Mark Scheme (Results)

November 2023

Pearson Edexcel International GCSE
In Physics (4PH1) Paper 1P and Science Double Award (4SD0) Paper 1P

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Notes	Marks
1 (a)	D (universe); A is incorrect because the Milky way is the name of a galaxy B is incorrect because a nebula contains dust and gas C is incorrect because a solar system contains stars and planets		1
(b)	D (newton per kilogram); A is incorrect because this is the unit of mass B is incorrect because this is the unit of force C is incorrect because this is the unit of the product of force and mass		1
(c)	C (the Moon has less mass than the Earth); A is incorrect because distance from the Sun has no effect on the gravitational field strength of the Moon/Earth B is incorrect because an atmosphere does not affect gravitational field strength D is incorrect because a greater density would give a larger gravitational field strength		1
(d)	moon orbits Earth/a planet and comet orbits Sun/star; moon's orbit is (almost) circular/**slightly** elliptical and comet's orbit is (very) elliptical;	marks may be awarded from a suitably **labelled** diagram allow comet's orbit is 'bigger'/takes more time allow oval for elliptical allow speed of moon is (almost) constant but speed of comet varies	2

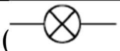
Total for Question 1 = 5 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2</td><td>one mark for each correct row;;;;
<table><tr><th>Description</th><th>Graph</th></tr><tr><td>current directly proportional to time</td><td>P</td></tr><tr><td>current increasing at a decreasing rate</td><td>S</td></tr><tr><td>current has a linear relationship to time but is not directly proportional</td><td>Q</td></tr><tr><td>current decreasing at a decreasing rate</td><td>R</td></tr></table></td><td>reject if more than one letter given in a row</td><td>4</td></tr>
</table>

Total for Question 2 = 4 marks

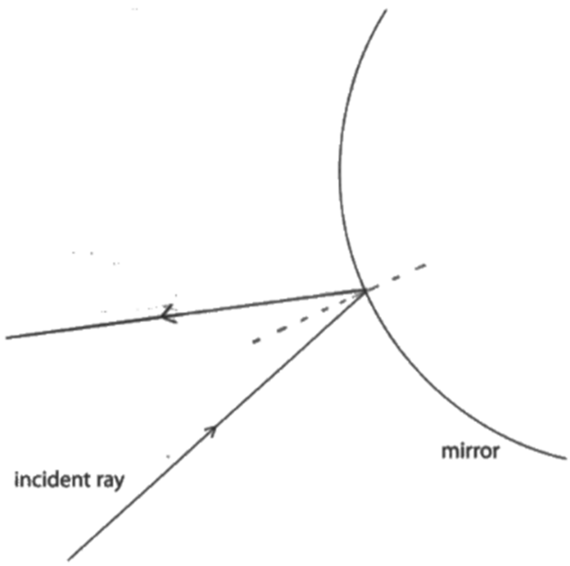
Question number	Answer	Notes	Marks
3 (a) (i)	wavelength in range 12 – 13 (cm) = 1 mark; wavelength = 12.5 (cm) = 2 marks;;		2
(ii)	substitution; conversion of ‘G’ to 10^9 or 1 billion; evaluation that would round to 3×10^8 given to 2 or more s.f.; e.g. speed = 2.35 × 12.5 speed = $2.35 \times 10^9 \times 12.5(\times 10^{-2})$ speed = $2.9\ldots \times 10^8$ (m/s)	ecf value from (i) ignore units for this mark allow answer in range $2.8\text{-}3.1 \times 10^8$ (m/s) POT error scores 2 max.	3
(b)	**internal** heating of {tissue/organs/body};	ignore references to skin ignore references to burning, cell damage, mutation, cancer etc.	1

Total for Question 3 = 6 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>4 (a)</td><td colspan="2">B ();

A is incorrect because it is an LED
C is incorrect because it is a motor
D is incorrect because it is an LDR</td><td>1</td></tr>
<tr><td>(b)</td><td>one mark for each correctly ticked statement;;
<table>
<tr><th>Statements</th><th>Correct (✓)</th></tr>
<tr><td>visible light is a longitudinal wave</td><td></td></tr>
<tr><td>visible light transfers energy</td><td>✓</td></tr>
<tr><td>visible light transfers matter</td><td></td></tr>
<tr><td>visible light has a longer wavelength than x-rays</td><td>✓</td></tr>
<tr><td>visible light travels faster in water than in air</td><td></td></tr>
</table></td><td>if 3 or more ticks, then −1 for each incorrectly ticked row</td><td>2</td></tr>
<tr><td>(c) (i)</td><td>normal line drawn correctly at mirror surface;</td><td>ignore tangent lines
does not need to be labelled but should be drawn at 90° by eye where the ray meets the mirror</td><td>1</td></tr>
<tr><td>(ii)</td><td>ray drawn reflecting;

angle of reflection correct;

e.g.

</td><td>reject if ray passes into the mirror
DOP
judge by eye
allow ecf from (c)(i)</td><td>2</td></tr>
</table>

(d)	(i)	substitution into E = I × V × t; rearrangement; evaluation; e.g. 120 = current × (3×)1.5 × 3.0(×60) current = 120 / 4.5 × 180 (current =) 0.15 (A)	allow if 1.5 V used for voltage ignore unit for time allow substitution into P=VI and P=E/t 26.6…, 8.8…, 0.44… = 2 marks allow 0.148…(A)	3
	(ii)	idea that current in wire produces a magnetic field;	ignore wire becomes magnetic	1

Total for Question 4 = 10 marks

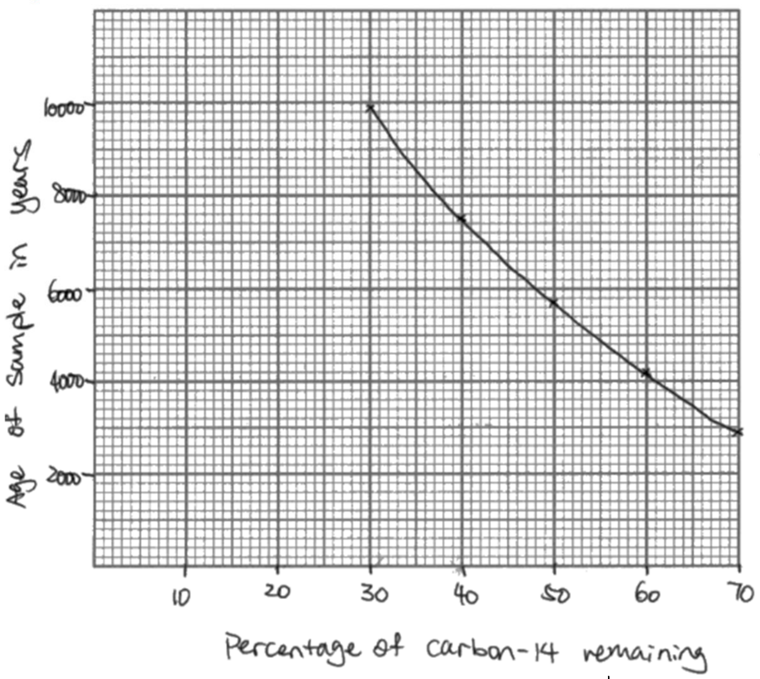
Question number	Answer	Notes	Marks
5 (a)	idea that there is a risk of burning from apparatus; wood is an insulator; wood will not get (as) hot;	allow prevents burns allow metal conducts heat (well) / metal gets hot allow wood does not conduct heat / wood is a poor conductor	3
(b)	idea that atoms in metal have vibrations; idea that vibrations increase in speed/amplitude (when metal is heated); idea that vibrations are passed (along the metal) between particles;	allow ions for atoms allow (free/delocalised) electrons in metal move around allow (free/delocalised) electrons move faster (when metal is heated) allow (free/delocalised) electrons collide with other electrons/atoms (along the metal)	3
(c) (i)	idea that metal is a discrete / categoric variable;	allow not continuous, discontinuous variable	1
(ii)	repeat the measurements; calculate a mean / identify anomalies;	allow repeat the experiment allow average for mean	2
(iii)	copper/aluminium/brass are better conductors; (because) time taken (for tack to fall) is shorter / quicker;	ignore student is wrong allow {iron / it} is not the best conductor allow (because) time taken (for tack to fall) is longer / slower	2

Total for Question 5 = 11 marks

Question number	Answer	Notes	Marks
6 (a) (i)	idea of acceleration = gradient; correct substitution; evaluation; e.g. acceleration = gradient acceleration = 3.0 (-0) / 2.5 (-0) acceleration = 1.2 (m/s^2)	allow use of acceleration formula a = (v−u)/t allow any pairs of values that lie on line allow answers that round to 1.2 (m/s^2)	3
(ii)	any reference to area;		1
(iii)	any attempt at area of triangle; correct area attempted; evaluation; e.g. distance = area of triangle distance = ½ × 3.0 × 2.5 distance = 3.8 (m)	allow alternative method using $v^2=u^2+2as$ with ecf from (i) e.g. $3.0^2 = (0.0^2 +)\ 2×1.2×s$ s = 9.0 / 2.4 allow 3.7, 3.75 (m)	3
(b)	evaluation of either ($15/5^2$) or ($60/10^2$); evaluation of second constant; comparison of the two values to conclude suggestion supported;	allow 0.6 or $^3/_5$ seen in working ignore constants calculated using data from graph	3

Total for Question 6 = 10 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>7 (a) (i)</td><td>proton;</td><td>allow hydrogen (nucleus/atom), hydrogen 1</td><td>1</td></tr>
<tr><td>(ii)</td><td>protons increase {by 1 / to 7};

neutrons decrease {by 1 / to 7};</td><td>ignore references to atomic number
ignore references to nucleon/mass number</td><td>2</td></tr>
<tr><td>(b) (i)</td><td>linear scales that take up ≥ 50% of the grid for both axes;
labelled axes with units;
all points plotted correctly within ½ small square;</td><td>ignore orientation of axes
allow use of false origins
allow no units on percentage axis
<table>
<tr><th>Percentage (%) of carbon-14 remaining</th><th>Age of sample in years</th></tr>
<tr><td>30</td><td>9900</td></tr>
<tr><td>40</td><td>7500</td></tr>
<tr><td>50</td><td>5700</td></tr>
<tr><td>60</td><td>4200</td></tr>
<tr><td>70</td><td>2900</td></tr>
</table></td><td>3</td></tr>
<tr><td>(ii)</td><td>smooth curve within ½ small square of each point;
e.g.

</td><td></td><td>1</td></tr>
<tr><td>(iii)</td><td>indication on graph from 36% to curve;
(age =) 8400 (years);</td><td>ecf curve from (ii)
allow 8200-8600 (years)
allow within a small square of candidate's curve
answer in allowed range scores both marks</td><td>2</td></tr>
</table>

(c)	(i)	idea that tree contains more carbon-14/radioactive atoms than it would do normally / eq;		1
	(ii)	samples will appear younger; with any one from: • idea that trees absorb **more** carbon-14 (from the atmosphere); • **more** radioactive than 'normal'/before 1950;	allow idea that age of wood is less than it should be e.g. an underestimate allow **more** carbon-14 in the wood allow **more** contaminated than 'normal'/before 1950	2

Total for Question 7 = 12 marks

Question number	Answer	Notes	Marks
8 (a)	arrow pointing **inwards,** in direction from star to centre of galaxy;	reject if contradicting arrows drawn	1
(b) (i)	any evidence of distance = (average) speed × time; correct evaluation given to at least 2s.f.; e.g. (distance =) 3.0 ($\times 10^8$) × 3.2 ($\times 10^7$) (distance =) 9.6×10^{15}	 allow 9.5×10^{15}	2
(ii)	substitution into given formula; rearrangement; evaluation and presentation in standard form; e.g. 220 000 = 2 × π × (29 000 × 10^{16})/T T = 2 × π × (29 000 × 10^{16})/220 000 (T =) 8.3×10^{15} (s)	ignore units correct answer not in standard form = 2 marks e.g. 8 300 000 000 000 000 (s) POT error in standard form = 2 marks e.g. 8.3×10^n (s) POT error not in standard form = 1 mark e.g. 830, 828, 0.83, 0.828 (s) etc. allow 8.28… × 10^{15} (s) allow 7.9(5) × 10^{15} (s) (from use of 9.6 × 10^{15} for the light year)	3

Total for Question 8 = 6 marks

Question number			Answer	Notes	Marks
9	(a)	(i)	uranium / U;	allow plutonium / Pu or any named isotopes of either e.g. U-235, Pu-239	1
		(ii)	neutron absorbed by (parent) nucleus; nucleus splits; releasing (daughter) nuclei / neutrons; fission process repeats;	allow named daughter nuclei e.g. krypton, barium etc. reject if reference to daughter nuclei splitting allow idea that chain reaction occurs	4
	(b)	(i)	coil(s) rotate; coil(s) cut magnetic field of magnet(s); voltage is induced / eq;	allow magnet(s) rotate ignore magnetic fields interacting allow current induced	3
		(ii)	any one of: • reduce the strength of the magnetic field; • fewer coils; • rotate slower / reduce speed; • reduce the flow/speed/pressure of steam; • reduce rate of fission / reactor output;	ignore references to transformers allow weaker magnets allow remove some magnets allow less turns on coil(s) allow lower/insert control rods	1
		(iii)	a.c. changes direction **continuously** / eq; d.c. has one direction;		2

Total for Question 9 = 11 marks

Question number	Answer	Notes	Marks
10 (a) (i)	voltage = current × resistance;	allow standard symbols and rearrangements e.g. I = V / R condone ‘i’ for current ignore ‘c’ or ‘C’ for current	1
(ii)	substitution; rearrangement; evaluation; e.g. 5.8 = current × 13(× 10^3) (current =) 5.8 / 13(× 10^3) (current =) 4.5 × 10^{-4} (A)	ignore units −1 for POT error allow 4.46…×10^{-4} (A) allow 0.0004, 0.00045, 0.000446… (A) condone 0.00044 (A)	3
(b) (i)	correct ammeter symbol in series with 13 kΩ resistor;		1
(ii)	13 kΩ resistor: • voltage remains the same; • so current stays the same; battery: • total voltage remains the same; • (circuit) resistance is reduced; • (therefore) current through battery increases;	allow current is (still) 0.000446… (A) allow current flows in 200 Ω resistor / additional path allow (total) resistance = 197(Ω) allow current through battery is sum of 2 currents allow (new) current = 0.0294…(A)	5

Total for Question 10 = 10 marks

Question number			Answer	Notes	Marks
11	(a)	(i)	pressure (difference) = height (of liquid) × density × g	allow standard symbols and rearrangements e.g. $h = p / (\rho \times g)$ allow d, depth for height allow rho for density allow g.f.s for gravitational field strength ignore gravity for g	1
		(ii)	pressure due to liquid = 117 − 12 or 105 seen; substitution; rearrangement; evaluation; e.g. liquid pressure = 105 kPa $105\,(000) = h \times 1.36 \times 10^4 \times 10$ $h = 105\,(000) / (1.36 \times 10^5)$ (height =) 0.772 (m)	ignore units allow ecf from use of incorrect pressure allow use of g = 9.8, 9.81 −1 for POT error unless due to omission of g 0.000772…, 0.000787…, 0.96…, 0.948…, 0.87…, 0.860… (m) = 3 marks 0.00096…, 0.000948…, 0.00087…, 0.000860… (m) = 2 marks allow 0.8, 0.77, 0.772…, 0.79, 0.787… (m)	4
	(b)	(i)	speed/KE of particles increases; idea that particles collide with wall(s) **more frequently**; idea that particles collide with wall(s) with more force/harder;	ignore particles gain energy ignore if no evidence of walls/sides of container ignore if no evidence of walls/sides of container	3
		(ii)	conversion of both temperatures into kelvin; substitution into given equation; rearrangement; evaluation; e.g. T_1 = 296 K and T_2 = 311 K $12/296 = p_2 / 311$ $p_2 = 311 \times 12/296$ p_2 = 13 (kPa)	allow ecf from incorrect conversion 20 kPa, 19.8 kPa scores 3 (no kelvin conversion) allow 12.6…(kPa)	4

Total for Question 11 = 12 marks

Question number	Answer	Notes	Marks
12 (a)	any five from: MP1. chemical energy (store of student); MP2. transferred mechanically; MP3. (to) gravitational energy (store of marble); MP4. transferred mechanically; MP5. (to) kinetic energy (store of marble); MP6. idea that thermal energy (store of marble) increases; MP7. idea that thermal energy (store) of marble run / surroundings increases; MP8. energy transferred to surroundings by radiation;	allow idea this is due to a lift force exerted by student must be a clear second reference allow idea this is due to marble's weight allow heat for thermal allow heat for thermal allow transferred/lost as sound	5

(b) (i)	let marble roll across table for a known distance;
	measure time taken;
	use speed = distance / time;
	OR
	use of light gate;
	connected to datalogger;
	positioned so that (centre of) marble cuts beam(s);
		allow measure distance travelled across table
		reject if linked to measuring time between A and B
		allow use of device with two integrated light gates
			3

(ii)	substitution into GPE formula; evaluation of GPE; substitution into KE formula; evaluation of KE; subtraction to find energy lost; e.g. GPE = 0.0055 × 10 × 0.21 GPE = 0.01155 (J) KE = 0.5 × 0.0055 × 0.76^2 KE = 0.0015884 (J) energy lost = (0.01155 − 0.0015884 =) 0.010 (J)	ignore units allow use of g = 9.8, 9.81 only penalise not converting g to kg once ignore units only penalise not converting g to kg once allow ecf from incorrect GPE and/or KE 10, 10.0, 9.96…, 9.7… (J) etc. scores 4 marks allow 0.0113… allow 0.00996…, 0.0097… (J)	5

Total for Question 12 = 13 marks

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