



Mark Scheme (Results)

November 2023

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

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

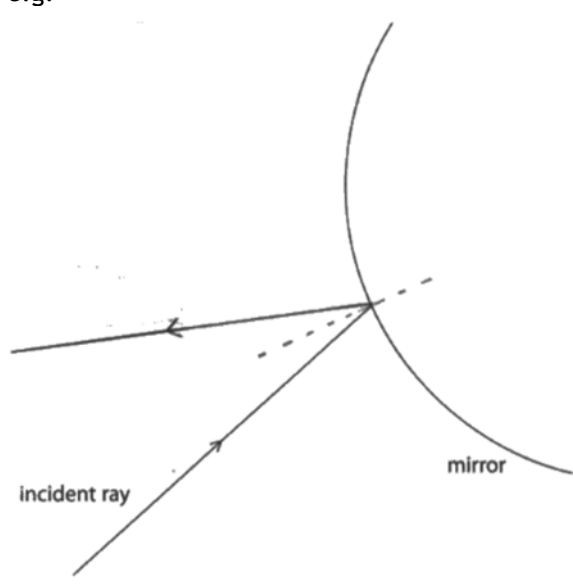
Total for Question 1 = 5 marks

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

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 = $2.9... \times 10^8$ (m/s)	ecf value from (i) ignore units for this mark allow answer in range $2.8-3.1 \times 10^8$ (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

Question number	Answer	Notes	Marks												
4 (a)	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		1												
(b)	one mark for each correctly ticked statement;; <table><thead><tr><th>Statements</th><th>Correct (✓)</th></tr></thead><tbody><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></tbody></table>	Statements	Correct (✓)	visible light is a longitudinal wave		visible light transfers energy	✓	visible light transfers matter		visible light has a longer wavelength than x-rays	✓	visible light travels faster in water than in air		if 3 or more ticks, then -1 for each incorrectly ticked row	2
Statements	Correct (✓)														
visible light is a longitudinal wave															
visible light transfers energy	✓														
visible light transfers matter															
visible light has a longer wavelength than x-rays	✓														
visible light travels faster in water than in air															
(c) (i)	normal line drawn correctly at mirror surface;	ignore tangent lines does not need to be labelled but should be drawn at 90° by eye where the ray meets the mirror	1												
(ii)	ray drawn reflecting; angle of reflection correct; e.g. 	reject if ray passes into the mirror DOP judge by eye allow ecf from (c)(i)	2												

(d)	(i)	substitution into $E = I \times V \times t$; rearrangement; evaluation; e.g. $120 = \text{current} \times (3 \times) 1.5 \times 3.0(\times 60)$ $\text{current} = 120 / 4.5 \times 180$ (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 = $3.0 \text{ (-0)} / 2.5 \text{ (-0)}$ acceleration = $1.2 \text{ (m/s}^2\text{)}$	allow use of acceleration formula $a = (v-u)/t$ allow any pairs of values that lie on line allow answers that round to $1.2 \text{ (m/s}^2\text{)}$	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 = $\frac{1}{2} \times 3.0 \times 2.5$ distance = 3.8 (m)	allow alternative method using $v^2 = u^2 + 2as$ with ecf from (i) e.g. $3.0^2 = (0.0^2 +) 2 \times 1.2 \times s$ $s = 9.0 / 2.4$ 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 $\frac{3}{5}$ seen in working ignore constants calculated using data from graph	3

Total for Question 6 = 10 marks

Question number	Answer	Notes	Marks												
7 (a)	(i) proton;	allow hydrogen (nucleus/atom), hydrogen 1	1												
	(ii) protons increase {by 1 / to 7}; neutrons decrease {by 1 / to 7};	ignore references to atomic number ignore references to nucleon/mass number	2												
(b)	(i) linear scales that take up $\geq 50\%$ of the grid for both axes; labelled axes with units; all points plotted correctly within $\frac{1}{2}$ small square;	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>	Percentage (%) of carbon-14 remaining	Age of sample in years	30	9900	40	7500	50	5700	60	4200	70	2900	3
	Percentage (%) of carbon-14 remaining	Age of sample in years													
	30	9900													
40	7500														
50	5700														
60	4200														
70	2900														
(ii)	smooth curve within $\frac{1}{2}$ small square of each point; e.g. 		1												
(iii)	indication on graph from 36% to curve; (age =) 8400 (years);	ecf curve from (ii) allow 8200-8600 (years) allow within a small square of candidate's curve answer in allowed range scores both marks	2												

(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 $\times$ time; correct evaluation given to at least 2s.f.; e.g. (distance $\Rightarrow$) $3.0 (\times 10^8) \times 3.2 (\times 10^7)$ (distance $\Rightarrow$) 9.6×10^{15}	allow 9.5×10^{15}	2
(ii)	substitution into given formula; rearrangement; evaluation and presentation in standard form; e.g. $220\,000 = 2 \times \pi \times (29\,000 \times 10^{16})/T$ $T = 2 \times \pi \times (29\,000 \times 10^{16})/220\,000$ (T $\Rightarrow$) 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 $8.28... \times 10^{15}$ (s) allow $7.9(5) \times 10^{15}$ (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 $\times$ 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. $5.8 = \text{current} \times 13(\times 10^3)$ (current =) $5.8 / 13(\times 10^3)$ (current =) 4.5×10^{-4} (A)	ignore units -1 for POT error allow $4.46... \times 10^{-4}$ (A) allow 0.0004, 0.00045, 0.000446... (A) condone 0.00044 (A)	3
(b) (i)	correct ammeter symbol in series with 13 k Ω resistor;		1
(ii)	13 k Ω 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) $\times$ density $\times$ 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. $T_1 = 296\text{ K}$ and $T_2 = 311\text{ K}$ $12/296 = p_2 / 311$ $p_2 = 311 \times 12/296$ $p_2 = 13\text{ (kPa)}$	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 <u>force</u> exerted by student must be a clear second reference allow idea this is due to marble's <u>weight</u> 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. $GPE = 0.0055 \times 10 \times 0.21$ $GPE = 0.01155 \text{ (J)}$ $KE = 0.5 \times 0.0055 \times 0.76^2$ $KE = 0.0015884 \text{ (J)}$ 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