

# Mark Scheme (Results)

## November 2009

IGCSE

### IGCSE Physics (4420/2H)

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November 2009

Publications Code UG022386

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The following abbreviations have been used:

ecf error carried forward

dop dependent on previous

owtte or words to that effect

ora or reverse argument

Question Number	Acceptable Answers	Extra Information	Mark
1 (a)	wire melts/blows breaks circuit/no current		1 1

Question Number	Acceptable Answers	Extra Information	Mark
1 (b)	Use of $P = V I$ $1500 / 240$ $= 6.25 \text{ (A)}$		3

Question Number	Acceptable Answers	Extra Information	Mark
1 (c)(i)	13A		1

Question Number	Acceptable Answers	Extra Information	Mark
1 (c)(ii)	all the others would blow dop		1

Question Number	Acceptable Answers	Extra Information	Mark
1 (d)	toaster / oven / kettle /bread machine /soldering iron etc.	not microwave	1

(Total 8 marks)

Question Number	Acceptable Answers	Extra Information	Mark
2 (a)(i)	protons and neutrons/ Helium atom  2p + 2n /He nucleus/nuclei scores 2		2
2 (a)(ii)	another source of background radiation	buildings rock soil nuclear power medical uses radon etc	1
2 (b)	less absorption/space less dense or vacuum owtte		1
2 (c)(i)	time for activity to halve <b>owtte</b>		1

Question Number	Acceptable Answers	Extra Information	Mark
2 (c)(ii)	1. method shown on graph 6 000 (years)  2. count similar to background/no (carbon-14) activity		1 1  1

Question Number	Acceptable Answers	Extra Information	Mark
2 (c)(iii)	smoke detector sterilising tracers checking welds cancer treatment etc	accept 'medical'	1

(Total 9 marks)

Question Number	Acceptable Answers	Extra Information	Mark
3 (a)	force distance  direction	either order   <i>independent marks</i>	1 1  1

Question Number	Acceptable Answers	Extra Information	Mark
3 (b)	2000/ 5 = 400 (W)		1 1

Question Number	Acceptable Answers	Extra Information	Mark
3 (c)(i)	efficiency = useful output energy/ input energy	= ( input energy – waste energy) / input energy	1
3 (c)(ii)	20 000/ 50 000 = 0.4 or 40%	0.4 scores 3 (c) marks	1 1

(Total 8 marks)

Question Number	Acceptable Answers	Extra Information	Mark
4 (a)(i)	(loft) insulation or named material		1
4 (a)(ii)	curtains/shutters/double glazing/triple glazing		1

Question Number	Acceptable Answers	Extra Information	Mark
4 (b)	air heated/hot air expands / less dense rises  <b>ora</b>	not 'lighter'	1 1 1

(Total 5 marks)

Question Number	Acceptable Answers	Extra Information	Mark
5 (a)	2 <sup>nd</sup> 5 <sup>th</sup>		2

Question Number	Acceptable Answers	Extra Information	Mark
5 (b)(i)	one line with arrow second line with arrow	do not credit either if they contradict	1 1
5 (b)(ii)	attract / move towards		1
5 (b)(iii)	opposite poles attract <i>independent mark</i> no <b>ecf</b>		1

Question Number	Acceptable Answers	Extra Information	Mark
5 (c)(i)	flat circular coil	allow solenoid	1

Question Number	Acceptable Answers	Extra Information	Mark
5 (c)(ii)	(no) lines not evenly spaces and/or parallel		1

(Total 8 marks)

Question Number	Acceptable Answers	Extra Information	Mark
6 (a)	A diffraction B reflection C refraction  <i>independent marks</i>		1 1 1

Question Number	Acceptable Answers	Extra Information	Mark
6 (b)	wavelength changes  wavelength reduced	scores both marks	2
6 (c)	wavefront(s) as concave curve(s) more curved than A  three equally spaced  <i>independent marks</i>		2

(Total 7 marks)



Question Number	Acceptable Answers	Extra Information	Mark
7 (a)(i)	(total) clockwise moment(s) = (total) anticlockwise moment(s)	accept just 'balanced' accept 'no unbalanced force'	1

Question Number	Acceptable Answers	Extra Information	Mark
7 (a)(ii)	3.6 (kN) (2)	credit either ' $12 \times 2.7 = \text{weight/load} \times 9$ ' or ' $= 12 \times 2.7 \div 9$ ' or any transposed version which will calculate to 3.6 with (1)	2

Question Number	Acceptable Answers	Extra Information	Mark
7 (b)(i)	(size and) direction shown		1

Question Number	Acceptable Answers	Extra Information	Mark
7 (b)(ii)	acceleration	or momentum/velocity/displacement/impulse	1

(Total 5 marks)

Question Number	Acceptable Answers	Extra Information	Mark
8 (a)(i)	there is no movement (of any sort)	credit 'internal kinetic energy is zero' assume that the reference is to the particles so credit 'kinetic energy is zero' with (1)	1

Question Number	Acceptable Answers	Extra Information	Mark
8 (a)(ii)	303	do not credit '-303' or '303 °C'	1

Question Number	Acceptable Answers	Extra Information	Mark
8 (b)(i)	any of <ul style="list-style-type: none"> <li>• the temperature in kelvin(s)</li> <li>• the temperature on the kelvin scale</li> <li>• the absolute temperature</li> </ul>	do not credit just 'the temperature' allow 'the temperature in degrees (sic) kelvin(s)'	1

Question Number	Acceptable Answers	Extra Information	Mark
8 (b)(ii)	1190 (kPa) (3)	or credit 1188.1..... (kPa) with (2) or credit the use of 303 <u>and</u> 288 with (1) do not credit '625', '620' or '630'	3

(Total 6 marks)

Question Number	Acceptable Answers	Extra Information	Mark
9 (a)	advantages - (1) each any two of <ul style="list-style-type: none"> <li>• (energy source is) renewable</li> <li>• no (chemical) pollution (in use)</li> <li>• (in UK it is generally) windier in winter when more energy required</li> </ul>	ignore references to cost(s)	2

Question Number	Acceptable Answers	Extra Information	Mark
9 (b)	disadvantages - (1) each any two of <ul style="list-style-type: none"> <li>• not much power/energy from each</li> <li>• (so) large numbers are needed</li> <li>• (so) large space is needed</li> <li>• limited number of suitable sites</li> <li>• wind not always available</li> <li>• not safe to operate at (very) high wind speeds</li> <li>• noise (pollution when in use)</li> <li>• eyesore/damage scenic value/visual pollution</li> <li>• obstruction to shipping/low flying aircraft/</li> <li>• danger to birds (from collision with them/their blades)</li> <li>• damage/destroy (natural) habitat</li> <li>• (chemical) pollution during manufacture</li> </ul>	ignore references to cost(s)	2

(Total 4 marks)

Question Number	Acceptable Answers	Extra Information	Mark
10 (a)	any two (1) each <ul style="list-style-type: none"> <li>• (d.c.) electric motor</li> <li>• (loud) speaker</li> <li>• ammeter/voltmeter</li> <li>• Barlow's wheel</li> </ul>	allow any device which uses an electric motor for example a washing machine, an electric drill etc but do not credit such devices with more than one of the two available marks	2

Question Number	Acceptable Answers	Extra Information	Mark
10 (b)	any two (1) each <ul style="list-style-type: none"> <li>• increase the strength/intensity of the magnetic field/use a more powerful magnet</li> <li>• increase the current/voltage/p.d.</li> </ul>	ignore references to bigger magnets  ignore references to resistance/number of coils/number of turns  do not credit just 'change the intensity' 'change the current'	2

Question Number	Acceptable Answers	Extra Information	Mark
10 (c)	thumb → direction of force (1)  first finger → magnetic field N to S (1)  second finger → current from + to - (1)	if any digit connected to more than one box cancel both connections	3

Question Number	Acceptable Answers	Extra Information	Mark
10 (d)	the wire/current is parallel to the (magnetic) field	do not credit just 'the current/wire is not perpendicular/at right angles/90° to the (magnetic) field'	1

(Total 8 marks)

Question Number	Acceptable Answers	Extra Information	Mark
11 (a)(i)	gravitational potential energy = mass $\times$ $g$ $\times$ height	or $GPE = m \times g \times h$ or any correctly transposed version accept 'acceleration due to gravity' or 'acceleration of free fall' or 'gravitational field strength' for $g$	1

Question Number	Acceptable Answers	Extra Information	Mark
11 (a)(ii)	either 5 880 000 (1) J (1) or 5880(1) kJ (1) or 5.88(1)MJ (1)	either 5 762 400 or 5 768 200  note 588 000 J/joules is (1)	2

Question Number	Acceptable Answers	Extra Information	Mark
11 (a)(iii)	5 880 000 J	or same as answer to (a)(ii) with same unit	1

Question Number	Acceptable Answers	Extra Information	Mark
11 (a)(iv)	any one of <ul style="list-style-type: none"> <li>• no energy/work wasted</li> <li>• process is 100 %/perfectly efficient</li> <li>• no heat/sound output</li> <li>• no friction</li> <li>• no air resistance</li> <li>• no kinetic energy/not moving at top/70 m</li> </ul>	do not credit 'no wind resistance'	1

Question Number	Acceptable Answers	Extra Information	Mark
11 (b)(i)	kinetic energy = $\frac{1}{2}$ mass $\times$ speed <sup>2</sup>	or $KE = \frac{1}{2}mv^2$ or any correctly transposed version  do not credit 'velocity' rather than 'speed'	1

Question Number	Acceptable Answers	Extra Information	Mark
11 (b)(ii)	14 (m/s) (3)	<p>otherwise evidence that  <math>823.2 \text{ kJ} = 823\,200 \text{ J}</math> (1)  <math>\text{speed}^2 / v^2 = 823200 \div 4200</math>  <math>\text{or} = 196</math> (1)</p> <p>use of 823.3 scores 2 max  (leads to 0.4427... m/s)</p>	3

(Total 9 marks)

Question Number	Acceptable Answers	Extra Information	Mark
12 (a)(i)	20 (2) m/s <sup>2</sup> (1)	or m s <sup>-2</sup> or m/s/s  allow for (1) '28 ÷ 1.4' or any other correct indication that the slope of the ascending line is being used	3

Question Number	Acceptable Answers	Extra Information	Mark
12 (a)(ii)	19.6 (m) (3)	or clear indication that the distance is given by the area under (the main part of) the graph  (1) a numerical statement which, if correctly evaluated, leads to 19.6 e.g. $\frac{1}{2} \times 1.4 \times 28$ (1)	3

Question Number	Acceptable Answers	Extra Information	Mark
12 (a)(iii)	(0).06 (s)		1

Question Number	Acceptable Answers	Extra Information	Mark
12 (b)(i)	(unbalanced) force = mass × acceleration	or F = ma or any correctly transposed version	1

Question Number	Acceptable Answers	Extra Information	Mark
12 (b)(ii)	1250 (kg) (2)	or 25000 ÷ 20 (kg) (1)	2

(Total 10 marks)

Question Number	Acceptable Answers	Extra Information	Mark
13 (a)	103 680 (2) J/joules (1)	credit $4 \times 60 \times 60$ (s) or 14400 (s) with (1)  note 28.8 J/joules is (2) and 28.8 is (1) and 1728 J/joules is (2)	3

Question Number	Acceptable Answers	Extra Information	Mark
13 (b)(i)	charge		1

Question Number	Acceptable Answers	Extra Information	Mark
13 (b)(ii)	coulomb	allow minor misspellings  allow C	1

(Total 5 marks)



Question Number	Acceptable Answers	Extra Information	Mark
14 (a)(i)	(triangular) prism(s)		1

Question Number	Acceptable Answers	Extra Information	Mark
14 (a)(ii)	total internal reflection	all three words needed accept minor misspellings but do not credit anything which could be 'refraction' however accept 't.i.r.'	1

Question Number	Acceptable Answers	Extra Information	Mark
14 (b)(i)	1. normal 2. $y = x$ 3. refractive index = $\frac{\sin i}{\sin r}$	do not credit 'perpendicular' or 'vertical'  do not accept ' $x = y$ '  accept $n = \frac{\sin y}{\sin u}$	3

Question Number	Acceptable Answers	Extra Information	Mark
14 (b)(ii)	the angle of incidence is bigger than the critical angle	accept ' $i > c$ '	1

Question Number	Acceptable Answers	Extra Information	Mark
14 (b)(iii)	$\sin(e)$ of critical angle = $\frac{1}{\text{refractive index}}$	or $\sin c = \frac{1}{n}$	1

(Total 7 marks)

Question Number	Acceptable Answers	Extra Information	Mark
15 (a)(i)	(wave)speed = frequency × wavelength  or $v = f\lambda$	or any correctly transposed version	1

Question Number	Acceptable Answers	Extra Information	Mark
15 (a)(ii)	250 (2) metre(s)/m (1)	either credit 250 000 metre(s)/m with (2)  or evidence of correct transposition with (1)  or evidence of 1200 kHz = 1 200 000 Hz with (1)	3

Question Number	Acceptable Answers	Extra Information	Mark
15 (b)	0.00000083 (3)	or 0.0000008333..... (2)  or evidence that time period = $\frac{1}{\text{frequency}}$ (1)	3

(Total 7 marks)

Question Number	Acceptable Answers	Extra Information	Mark
16 (a)	either pressure = <u>force</u> or $p = \frac{F}{A}$ area	or any correctly transposed equation	1

Question Number	Acceptable Answers	Extra Information	Mark
16 (b)	sharp blade has smaller <u>area</u> (1)  either (so) same <u>force</u> will give a greater <u>pressure</u> (1)  or (so) same <u>pressure</u> (obtained) with a <u>smaller force</u>	allow credit (up to (2) marks) for converse reasoning	2

Question Number	Acceptable Answers	Extra Information	Mark
16 (c)	5000 N on 1 m <sup>2</sup> (2)	units must be correctly given  either any other correct example example 0.5 N on 1 cm <sup>2</sup>  or for (1) mark evidence that 5 kPa = 5000 Pa	2

(Total 5 marks)

Question Number	Acceptable Answers	Extra Information	Mark
17 (a)	steam produced (in boiler(s)) (1) drives turbine (1) rotates generator (1)	all in correct order for (3) marks accept drives/rotates/turns/spins but not just 'moves'	3

Question Number	Acceptable Answers	Extra Information	Mark
17 (b)(i)	neutrons ... protons	or nucleons ... protons  or nucleons ... neutrons  either order but both required	1

Question Number	Acceptable Answers	Extra Information	Mark
17 (b)(ii)	${}_{92}^{235}\text{U}$ and ${}_{92}^{236}\text{U}$	or U 235 and U 236 both required either order	1

Question Number	Acceptable Answers	Extra Information	Mark
17 (b)(iii)	Kr and Ba	either order but both required and no others  further details of the nuclei are not required but if any are given e.g. the mass number they must be correct from the equation	1

Question Number	Acceptable Answers	Extra Information	Mark
17 (b)(iv)	(the) moderator	accept 'the graphite' do not credit 'the control rods'	1

Question Number	Acceptable Answers	Extra Information	Mark
17 (b)(v)	(three) neutrons are emitted which can collide with/hit other uranium nuclei (1)  this will start new fission processes which in turn will lead to more and so on (1)	accept ..... other uranium atoms/particles  idea of a cascade or domino effect required for this mark  or one or both marks may be shown diagrammatically but do	2

		not credit any point contradicted on the diagram and in the written response	
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(Total 9 marks)

PAPER TOTAL: 120 MARKS

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