4 Full marks for correct answer without working (bald answer)	2

3 (c)	(i)	Substitution into correct equation; Calculation; e.g. $\frac{22500}{0.14}$ 160 000 (N)	No mark for the equation as it is given on page 2 Accept 2 or more sf, e.g. 161 000, 160 714 Full marks for bald correct answer	2

(2)

5 An ice skater throws a 0.23 kg snowball with a velocity of 13 m/s.



5 (a) (i)	momentum = mass × velocity;	allow symbols and rearrangements e.g. p = m × v	1
(ii)	substitution into correct equation; evaluation; e.g. (momentum =) 0.23 × 13 = 3.0 (kg m/s)	 allow 3, 2.99	2

initial momentum = ... kg m/s

11 An underground train enters a station.

11	(a)	(i)	kinetic energy = ½ × mass × velocity^2	Accept symbols KE = ½ × m × v^2	1
		(ii)	Conversion of units; Substitution and rearrangement into correct formula; Calculation; e.g. 18 MJ = 18 000 000 J v^2 = 18 000 000 × 2 ÷ 250 000 (= 144) v = 12 (m/s)	at any stage POT error max 2 marks e.g. 3.8 x 10^n or 1.2 x 10^n	3
		(iii)	Energy is transferred to surroundings;	Allow to heat, sound, other forms / energy decreases	1

velocity = ... m/s

6 The photograph shows a hammer just before it hits a nail.

6 (a)	(i)	momentum = mass x velocity;	words or correct symbols p = m x v reject M for momentum	1
	(ii)	substitution; evaluation; e.g. (p =) 0.50 x 3.1 (p =) 1.6 (kg m/s)	ignore - signs allow 1.55 1 mark max for 1.5	2
	(iii)	substitution into correct equation; evaluation; e.g. F = 1.55(- 0) ÷ 0.070 (F =) 22 (N)	no mark for equation as given in paper allow ECF from (ii) ignore - signs allow F in range 22-23 (N) inclusive allow method using F=ma.	2

(ii) The card takes 0.040 s to travel through the light gate.

The student calculates that the average speed of the trolley through the light gate is 1.15 m/s.

Question number	Answer	Additional guidance	Mark
7 (a) (ii)	substitution into speed = d/t (1) 1.15 = d / 0.04 (1) evaluation (1) d = 0.046m = 4.6 cm (1)	full marks will be awarded for correct numerical answer without working	**(2)**

Question number	Answer	Additional guidance	Mark
7 (a)(iii)	using $V^2 - u^2 = 2ax$ $V^2 = 1.15^2$ $= 1.3225$ (1) $2 \times a \times x = 2 \times 1.2 \times 0.55$ $= 1.32$ (1)	allow 1.3225	**(2)**

..... cm

ADD SAMS

(b) The table shows some data about the Earth's orbit of the Sun.

Question number	Answer	Additional guidance	Mark
9(b)	$v = \frac{2 \times \pi \times R}{T}$ unit conversion (1) 10^8 km = 10^{11} m substitution (1) $v = \frac{2 \times \pi \times 1.5 \times 10^{11}}{3.2 \times 10^7}$ evaluation (1) v= 2.9 x 10^4 (m/s)	Allow values which round to 2.9 x 10^4 full marks will be awarded for correct numerical answer without working	**(3)**

n/s

June 2012

(a) In one lift, he does 5040 J of work against gravity.

(i) One lift takes 4 seconds.

Complete the sentence by putting a cross (☒) in a box next to your answer.

The power used to lift the weight is

(1)

- ☐ **A** 1260 W
- ☐ **B** 2016 W
- ☐ **C** 12600 W
- ☐ **D** 20160 W

(ii) The weight he lifts has a
Gravitational Field Strer
The energy gained by t

Calculate the height he

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	**A** 1260 W		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	substitution (1) 5040 = 240 × 10 × height transposition (1) height = $\frac{5040}{240 \times 10}$ evaluation (1) 2.1 (m)	substitution and transposition in either order give full marks for correct answer, no working	**(3)**

March 2012

The swing

5 A child is stationary on a swing.

(a

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	substitution (1) work done = 84 x 0.25 evaluation (1) 21(J)	Full marks for correct answer even if no working is evident	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	21 J	Ecf from (a)(i)	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	substitution (1) KE = ½ x 27 x $(2.3)^2$ evaluation (1) = 71.4 (which is approx 71)	V=2.29 gains two marks Reverse argument which shows that V = $\sqrt{5.3}$ gains two marks	**(2)**

June 2013

(iii) The first motor has a power rating of 20 W.

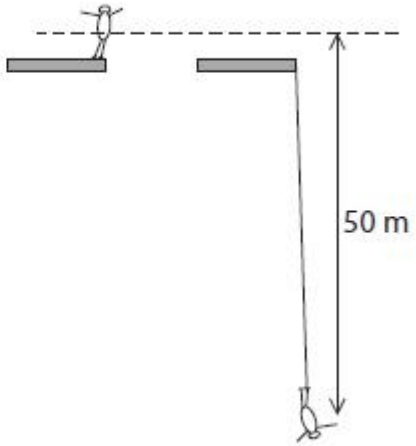
The motor is used for 15 s

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	substitution 20 x 15 (1) evaluation 300 (J) (1) If no other mark scored award 1 mark for correct transposition ie E= P x t Ignore any unit given by candidate	Power of 10 error maximum of 1 mark eg 300 000 (J) gains 1 mark Give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iv)	substitution 18 ÷ 24 (x 100) (1) evaluation 0.75 or 75% (1) Ignore any unit given by candidate	Power of 10 error maximum of 1 mark give full marks for correct answer, no working	**(2)**

June 2013

2 A 60 kg student weighs 600 N.
He does a bungee jump.



Question Number	Answer	Acceptable answers	Mark
2(c)(i)	Substitution: (1) 60 x 10 x 50 or 600 x 50 Evaluation: (1) 30 000 Unit: (1) J / Nm	 give two marks for correct answer no working j / joule 30 kJ for full marks	 **(3)**

change in gravitational potential energy = ... unit .....

June 2014

(iii) The child and cart have a total mass of 50 kg. They travel at a velocity of 4 m/s.

Calculate the momentum of the child and cart.

(2)

Question Number	Answer	Acceptable answers	Mark
3 a(iii)	Substitution 50 x 4 (1) Evaluation 200 (kg m/s) (1)	Allow full marks for correct answer with no working shown	**(2)**

Question Number	Answer	Acceptable answers	Mark
3 a(iv)	Substitution 450 / 1.5 (1) Evaluation 300 (N) (1)	Allow full marks for correct answer with no working shown Allow (1) for 167 (N) obtained by 450-200 / 1.5	**(2)**

force = ... N

June 2016

Work, energy and momentum

3 The diagram shows a car and passengers at the start of a roller coaster ride at an amusement park.

Question Number	Answer	Acceptable answers	Mark
3(a)	Substitution into PE = m x g x h: 18 x 9500 x 10 (1) Evaluation: 1 710 000 (J) (1)	 Allow 1 mark for evaluation of 2 375 000 (arising from using 25m for distance) 1 710 kJ Allow full marks for correct answer with no working shown	**(2)**

Question Number	Answer	Acceptable answers	Mark
3 (b)	1 710 000 J (1)	Allow ecf from 3 a	**(1)**

(b) The car is released at B and continues down the track.

State the maximum possible kinetic energy of the car and passengers at C.

(1)

maximum KE = ... J

June 2016

(iv) One cyclist produces an average power output of 600 W during the race.
She completes the race in exactly 4 minutes.

Calculate the work done by the cyclist during the race.

Question Number	Answer	Acceptable answers	Mark
6 a iv	Substitution : (1) 600 = w / 240 Transposition (1) w = 600 x 240 evaluation: (1) 144 000 J	conversion between mins and secs can be delayed until evaluation 600 = w / 4 W = 600 x 4 Substitution and transposition can be in either order 144 kJ Allow full marks for correct answer with no working shown 2400 obtained by failure to convert mins to secs can score a maximum of 2 marks	**(3)**

AQA June 2014

1 **Figure 1** shows a slide in a children's playground.

Figure 1

Metal ladder

Question	Answers	Extra information	Mark	AO spec ref
1(a)	450	allow **1** mark for correct substitution, ie 18 × 10 × 2.5 provided no subsequent step	2	AO2 2.2.1f

[2 marks]

.....

.....

.....

Decrease in gravitational potential energy = ... J

3 (b) (i) The cyclist used the brakes to slow down and stop the bicycle.

A constant braking force of 140 N stopped the bicycle in a distance of 24 m.

Calculate the work done by the braking force to stop the bicycle. Give the unit.

Question	Answers	Extra information	Mark	AO spec ref
3(b)(i)	3360	allow **1** mark for correct substitution, ie 140 × 24 provided no subsequent step accept 3400 for **2** marks if correct substitution is shown	2	AO1 AO2 2.2.1b
	joule / J	do **not** accept j do **not** accept Nm	1	

AQA June 2015

6 (b) The speed of the rocket just after being launched is 12 m/s.
The mass of the rocket is 0.05 kg.

6 (b) (i) Calculate the kinetic energy of the rocket just after being launched.

Use the correct equation from the Physics Equations Sheet.

6(b)(i) mark with 6bii 6biii	3.6	allow **1** mark for correct substitution i.e. ½ x 0.05 x 12^2 provided no subsequent step	2	AO2 2.2.1g	**E**
6(b)(ii) mark with 6bi, 6biii	3.6 **or** their (b)(i)		1	AO1 2.2	**E**
6(b)(iii) mark with 6bi, 6bii	7.2 **or** their (b)(ii) ÷ 0.5 correctly calculated	allow **1** mark for correct substitution i.e. 3.6 or their (b)(ii) = 0.05 x 10 x h	2	AO2 2.2.1f	**E**

Use the correct equation from the Physics Equations Sheet.

[2 marks]

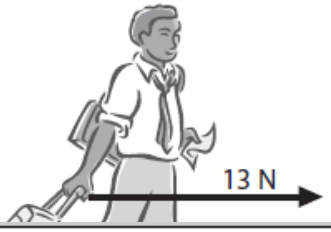
.....

.....

.....

Maximum height = ... m

6 A person has a suitcase with wheels.



6 (a)	(i)	Work done = force x distance moved;	Allow W = F x d and rearrangements	1
	(ii)	Substitution into correct equation; Calculation; e.g. 13 x 110 1430 (J)	Correct answer without working scores 2 marks	2
	(iii)	Same response as for 3(a)(ii)	1430 (J) or ecf	1

work done = ... J

(iii) How much energy is transferred to the suitcase?

(1)

energy transferred = ... J

iGCSE January 2015

7 The photograph shows a car tyre that needs to be inflated.

Question number	Answer	Notes	Marks
7 (a) (i)	pressure = $\frac{\text{force}}{\text{area}}$	Allow symbols and rearrangements e.g. p=F/A	1
(ii)	substitute; rearrange; evaluate; **matching** unit; e.g. 270 000 = F ÷ 0.016 1 mark F = 270 000 x 0.016 2 marks 4320 3 marks N 4th mark	Substitution and rearrangement in either order allow in words Allow alternatives with matching unit, e.g. 4.32 3 marks kN 4th mark	4
		(4)	

force = ... unit .....

iGCSE January 2015

8 (a) A student investigates the energy transfers in a small generator.

She connects the generator to a circuit that includes a lamp.

She hangs a mass from a string wound around the axle.

The lamp lights as the mass falls to the ground.

Question number	Answer	Notes	Marks
8 (a) (i)	gravitational potential energy = mass x g x height	Allow symbols and rearrangements, e.g. GPE = m x g x h	1
(ii)	Substitution into correct equation; Calculation; e.g. GPE = 2.75 x 10 x 0.61 = 17 (J)	16.8, 16.775, 16.78 (J) allow calculation with g = 9.81 =16.46 (J)	2

(ii) Calculate the gravitational potential energy, GPE, lost by the mass.

(2)

GPE = ... J

(c) The mass of ball Y is 45 g.

The golfer gives the ball 36 J of kinetic energy when he hits it.

(i) State the equation linking kinetic energy, mass and speed

Question number	Answer	Notes	Marks
13 (c) (i)	KE = ½ mv^2;	Words or symbols	1
(ii)		allow	4
	Conversion to kg;	• 1000 seen	
	Substitution into correct equation;		
	Rearrangement;		
	Evaluation;	• steps in any order	
	e.g. 45 g = 0.045 kg (or 1 kg = 1000 g etc)	• correct answer with no working for full marks	
	$36 = ½ \times 0.045 \times v^2$	• up to 3 marks for use of 45 kg →1.26 (m/s)- working must be seen	
	$v^2 = \frac{2 \times 36}{0.045}$ (= 1600)		
	40 (m/s)		

initial speed = ... m/s

7 A skydiver jumps from an aircraft.

(a) The mass of the skydiver is 70 kg.

(i) State the equation linking weight, mass and *g*.

(1)

7	(a)	(i)	Weight = mass x g;	allow in accepted symbols ignore units, triangle eqns	1
		(ii)	700; N / newton(s);	 ignore kg m/s^2	1 1

weight = ... unit .....

iGCSE January 2014

8 A student investigates the efficiency of an electric motor

Question number			Answer	Notes	Marks
8	(a)		Substitution into **correct** equation; Calculation; e.g. - 1.3 x 10.3 x 4.7; 63 (J);	No credit for merely quoting the equation as $E = IVt$ is given on p2. 62.9 (J)	2
	(b)	(i)	Work done = force x distance moved (in the direction of the force);	Accept rearrangements and symbols e.g. force = $\frac{\text{work}}{\text{distance}}$ W = F x d F=W/d	1
		(ii)	Substitution into **correct** equation; Calculation; e.g. - Work done = 20 x 0.85; 17 (J);		2
		(iii)	Value given in 8(b)(ii);	Allow GP(E)	1
	(c)	(i)	Efficiency = useful energy output divided by total energy input;	Accept efficiency in terms of work or power and percentage e.g. Efficiency = (work out / work in) x 100 %	1
		(ii)	17 divided by 63; 0.27;	Allow ecf answer from b(ii) [or (b)(iii)] divided by answer from (a) Allow 27%	2

Total 9 marks

iGCSE June 2013

Question number	Answer	Notes	Marks
8 (a) (i)	work done = force x distance moved ;	Accept W = F x d Allow rearrangements do not accept eqn in units only	1
(ii)	Substitution into correct equation; Calculation; 170 x 110 19 000 (J)	Accept **18 700** (J)	2
(iii)	exactly same as their answer to (ii);		1

(1)

(3)

Question number	Answer	Notes	Marks
8 (b) (i)	$KE = \frac{1}{2}mv^2$	Accept word equation	1
(ii)	addition of masses before OR addition of energies after; Substitution into correct equation; Calculation; 1650 + 950 = 2600 (OR 436 425 + 251 275 = 687 700) $\frac{1}{2}$ x 2600 x 23^2 688 000	Accept for 1 mark - either 436 000 or 251 000 accept for 2 marks - both 436 000 and 251 000 Accept for 3 marks- 687 700	3

J

energy transferred = ... J

(c) In 1971, astronaut A

The golf ball had a

(i) State the equat

(ii) Calculate the in

			of orbit, time of orbit etc	
	b	Substitution; Evaluation; Unit (to **match** the value of v); e.g. $V = \frac{(2 \times \pi \times 385000)}{27} = \frac{2\,417\,800}{27}$ 90 000 km/day	Note value of π used may vary time values and corresponding approximate speeds are 27 days..... 89 600 km/days 648 hours..... 3 731 km/ hours 38 880 mins..... 62 km/min 2 332 800 s..... 1.04 km/s allow answers which round to 89 600 Accept suitable **matching** units	1 1 1
	c i	$E=1/2\ mv^2$;	Accept • rearranged equation • equation in words	
	ii	substitution ; Mass converted to kg ; 47.(33.....) seen;	allow sub of mass as 50 g 1.496 or 1.5 seen gets 2 marks	3
	d i	44(J) ;		1
	ii	GPE = mgh;	Accept • rearranged equation • equation using (all the) words Allow for 'g' • gravitational field strength but NOT gravity	1
	iii	Substitution and rearrangement; Calculation ; $\frac{12}{0.05 \times 1.6}$ 150 (m)	POT error loses 1 mark e.g. 0.15 (m) gets 1 mark	2

ential energy.

(1)

.....J

ss, *g* and height.

(1)

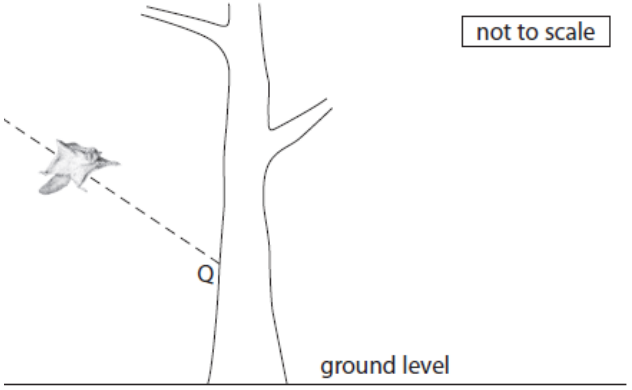
(2)

.....m

iGCSE June 2014

7	(a)	(i)	gravitational potential energy = mass × g × height	Allow abbreviations e.g. g.p.e. = mgh for g/gravitational field strength reject 'gravity'	1
		(ii)	Substitution into correct equation; Evaluation; e.g. g.p.e. = 0.19 × 10 × 17 = 32 (J)	32.3 (J) (or 31.6 J when g = 9.8 ms^{-2}) allow 32300 for 1 mark	2
		(iii)	Value same as for (a)(ii)	Allow "the same"	1

from P to Q with a constant velocity of 13 m/s.

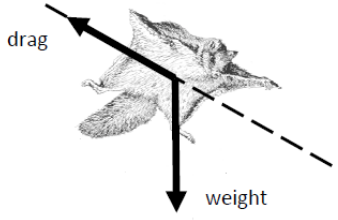


to the diagram to show the directions of the forces of

(i) State the equation linking gravitational potential energy (GPE), mass, *g* and

(ii) Calculate the GPE gained by the squirrel during this climb.

GPE = ...

(b)	(i)	Judge by eye **Weight** shown acting downwards; Drag shown acting against motion;  	NB NO label = no mark Allow abbreviations for labels e.g W, mg ignore gravity	2
	(ii)	k.e. = ½ × mass × velocity^2	Allow abbreviations e.g. k.e. = ½mv^2	1
	(iii)	Substitution into correct equation; Evaluation; e.g. k.e. = ½ × 0.19 × 13^2 = 16 (J)	(16.055) 16055 gets 1 mark	2

iGCSE June 2016

5 A man uses a wheelbarrow to carry some logs along a flat path, as shown.

5	(a)	(i)	work done = force × distance (moved);	Accept correct symbols e.g. W = F x d W = F x s	1
		(ii)	substitution; evaluation; e.g. (work =) 140 × 39 5500 (J)	 5460	2
		(iii)	same answer as 5(a)(ii)	allow 'the same'	1

work done = ... J

(iii) State how much energy is transferred to the wheelbarrow.

(1)

energy transferred = ... J

ADD SAMS

Question number	Answer	Additional guidance	Mark
4(a)(iii)	Substitution (1) F = 7.26 x 20.6 Evaluation (1) 150 (N)	 Accept 149.6 (N) full marks will be awarded for correct numerical answer without working	(2)

..... N

Question number	Answer	Additional guidance	Mark
4(a)(iv)	Rearrangement (1) v = a x t Substitution (1) v = 23 x 0.48 Evaluation (1) 11 m/s	 Accept 11.04(m/s) full marks will be awarded for correct numerical answer without working	(3)

..... m/s

Calculate the amount of gravitational potential energy gained by the shot.

Question number	Answer	Additional guidance	Mark
4(b)	Substitution (1) PE = 7.26 x 10 x 1.3 Evaluation (1) 94.4 (J)		(2)

gravitational potential energy gained = ... J

ADD SAMS

Question number	Answer	Additional guidance	Mark
10(a)(i)	substitution (1) 371 = (64.5+ m) x 3.5 rearrangement (1) m+64.5 = 371 / 3.5 evaluation of total mass (1) m+64.5 = 106 (kg) evaluation of woman's mass (1) m = 106-64.5 = 41.5 (kg)	full marks will be awarded for correct numerical answer without working	(4)

Question number	Answer	Additional guidance	Mark
10(a)(ii)	substitution (1) KE = ½ x 64.5 x 3.5^2 evaluation (1) 395 (J)	allow answers which round to 395 e.g. 395.0625 full marks will be awarded for correct numerical answer without working	(2)

kinetic energy = ... J

November 2011

(b) Some microwaves have a frequency of 1.5×10^{10} Hz.
They travel at a speed of 3.0×10^{8} m/s.

Calculate their wavelength

Question Number	Answer	Acceptable answers	Mark
3(b)	substitution: (1) $3.0 \times 10^{8} = 1.5 \times 10^{10} \times \lambda$ transposition: (1) $\lambda = c/f$ or $(\lambda =) \frac{3.0 \times 10^{8}}{1.5 \times 10^{10}}$ evaluation: (1) 0.02 (m)	Give full marks for correct answer, no working **Allow** substitution and transposition in either order if clear **Ignore** powers of 10 until evaluation e.g. 3/1.5 2 marks $\lambda = f/c$ (0) then 1.5/3 1 mark bald 1.5/3 0 mark 2×10^{-2} (m) ignore formula triangle	**(3)**

June 2012

(d) The telescope is used to look at the planet Venus.
Assume that the distance from Venus to the Earth is 39 000 000 km.
The speed of light is 300 000 000 m/s.

Calculate the time it takes for light to travel from Venus to the Earth.

(3)

Question Number	Answer	Acceptable answers	Mark
1(d)	transposition (1) $t = x/v$ substitution (1) $t = 39\,000\,000\,000/300\,000\,000$ evaluation (1) 130 (s)	Transposition and substitution may be in either order Transposition may be implied by correct figures Ignore powers of ten until final answer $39\,000\,000 \div 300\,000\,000$ 2mins 10sec give full marks for correct answer, no working give 2 marks for a power of 10 error, no working e.g. 0.13 (s)	**(3)**

June 2012

(c) Both infrasound waves and ultrasound waves are types of
They are used by animals to communicate.

Two elephants use infrasound waves for long distance con
The distance between these two elephants is 2500 m.

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	transposition (1) t = distance ÷ speed substitution (1) (2 x)2500 ÷ 340 evaluation (1) 14.7 (s)	**This is a "show that" question, there must be evidence of calculation** **Ignore** factor of 2 until final evaluation 2500 ÷ 340 = 2 marks 14.7 is evidence of calculation = 3 marks There are other ways to use the data e.g. 5000 ÷15 = 333 (m/s) (which is about 340 m/s) 2500 ÷7.5 = 333 (m/s) (which is about 340 m/s) **OR** 340 x 15 = 5100 (m) (which is about 5000 m) Give marks for transposition, substitution and evaluation clearly shown	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	Any **one** of the following points • idea of a conversation (1) • (4000 m is) a longer distance taking a longer time (to reach other elephant) (1) • time needed for waves to travel is about 24 s (1) • time gap between calls (sufficient) for elephant to hear a reply (1) • call lasts long enough to be identified by other elephants (OWTTE) (1)	longer distance and call takes (some) time waiting to see if there is a reply/response (from another elephant)	**(1)**

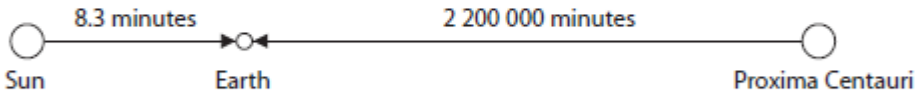
Suggest a reason why elephants wait 30 s before calling again.

(1)

June 2012

(c) Outside our Solar System, the star closest to Earth is called Proxima Centauri.
Light from this star takes 2 200 000 minutes to reach the Earth.
Light from the Sun takes 8.3 minutes to reach the Earth.
The speed of light is 18 000 000 km/minute.

not to scale



(i) By calculation, compare the distance of Proxima Centauri from the Earth with the distance of the Sun from the Earth.

(2)

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	calculate **one** distance (1) e.g. 1.49×10^8 or 3.96×10^{13} evaluation (1) e.g. $(3.96 \times 10^{13} \div 1.49 \times 10^8)$ = 265 000 e.g. inverse $(1.49 \times 10^8 \div 3.96 \times 10^{13})$ 3.77×10^{-6} e.g. from comparison of times (2 200 000 ÷ 8.3) = 265 000	accept 149 400 000 or 39 600 000 000 000 265 060 265 771.18 Give 2 marks for a correct evaluation with no working shown or no distance calculation Give 2 marks for two correct distances and a correct comparative statement	**(2)**

March 2012

(iii) The average speed of a P-wave in the mantle is 12 km/s.
A P-wave travels vertically down from the surface and reflects from the core–mantle boundary back to the surface.
It travels a total distance of 5800 km.

Calculate the total time of travel for the wave

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	substitution (1) 12 = 5800 ÷ t transposition (1) t = 5800 ÷ 12 evaluation (1) 480 (s)	Substitution and transposition can be in either order 8 minutes A value which correctly rounds to 480 give full marks for correct answer, no working	**(3)**

March 2012

(b) The velocity of the waves in deep water is 25 m/s.
The wavelength is 120 m.

Calculate the frequency of the waves.

(3)

Question Number	Answer	Acceptable answers	Mark
3(d)	substitution (1) 800 x 0.4 / 800 x 40 evaluation of payment (1) (£)320 / 32000 (p) evaluation of payback time (1) 15 (years)	4800 / 0.4 = 12000 Kwh (to be sold) takes 12000 / 800 years substitution and transposition can be in either order allow power of 10 error in 15 for (2) give full marks for correct answer, no working	**(3)**

March 2012

(d) An X-ray of wavelength 2.0 nm has a frequency of 1.5×10^{17} Hz.

$1.0\ nm = 1.0 \times 10^{-9}\ m$

Calculate the speed of the wave.

(2)

Question Number	Answer	Acceptable answers	Mark
1(d)	substitution ie (v =) 1.5 x 10^{17} x 2 x 10^{-9} (1) evaluation ie (v =) 3 x 10^{8} m/s (1)	[Remember that equations, including v = fλ are given on page 2. Please do not credit] Give full marks for correct answer, no working 3 x any other power of 10 =1 mark	**(2)**

speed = ... m/s

(c) Light travels the 150 million km from the Sun to the Earth in about 500 s.
It takes about 2100 s for light to reach the Earth from Jupiter.
Using this information, calculate the approximate distance of Jupiter from the

Question Number	Answer	Acceptable answers	Mark
3(c)	2100/500 = 4.2 (1) 4.2 x 150 = 630 (million km) (1) Accept ratios as speed is constant 150/500 = distance to Jupiter/2100 OR Distance to Jupiter = (150/500) x 2100 Either for 1 mark	Power of 10 error maximum of 1 mark (speed of light) about 150 000 000 ÷ 500 = 300 000 (km/s) (1) (distance to Jupiter)= 300 000 x 2 100 = 630 000 000 km (1) / = 630 (million km) An answer with no calculation of 630 (million km) gains 2 marks If an answer of 630 million/ 630 000 000 is given with correct working award both marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)	transposition $\lambda = v/f$ (1) substitution $\lambda = 3 \times 10^8/7 \times 10^9$ (1) evaluation 0.043 (m) (1) Ignore any unit given by candidate	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. $3 \times 10^8/7 \times 10^9$ gains 2 marks Accept any number of sig.figs. that rounds to 0.04 0.04 , 0.0428 (m) (1) Give full marks for correct answer with no working. 0.04 x any other power of 10 = 2 marks	**(3)**

March 2013

(b) The earthquake causes seismic waves.

(i) S waves are one type of seismic wave. They travel at 0.65 km/s.
There is a seismometer 80 km away from point E.
Show that it takes about 2 minutes for the S waves from the earthquake to reach the seismometer.

(2)

Question Number	Answer	Acceptable answers	Mark
4(bi)	substitution (1) 0.65 = 80 / t transposition (1) t = 80 / 0.65 (123 seconds)	transposition and substitution can be in either order . Allow reverse calculations eg speed = 80/120 (1) = 0.67 (about 0.65) (1) or distance = 0.65 x 120 (1) = 78 km (about 80) (1).	**(2)**

June 2014

(c) The telescope collects light reflected from Jupiter.
The light has a frequency of 4.30×10^{14} Hz and a speed of 3.00×10^{8} m/s.
Calculate the wavelength of the light.

(3)

Question Number	Answer	Acceptable answers	Mark
5(c)	Substitution (1) $3.0 \times 10^{8} = 4.3 \times 10^{14} \times \lambda$ Transposition (1) $(\lambda =) \quad \frac{3.0 \times 10^{8}}{4.3 \times 10^{14}}$ Evaluation (1) 6.98×10^{-7} (m)	 Substitution and transposition in either order Ignore triangle correct answer no working = 3 power of ten error = 2 to at least 2sf (eg 7.0/6.97.....)$\times 10^{-7}$ Ignore powers of 10 until evaluation	 **(3)**

(b) The velocity of light in a vacuum is 300 000 000 m/s (3×10^8 m/s).

1

(

Question Number	Answer	Acceptable answers	Mark
4b	transposition (1) (f =) v/λ OR c/□ substitution (1) 3 x 10^8 / 800 x 10^{-9} evaluation (1) 3.75 x 10^{14} hertz / Hz (1)	allow substitution and transposition in either order 3 x 10^8 / 800 shows transposition 3 x 10^8 / 800 x 10^{-9} scores for transposition and substitution 3 x 10^8 = f x 800 x 10^{-9} just scores substitution mark ignore power of 10 errors until evaluation mark award full marks for correct answer with no working POT error gives 2 calculation marks, but check for unit e.g. kHz/GHz etc condone Hertz OR s^{-1} ignore hz or c.p.s accept correct SI prefix eg kHz, MHz, GHz, THz etc	**4**

AQA June 2014

4 A note was played on an electric keyboard.

The frequency of the note was 440 Hz.

4 (a) (i) What does a frequency of 440 Hz mean?

[1 mark]

Question	Answers	Extra information	Mark	AO spec ref
4(a)(i)	440 (sound) waves produced in one second	accept vibrations / oscillations for waves	1	AO1 1.5.1i
4(a)(ii)	0.773 (metres)	allow **2** marks for an answer that rounds to 0.773 allow **2** marks for an answer of $0.7\dot{7}\dot{2}$ allow **2** marks for an answer of 0.772 allow **1** mark for correct substitution ie $340 = 440 \times \lambda$	3	AO2 1.5.1j

Wavelength = ... metres

(b) The foghorn emits sound waves with a frequency of 160 Hz.

The speed of sound is 340 m/s.

(b)	(i)	(wave) speed = frequency × wavelength	allow abbreviation, e.g. $v = f \times \lambda$ or rearrangements	1
	(ii)	substitution into correctly rearranged equation; evaluation; e.g. (v =) 340 / 160 (v =) 2.1 (m)	allow 2.125, 2.12, 2.13 or 2 (if supported)	2

wavelength = ... m

6 Echo sounding is used to detect fish in the sea.

Sound waves are emitted from a fishing boat. Some of the sound waves are reflected by fish and detected back at the boat.

(a) The shortest time between the sound waves being emitted and detected is 0.26 s

6	(a)		MP1. Substitution into correct equation; MP2. Rearrangement; MP3. Divide by 2; MP4. Conversion between km and m; e.g. 1.5 x 1000 = 1500 Speed = $\frac{\text{distance}}{0.26}$ Distance = 1500 x 0.26 = 390 (m) So distance to fish = 195 m	Accept x 1000 at any point in calculation 0.39 gets 2 marks 390 gets 3 marks	4

distance = ... m

(c) Visible light from Mars reaches the Earth.

Question number	Answer	Notes	Marks
6 (c) (i)	Working;; e.g. $300\,000 = \frac{170\,000\,000}{t}$ 1 working mark (sub ONLY) $t = \frac{170\,000\,000}{300\,000}$ both working marks (sub AND rearrange) Calculation; e.g. = 570 (566.7) (s) 1 mark (ans to > 1 SF)	'show that' question, working must be shown for full marks REVERSE CALCS: maximum mark =2 (correct calc plus a comparison statement e.g. 283 333 ≡ 300 000 180 000 000 ≡ 170 000 000) Allow (without the subject of the equation) for 2 marks, $\frac{170\,000\,000}{300\,000}$	3

(c) A radio station broadcasts at a frequency of 200 kHz.

The wavelength of the radio waves is 1500 m.

(i) State the equation linking wave speed, frequency and wavelength.

c	i	(wave) speed = frequency x wavelength	Accept equivalent Accept recognised symbols	1
	ii	Substitution into correct equation; Evaluation; Unit; Eg. (wave) speed = 200 000 x 1500 300 000 000 m/s	mark unit and calc independently Power Of Ten error = -1 e.g. not converting kHz to Hz Accept • bald answer • answer in SF • alternative speed units with corresponding evaluation e.g. 300 000 km/s 1.08×10^{12} km/hour	3

speed = ... unit .....

(c) (i) State the equation linking wave speed, frequency and wavelength.

(1)

13 (c) cont	(i)	wave speed = frequency × wavelength	Allow abbreviations and rearrangements, e.g. $v=f\lambda$	1
	(ii)	Conversion to Hz; Substitution into correct equation and rearrangement; Evaluation; e.g. 31 MHz = 31 000 000 Hz wavelength = 300 000 000 ÷ 31 000 000 9.7 m	Allow 10^6 seen at any stage allow answers which round to 9.7 (9.6774)	3

wavelength = ... m

(d) A sound wave travels with a velocity of 1530 m/s.

Question number	Answer	Acceptable	Mark
8(d)	substitution (1) 1530 = (1.2/1000) x wavelength rearrangement (1) wavelength = 1530 / (1.2/1000) evaluation (1) = 1.275 (m)	2 marks for 1275m (incorrect conversion into Hz) full marks will be awarded for correct numerical answer without working	**(3)**

wavelength = ... m

November 2011

(b) A transfor

It has 200
The input

(i) Show

(ii) Calculat
coil is 0.

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	substitution: (1) $\frac{55}{V} = \frac{200}{3000}$ transposition: (1) $V = \frac{3000}{200} \times 55$ evaluation / comment: (1) 825(V) / which is about 800 (V)	**Allow** substitution and transposition in either order if clear $\frac{55}{\mathbf{825}} = \frac{200}{3000}$ scores 3 $\frac{55}{\mathbf{800}} = \frac{200}{3000}$ scores 1 Correct comparison of ratios scores 3 (15 and 14.5, 0.067 and 0.069)	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	• power input = power output (1) • I = 0.033 (A) (1)	power input = 55 x 0.5 (W) power input = 27.5 (W) I = 0.034 (A) Give full marks for correct answer no working	**(2)**

June 2012

5 A windfarm generates electrical power from the wind.

(a) State **one** disadvantage of using the wind to generate electrical power.

(1)

.....

.....

(b) A windfarm generates 322 MW of electrical pov

The windfarm is connected to a transmission lir of 132 kV.

(i) Calculate the current from the windfarm.

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	transposition (1) current = power ÷ voltage substitution (1) 322 000 000 ÷ 132 000 evaluation (1) 2440 (A)	Transposition and substitution may be in either order Transposition may be implied by correct figures I = P ÷ V Ignore powers of ten until final answer i.e. give 2 marks for 322 ÷ 132 2439 (A) 2439.39….(A) 2.44 kA give full marks for correct answer, no working give 2 marks for a power of 10 error, no working e.g. 2.44 (A)	**(3)**

(ii) The windfarm produces 322 MW of power.
The windfarm is to be extended by adding
The extended windfarm will then produce a

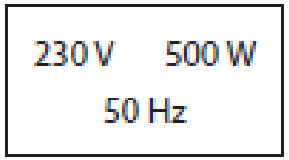
Calculate the power produced by each impr

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	• calculation to find additional power generated e.g. 539 – 322 = 217 (MW) (1) • 2.9 (MW) (1)	217 without working 2.893 (MW) give full marks for correct answer, no working	**(2)**

power = ... MW

June 2012

(b) This label is attached to the heater.

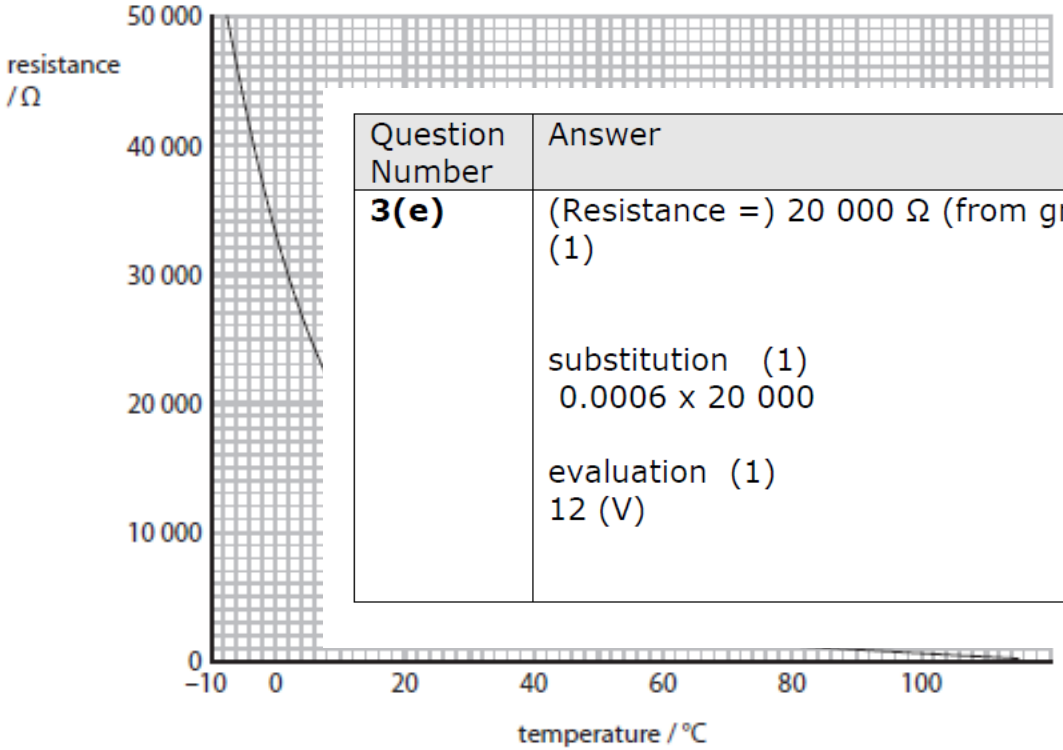


Use this information to calculate the expected current in the heater.

(3)

Question Number	Answer	Acceptable answers	Mark
3(b)	substitution (1) 500 = I x 230 transposition (1) 500/230 evaluation (1) 2.2 (A)	substitution and transposition in either order 2.17 (A) / 2 (A) give full marks for correct answer, no working	**(3)**

June 2012



Question Number	Answer	Acceptable answers	Mark
3(e)	(Resistance =) 20 000 Ω (from graph) (1) substitution (1) 0.0006 x 20 000 evaluation (1) 12 (V)	ecf if clear misread of R from graph ignore powers of ten until evaluation Give full marks for correct answer, no working	**(3)**

When the temperature is 10 °C, the current in the thermistor is 0.60 mA.

Calculate the potential difference across the thermistor at 10 °C.

(3)

potential difference = ... V

March 2012

(b) The students use the electric motor to lift a weight.
The current in the motor is 0.5 A.
The potential difference (voltage) across the motor is 6 V.

Calculate the input power to the motor.
State the unit.

(3)

Question Number	Answer	Acceptable answers	Mark
1(b)	substitution (1) 0.5 × 6.0 evaluation (1) 3 unit (1) W / watts	 give (2) for correct answer, no working 0.003 kW (3) 3 kW (2) J/s, VA Accept kW for unit with incorrect or no numerical answer	**(3)**

input power = ... unit = ...

March 2012

(d) A homeowner fits a solar panel to her roof.
The cost of the solar panel is £4800.
The solar panel supplies an average of 800 kW h of electrical energy to the National Grid each year.
The homeowner is paid 40p for each kW h of energy supplied to the National Grid.

Calculate the payback time for the solar panels by selling energy to the National Grid.

(3)

Question Number	Answer	Acceptable answers	Mark
3(d)	substitution (1) 800 x 0.4 / 800 x 40 evaluation of payment (1) (£)320 / 32000 (p) evaluation of payback time (1) 15 (years)	4800 / 0.4 = 12000 Kwh (to be sold) takes 12000 / 800 years substitution and transposition can be in either order allow power of 10 error in 15 for (2) give full marks for correct answer, no working	**(3)**

5

March 2012

(ii) A large solar farm has 21 700 solar panels and generates 5.0 MW of power.

$1.0\ MW = 1.0 \times 10^6\ W$

Calculate the average power each panel produces.

(2)

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	substitution (1) 5 000 000 / 21 700 evaluation (1) 230 W	Ignore powers of 10 until evaluation 230.4 W Give full marks for correct answer, no working 2.3 x any other power of 10 = 1 mark	**(2)**

average power produced by each panel = ... W

March 2012

(iii) The solar farm receives 25 MW of power from the Sun to generate 5 MW of electrical power.

Calculate the efficiency of the solar farm.

(2)

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	substitution (1) 5 x 100 / 25 evaluation (1) 20(%)	 0.2, 1/5 Give full marks for correct answer, no working 2 x any other power of 10 = 1 mark e.g. 200, 1/500	 **(2)**

March 2012

4 A small notebook computer has a power rating of 40 W.

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	C		**(1)**

Put a cross (☒) in the box next to your answer.

Question Number	Answer	Acceptable answers	Mark
4(b)	substitution (1) 2400/200 = 230/ V_s transposition (1) (V_s =) 230 x 200/2400 Evaluation (1) (V_s =) 19 (V)	 substitution and transposition in either order 230/12 = 2 marks (s&t) 200/10.43 = 2 marks (s&t) 19.2 (V) 19.17 (V) Give full marks for correct answer, no working 1.9 x any other power of 10 = 2	 **(3)**

(3)

secondary voltage = ... V

(ii) One of the components being investigated is a 12 ohm resistor.
When it is in the circuit, the ammeter reading is 0.50 A.

Calculate the voltmeter reading.

(2)

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	substitution (1) V = 0.5 x 12 evaluation (1) V = 6 (V)	Correct answer with no working shown gains two marks.	**(2)**

March 2012

(b) During the lightning flash a total charge of 52 C flows.
The average current is 2600 A.

Calculate the duration of the flash in seconds.

(3)

Question Number	Answer	Acceptable answers	Mark
4 (b)	substitution (1) 52 = 2600 x time transposition time = 52 / 2600 (1) evaluation 0.02 (s) (1)	T = Q / I Full marks for correct answer even if no working is evident	**(3)**

June 2013

(c) A LED lamp has a power rating of 3 W.
The voltage across the lamp is 12 V.
Calculate the current in the lamp.

(3)

Question Number	Answer	Acceptable answers	Mark
6(c)	substitute (1) 3 = I x 12 transformation (1) I = 3 ÷ 12 evaluation (1) 0 .25 (A) Ignore any unit given by candidate	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. Accept any number of sig. figs. that rounds to 0.25 (A) 250 mA gains 3 marks give full marks for correct answer, no working 2.5 x any other power of ten = 2 marks eg 25 (A) gains 2 marks	**(3)**

(iii) The supply voltage is 12 V.
At 20 °C the current is 0.047 A.

Calculate the resistance of the thermistor at this temperature.

(3)

Question Number	Answer	Acceptable answers	Mark
3 (a) (iii)	Substitution: (1) 12 = 0.047 x R Transposition: (1) R = 12/0.047 Evaluation: (1) R = 260	 transposition and substitution in either order substitution mark can be scored when incorrectly transposed word/symbol equation is given 255.3, 255 give full marks for correct answer no working power of 10 errors with no working score max 1 mark	 **(3)**

March 2013

(b) The current in a wire is 3.7 A.

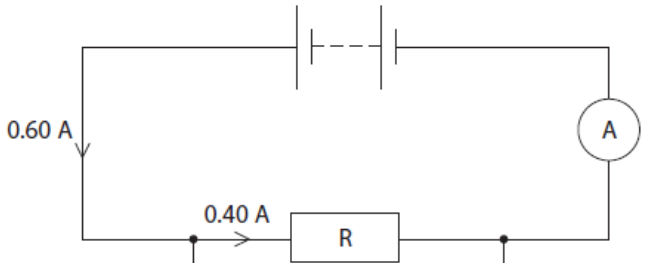
Calculate the charge that flows into the wire in 13 s.

(2)

Question Number	Answer	Acceptable answers	Mark
1(b)	substitution (1) 3.7 x 13 evaluation (1) 48 (C)	48.1 Correct answer with no calculation scores 2 marks	**(2)**

March 2013

5 (a) The diagram shows an electric circuit with two resistors, R and S.



Question Number	Answer	Acceptable answers	Mark
5(a)(i)	11x 0.4 (substitution) (1) 4.4 (V) (1)	Full marks for correct answer with no calculation	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	0.6 - 0.4 (A) (1)	0.2 or 1/5 (A)	**(1)**

(ii) Use int

current = ... A

June 2014

(c) A transformer has 2400 turns on the primary coil and 100 turns on the secondary coil.

Question Number	Answer	Acceptable answers	Mark
2(c)	Transposition (1) $V_s = V_p \times n_s/n_p$ Substitution (1) $(V_s =) \frac{12 \times 100}{2400}$ Evaluation (1) 0.5 (V)	Substitution and transposition in either order i.e. if $\frac{12 \times 100}{2400}$ is seen this scores 2 If they sub Vp, Np and Ns correctly, ignore anything for Vs even a blank Calculation may be done using turns ratio Correct answer no working = full marks answer (no working) with POT error =2 (eg 5 or 0.05) Ignore powers of 10 until evaluation	**(3)**

June 2014

(b) The power of the kettl
The mains voltage is 2

(i) Calculate the curre

(ii) The kettle is switcl

Calculate the total

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	Substitution (1) 1800 = 230 x I Transformation (1) I = 1800 / 230 Evaluation (1) 7.8 (A) substitution and transposition can be in either order	 current = power / pd Any value which rounds to 7.8 such as 7.8261 Allow full marks for correct answer with no working shown	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	Using E = I x V x T: Substitution (1) 7.8 x 230 x 2 (x 60) Evaluation(1) 220 000 (J) (note: incorrect conversion of time loses the evaluation mark)	Allow ecf from 2(b)(i) Using energy = power x time 1800 x 2 (x 60) (1) Values which round to 220 000 such as 216 000 (J) 215 280 (J) Allow correct conversion to MJ or kJ Allow full marks for correct answer with no working shown	**(2)**

June 2016

Power

3 The photograph shows a laptop computer plugged into the 230 V mains.

(b) W

C

Question Number	Answer	Acceptable answers	Mark
3(a)	conversion (1) 3.2 W = 0.0032 kW substitution (1) 0.0032 × 24 × 14 evaluation (1) 1.1 (p)	allow conversion and substitution in either order correct substitution of any power x time x cost (per unit) answers rounding up from 1.0752 to 1.1 =3 marks condone rounding to 1 (p) for 3 marks if some correct working shown any other answer using 10752 (to any {power of 10 / sig.fig.}) = 2 marks award full marks for the correct answer with no working	**(3)**

(c) The transformer shown in the photograph steps down the mains voltage of 230 V to 9.2 V.

The primary coil of the transformer has 4700 turns.

(i)

Question Number	Answer	Acceptable answers	Mark
3(b)	substitution (1) $97 = 230 \times I$ transposition (1) $\frac{\text{power}}{\text{voltage}}$ OR $\frac{97}{230}$ evaluation (1) 0.42 (A)	allow substitution and transposition in either order ignore power of 10 errors until evaluation mark allow numbers which round down to 0.42 (A) e.g. 0.42/0.42174 (A) for 3 marks award full marks for correct answer with no working unsupported 4.2 (A) OR 0.042 (A) score 2 condone rounding to 0.4 (A) condone use of 240 instead of 230 to give 0.402 so accept for 3	**(3)**

(c) An electric torch is switched on for 90 s.

The current in the torch is 70 mA.

Calculate the amount of charge flowing from the torch battery during this time.

(2)

Question Number	Answer	Acceptable answers	Mark
1 (c)	Substitution 70 (x 10^{-3}) x 90 (1) Evaluation: 6.3 (C) (1)	allow 1 mark maximum for power of ten error in final answer (C) Allow 2 marks for correct answer with no working shown.	**(2)**

..... C

Electrical resistance

5 A student uses this circuit to investigate how the current in a filament lamp varies with the potential difference (voltage) across the lamp.

Question Number	Answer	Acceptable answers	Mark
5(b)	A (12 joules per coulomb)		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(c)	Substitution: (using R=V/I) 4.0 / 0.37 (1) Evaluation: 10.8 (Ω) (1) (Approx 11) Accept answer of 10.8 with no working for both marks	Substitution: (using V = IR) 0.37 x 11 (1) Evaluation: 4.07 (V) (1) (approx 4) Accept answer of 4.07 with no working for both marks **Or** Substitution: (using I = V/R) 4/11 (1) Evaluation: 0.364 (A) (1) (approx. 0.37) Accept answer of 0.364 with no working for both marks	**(2)**

(a) A
di

(b) C
Th

☐ **A**

☐ **B**

☐ **C**

☐ **D**

(c) W
ar
Sh

(2)

AQA June 2014

1 (b) (i) A single wind turbine has a maximum power output of 2 000 000 W.

The wind turbine operated continuously at maximum power for 6 hours.

Calculate the energy output in kilowatt-hours of the wind turbine.

Use the correct equation from the Physics Equations Sheet.

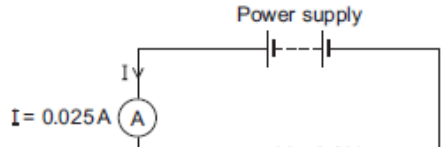
[2 marks]

1(b)(i)	12 000 (kWh)	allow **1** mark for correct substitution eg 2000 × 6 **or** 2 000 000 × 6 **or** $\frac{12\,000\,000}{1000}$ an answer of 12 000 000 scores **1** mark	2	AO2 1.3.1c

AQA June 2014

4 (a) **Figure 4** shows the apparatus used to obtain the data needed to calculate the resistance of a thermistor at different temperatures.

Figure 4



4(a)(i)			1	AO1 2.3.2c
4(a)(ii)	360	allow **1** mark for correct substitution, ie $9 = 0.025 \times R$	2	AO2 2.3.2h

4 (a) (ii) Use the data given in **Figure 4** to calculate the resistance of the thermistor at 20 °C.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

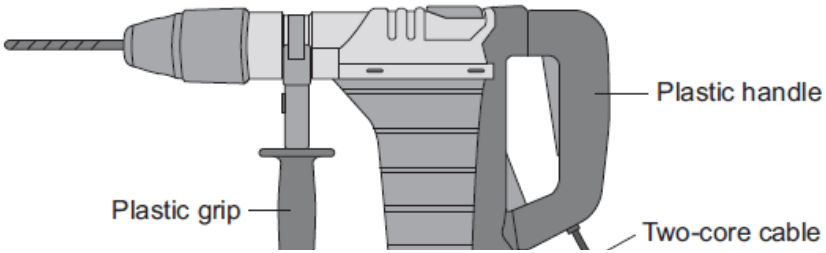
.....

Resistance = ... ohms

AQA June 2014

7 **Figure 8** shows an electric drill.

Figure 8



7(b)	4.4	allow **1** mark for correct substitution, ie 1012 = I × 230 provided no subsequent incorrect numerical step	2	AO2 2.4.2c

- Mass: 6 kg

7 (b) Calculate the current drawn from the mains electricity supply by the drill.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Current = ... A

5 (b) (ii) The solar storage power station can store a maximum of 2 200 000 kWh of energy. The solar storage power station can supply a town with a maximum electrical power of 140 000 kW.

Calculate for how many hours the energy stored by the solar storage power station can supply the town with electrical power

5(b)(ii)	16 (hours)	an answer that rounds to 16 gains **2** marks eg 15.71 allow **1** mark for a correct substitution ie 2 200 000 = 140 000 x t	3	AO2 AO1 P1.3.1c

.....

.....

Time = ... hours

Figure 6

5(a)(i) mark with 5aii 5aiii	1.7		1	AO2 2.3.2	**E**
5(a)(ii) mark with 5ai 5aiii	51 **or** 30 x their (a)(i) correctly calculated coulomb / C	allow **1** mark for correct substitution i.e. $1.7 = \frac{Q}{30}$ or their (a)(i) $= \frac{Q}{30}$ do **not** accept c	2 1	AO1/AO2 2.3.2a	**E**

Current = ... A

5 (a) (ii) The bulb works at normal brightness for 30 seconds before it is switched off.

Calculate the charge that flows through the bulb in the 30 seconds before it is switched off. Give the unit.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

.....

.....

.....

Charge = ... unit .....

5 (a) (iii) Calculate the energy transferred by the 12 V bulb when it is working at normal brightness for 30 seconds.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

5(a)(iii) mark with 5ai 5aii	612 **or** their(a)(ii)x 12 correctly calculated ***or*** their (a)(i) x 360 correctly calculated	allow **1** mark for correct substitution i.e. E = 12 x 51 or 12 x their (a)(ii) or their (a)(i) x 360	2	AO2 2.4.2d	**E**

8 (b) When the toothbrush is being charged, the p.d. across the primary coil in the charging base is 230 V.

The charging p.d. across the secondary coil in the toothbrush is 7.2 V.

8(b)	18	allow **1** mark for correct substitution, ie $\frac{230}{7.2} = \frac{575}{n_s}$	2	AO2 P3.3.2g

.....

.....

.....

.....

Number of turns on the secondary coil = ...

8 An electric vehicle

The battery is rech

(a) The battery vol

(i) State the ar through a p

(ii) Show that, amount of

Question number	Answer	Notes	Marks
8 (a) (i)	385 (J);		1
(ii)		reverse calculation e.g. calculating a voltage or charge gains 1 mark max.	
	substitution into E=QV; evaluation to at least 2 s.f.;		2
		if no other mark given allow 1 mark for 10^6 or 1000000 seen in working	
	e.g. (E =) 385 × 180 000 (E =) 69 000 000 (J) / 69 (MJ)	allow ecf from 8(a)(i) value	
(iii)	MP1. idea of <u>energy</u> wasted;	allow not 100% efficient, <u>energy</u> lost	2
	MP2. appropriate mechanism;	e.g. heat in wires	
8 (b) (i)	charge = current × time;	allow abbreviations e.g. Q = I × t or rearrangements	1
(ii)	substitution; rearrangement; evaluation;	ignore not converting time to seconds until evaluation	3
	e.g. 180 000 = current x (110 x 60) (current =) 180 000 / (110 × 60) (current =) 27 (A)	allow 27.3, 27.27...	
		1600, 1640, 1636 etc. gain 2 marks	
		if no other mark given allow 1 mark for 60 seen anywhere in working (attempt to convert to seconds)	

8	(b)	(i)	charge = current × time;	allow abbreviations e.g. Q = I × t or rearrangements	1
		(ii)	substitution; rearrangement; evaluation; e.g. 180 000 = current x (110 x 60) (current =) 180 000 / (110 × 60) (current =) 27 (A)	ignore not converting time to seconds until evaluation allow 27.3, 27.27… 1600, 1640, 1636 etc. gain 2 marks if no other mark given allow 1 mark for 60 seen anywhere in working (attempt to convert to seconds)	3

(d) (i) State the equation linking voltage, current and resistance.

(1)

Question number	Answer	Notes	Marks
4 (d) (i)	voltage = current x resistance;	Accept rearrangements and symbols e.g. current = voltage ÷ resistance, V=IR, R=V/I	1
(ii)	Substitution into correctly rearranged equation; Conversion between amps and milliamps; Calculation yielding value correct to at least 2 s.f.; e.g. I = 5.9 ÷ 680 = 0.00868 (A) = 8.7 (mA)	Accept x 1000 in calculation Allow 1 mark max if response is only a successful reverse argument leading to 5.8 V or 5.78 V	3

Total 14 marks

iGCSE January 2014

3	(a)	(i)	power = voltage x current;	Accept rearrangements and symbols e.g. current = power ÷ voltage, P=IV, I=P/V ignore a triangle mnemonic an eqn in units	1
		(ii)	2.9 (A);	Accept 2.92 (A), 2.916 (A)	1

(a) (i) State the equation linking power, current and voltage.

(1)

(ii) Complete the table by inserting the missing value.

(1)

Power in W	Voltage in V	Current in A
700	240	
2400	240	10

(b) It takes 3.5 hours to recharge the battery fully.

The average current supplied by the charger is 400 mA.

(i) State the equation linking charge, current and time.

	(b)	(i)	Charge = current x time;	Accept rearrangements and standard symbols e.g. current = $\frac{\text{charge}}{\text{time}}$ Q = I x t I=Q/t ignore units	1
		(ii)	Substitution; Calculation; Matching correct unit i.e. coulomb/C; e.g. Q = $\frac{400 \times 3.5 \times 3600}{1000}$ 5000 C	 Allow mC Allow 5040 **MAX 2 if** time not converted into s (1.4, 1400, 60, 60 000,seen) POT error seen	3
	(c)		Longer (charging) time needed;		2

charge = ... unit .....

(b) The student uses voltmeter and ammeter readings to find the resistance at each temperature.

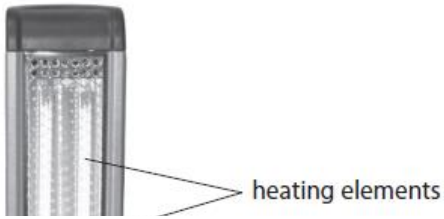
(b)	(i)	Voltage = current x resistance;	Allow V = IR Allow rearrangements ignore a bald 'triangle'	1
	(ii)	Convert milliamps to amps OR kilo-ohms to ohms; Substitution into *correct* equation & rearrangement; Calculation to greater than 1SF; 2.6 mA = 0.0026 A (R) = $\frac{13.2}{0.0026}$ = 5077 (Ω)	'show that' question, working must be shown for full mark Allow 5080, 5076 (truncation) 5.080 with working is worth 2 marks 5.08 with no working is worth 1 mark	3

(ii) Show that the resistance of the thermistor at 80 °C is about 5000 Ω.

(3)

(b)	(i)			No mark for stating the formula, since E = I x V x t is given on page 2
			Conversion to seconds; Substitution into correctly rearranged equation; Calculation; e.g. (time =) 60 (s) $\frac{39\ 000\ 000}{(490 \times 60)}$ 1300 (V)	60 seen in working 1330, 1327, 1326.5 (V) Correct answer without working scores full marks Allow 1.3 kV for THREE marks Allow Power of Ten error , for a maximum of TWO marks e.g. 1.326×10^{-3}, 1.33, 130
	(ii)			

6 The photograph shows an electric heater.



Question number	Answer	Notes	Marks
6 a i	Power = current x voltage;	Accept • rearranged equation • equation in recognised symbols	1
ii	Substitution and rearrangement; Evaluation; eg I = 2000 / 230 8.7 (A)	Accept • 9 (A) • 8.695.....(A) ETC NOT • 8.6 incorrect truncation • 9.0 incorrect rounding	1 1

(ii) Calculate the current in the heater.

(2)

current = ... A

7 The diagram shows a transformer that is 100% efficient.

Question Number	Answer	Notes	Marks
7 (a) (i)	input power = output power; OR $I_pV_p = I_sV_s$; OR $I_{in}V_{in} = I_{out}V_{out}$;	A dimensionally correct power equation is required. Accept - Power in = Power out $I_1V_1 = I_2V_2$ **input power = output power** $V_P I_P = V_S I_S$	1
(ii)	Substitution in correctly rearranged equation; Calculation; e.g. $I_s = \frac{(2 \times 230)}{110}$ 4 (A)	Full marks for bald correct answer Accept more s.f. e.g. 4.2, 4.18, 4.1818	2
(b) (i)	$(V_p/V_s) = (N_p/N_s)$; $\frac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}$ $\frac{V_P}{V_S} = \frac{n_P}{n_S}$	Allow • equation in words with turns ratio shown as a fraction • standard abbreviations :- s, p, in, out, 1, 2 • N, n or T for number of turns • "number of coils" for number of turns Rearrangements also to include turns ratio as a fraction $(V_S/V_P) = (N_S/N_P)$ [equation inverted] $V_S = (V_P)(N_S/N_P)$ [V_S as subject] $V_P = (V_S)(N_P/N_S)$ [V_P as subject]	1

number of turns = ...

(c) (i)	Conversion to seconds; Substitution in correct formula; Evaluation; e.g. t = 7 × 3600 (= 25200 s) E = 0.12 × 230 × 7 × 3600 700 000(J)	Allow 3600 or 25200 seen anywhere in working (695520) Correct answer without working scores full marks Accept alternative matching unit e.g. 696 kJ 11592 = 2 marks (time in mins) 193.2 = 2 marks (time in hours) Answer in Wh or Wmin with matching unit scores full marks.	3
(ii)	**B** - same as - less than		1

2 An electric kettle is connected to the 230 V mains supply.

The power of the kettle is 960 W.

2 (a)	(i)	B - 960 joules per second;		1
	(ii)	power = current x voltage;	allow equation as correct symbols and/or rearrangement e.g. I = P ÷ V	1
	(iii)	appropriate calculation (including substitution OR rearrangement); answer to at least 2 sf seen anywhere; e.g. 960 = I × 230 (I =) 4.2 (A)	using 4 (A) to calculate power (920 W) or voltage (240 V) scores 1 mark max. (4.17391) allow 4.1 (A)	2

(iii) Show that the current in the kettle is about 4 A.

(2)

(b)	(i)	$\frac{\text{input / primary voltage}}{\text{output / secondary voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}$	allow • equation in words with turns ratio shown as a fraction • standard abbreviations :- s, p, in, out, 1, 2 • N or n for number of turns (condone T for number of turns) • "number of coils" for number of turns rearrangements also to include turns ratio as a fraction $(V_S/V_P) = (N_S/N_P)$ [equation inverted] $V_S = (V_P)(N_S/N_P)$ [V_S as subject] $V_P = (V_S)(N_P/N_S)$ [V_P as subject]
	(ii)	substitution into a correct equation; evaluation (including rearrangement); e.g. 44 / V = 520 /30 (V =) 2.5 (V)	allow 3, 2.53, 2.54, 2.538

(b)	(i)	power = voltage × current;	Accept symbols P=I×V Condone a mix of correct symbols and words	1
	(ii)	Substitution and calculation; Conversion to megawatts; e.g. P=I×V P= 4000 × 600 = 2 400 000 (W) = 2 400 000 ÷ 1 000 000 = 2.4 (MW)	division by 10^6 or 1 000 000 seen correct answer without working scores two marks	2

d weighing 400 000 N through 190 m.

ip between work done, force and distance moved.

(1)

done on the load.

(2)

The machine uses an electric motor connected to a 600 V d.c. supply.

The maximum current in the motor is 4000 A.

(i) State the equation linking power, current and voltage.

(ii) Calculate the maximum power available from the motor.

maximum power = ...

9 (c)	(i)	work done = force × distance (moved)	Accept symbols W=F×d W =Fd	1
	(ii)	Substitution; Calculation; e.g. Work = 400 000 × 190 76 000 000 (J)	Accept 76 MJ with correct unit 7.6×10^7 (J) 76×10^6 (J)	2
(d)	(i)	Substitution into given equation; P = W/t Rearrangement; Calculation; e.g. 1.9 = 67 ÷ t.....worth 1 t = 67 ÷ 1.9 .....worth 2 = 35 (s).....worth 3	No mark for the equation as it is given in QP Substitution and rearrangement in either order Or (in joules and watts) 67 000 000 ÷ 1 900 000 (35.26) correct answer without working =3	3
	(ii)	Any one of :- Takes longer /eq;	Ignore: unqualified comments about the amount of work done	1

3)

(b) The man presses a metal button to operate the lift.

There is a spark and the man receives an electric shock.

(b)	(i)	charge = current × time;	words or correct symbols e.g. Q = I × t	1
	(ii)	substitution and rearrangement; evaluation; unit; e.g. (I =) 0.0017 ÷ 0.075 (I =) 0.023 A	-1 for POT error A or mA mark independently 0.02, 0.0227 etc. condone 0.022, 0.0226 etc. 23 mA gets 3 marks	3

current = ... unit .....

(ii) The cylinder contains air at a pressure of 21 000 kPa.

The volume of air in the cylinder is 15.0 litres

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	substitution (1) either $100 \times V = 15.0 \times 21\,000$ or $V = \frac{15.0 \times 21\,000}{100}$ evaluation (1) 3 150(litres)	$V_1P_1 = 15 \times 21000 = 315000$ (1 mark) $V_2P_2 =$ **100** $\times 3200 = 320000$ (1 mark) award full marks for 3150 (litres) without working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	substitution (1) $\frac{21\,000\ (\times V)}{305} = \frac{P\ (\times V)}{278}$ volume same (1) evaluation (1) 19 100 (kPa)	give full marks for correct answer, no working transposition accept 19141 (kPa) or 19000 and numbers rounding down to 191 00	**(3)**

pressure in the cylinder in the cold country = ... kPa

AQA June 2015

7 A 'can-chiller' is used to make a can of drink colder.

Figure 7 shows a can-chiller.

Figure 7

7(a)	4200 J/kg°C	allow **2** marks for correct substitution ie 6930 = 0.330 x c x 5.0 answers of 1050 **or** 840 **or** correctly calculated answer from correct substitution of incorrect temperature change **or** identification of temperature change ie 5 °C gain **1** mark accept J/kg K	3 1	AO2 AO1 P1.1.4d

.....

.....

.....

.....

Specific heat capacity = ... unit .....

iGCSE January 2016

2 The photograph shows some large concrete cubes.

Question number	Answer	Notes	Marks
2 (a)	10 000; N;	allow 9800, 9810, 10^4 allow "newton(s)" marks are independent	2
(b) (i)	density = mass / volume;	allow abbreviation, e.g. ρ = m/V, d = m/V or rearrangements	1
(ii)	substitution OR rearrangement; evaluation; e.g. 2300 = 1000/volume = 0.43 (m^3)	award if either seen in working allow 0.4, 0.434, 0.435, 0.4347... condone 0.44	2

volume of concrete cube = ... m^3

iGCSE January 2015

9 The volume of a piece of brass is 16.3 cm^3.

A student measures its mass using an electronic balance.

The mass of the brass is 138 g.

(a) (i) State the equation linking density, mass and volume.

Question number	Answer	Notes	Marks
9 (a) (i)	density = $\frac{\text{mass}}{\text{volume}}$	Allow symbols and rearrangements, e.g. $\rho = m / V$	1
(ii)	substitution into correct equation; calculation; matching unit; e.g. Density = 138 ÷ 16.3 = 8.47 g/cm^3	8.466, 8.5	3

density = ... unit .....

(d) The average density of the hot air in the balloon is 0.95 kg/m^3.

The volume of this air is 2800 m^3.

(i) State the equation linking density, mass and volume.

(1)

(d) (i)	Density = $\frac{\text{mass}}{\text{volume}}$;	Accept symbols or rearrangement e.g. $\rho = m/V$	1
(ii)	Substitution into correct equation;	allow sub and rearrangement in either order	3
	Rearrangement; Evaluation; e.g. $0.95 = \frac{m}{2800}$ $m = 0.95 \times 2800$ = 2700 (kg)	2660	

mass of hot air = ... kg