Mark Scheme (Results)

November 2024

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

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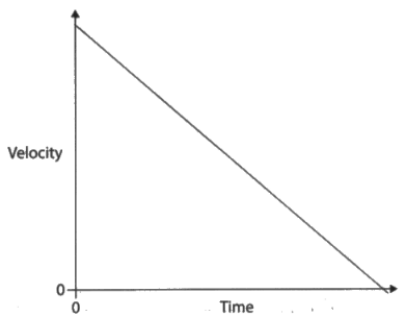
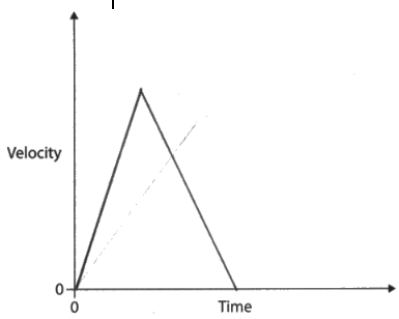
General Marking Guidance

- 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)	elliptical orbit drawn; star (approximately) at the focus of the ellipse;	allow partial elliptical orbits reject if star at the centre of the ellipse	2
(b) (i)	arrow drawn pointing from moon towards planet;	arrow does not need to start at moon but line of arrow must pass through moon and planet ignore force arrows associated with comet	1
(ii)	**B - gravitational**; A is incorrect as any electrical force would not be strong enough C is incorrect as any magnetic force would not be strong enough D is incorrect as nuclear forces are short range		1
(c)	substitution into given formula; correct evaluation; answer given to 2 s.f.; e.g. orbital speed = $2\pi \times 8.7 \times 10^{10} / 2.5 \times 10^{8}$ orbital speed = 2186.54848… (m/s) orbital speed = 2200 (m/s)	allow use of 3.14, 22/7 for π −1 for POT error any final value expressed to 2 s.f. gets this mark allow 2185.44, 2187.4… (m/s) allow 2.2×10^{3} (m/s)	3
(d)	blue star is hotter (than the Sun); region is further away (from the star);	allow blue star is hottest allow region for blue star has larger radius / eq	2

Total for Question 1 = 9 marks

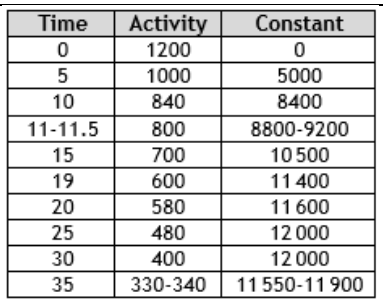
Question number	Answer	Notes	Marks
2 (a) (i)	kinetic energy = ½ × mass × speed^2;	allow velocity for speed allow standard symbols e.g. KE = ½ × m × v^2	1
(ii)	substitution; evaluation; e.g. KE = ½ × 85 × 4.5^2 KE = 860 (J)	 allow 861, 860.6, 860.62, 860.63, 860.625 (J)	2
(iii)	identical answer to (ii);	expect 860 (J) allow ecf from (ii)	1
(iv)	gravitational potential energy = mass × *g* × height;	allow standard symbols e.g. GPE = m × *g* × h ignore gravity for *g*	1
(v)	substitution; rearrangement; evaluation; e.g. 860 = 85 × 10 × h h = 860 ÷ 850 = 1.0(125) (m) (h =) 1.0 (m)	allow use of *g* = 9.8, 9.81 allow ecf from (ii) or (iii) allow use of v^2 = u^2 + 2as for full marks allow 1 (m) if supported by valid working allow 1.00 – 1.03 (m)	3
(b) (i)	velocity shown to decrease from an initial positive value; straight line of negative gradient drawn; finishes at 0 (m/s); e.g.  OR  	allow if velocity initially increases from 0 (m/s) and then decreases reject if velocity remains at maximum value (flat line) judge by eye	3

(ii)	**B - gradient**; A is incorrect as that would give the distance travelled C and D are incorrect as the *x* and *y* axes are integral features of the graph, not the data		1
(iii)	any two from: MP1. idea that Moon and Earth have different masses; MP2. gravitational field strength is proportional to mass; MP3. gravitational field strength on the Moon is less;	 allow RA allow density for mass condone Earth is heavier/Moon is lighter allow RA condone less gravity on Moon	2

Total for Question 2 = 14 marks

Question number	Answer	Notes	Marks
3 (a)	plastic is an (electrical) insulator; idea that it prevents an electric shock;	allow idea the plastic doesn't conduct (electricity) allow reference to double insulation ignore references to current transferring to surroundings	2
(b) (i)	power = current × voltage;	allow standard symbols and rearrangements e.g. I = P / V ignore C, c for current	1
(ii)	substitution OR rearrangement; evaluation; e.g. 350 = current × 230 OR current = power / voltage (current =) 1.5 (A)	allow 1.52… (A)	2
(c)	idea the circuit breaker is faster (at isolating circuit); idea the circuit breaker is resettable;	allow circuit breaker is more sensitive allow circuit breaker can be reused / used multiple times	2

Total for Question 3 = 7 marks

Question number	Answer	Notes	Marks
4 (a)	becquerel(s)/Bq;	accept with any prefix (e.g. kBq) or recognisable spelling allow bq, BQ	1
(b)	idea that background radiation is always present; appropriate named source of background radiation mentioned;	allow radiation all around us, in the surroundings/environment, everywhere etc. e.g. from: • the Sun / cosmic rays • rocks / soil • radon • weapons testing • food • nuclear disasters • medical equipment reject CMBR	2
(c) (i)	(average) time; for halving of: • the (radio)activity; • number of nuclei; • mass of isotope;	allow how long it takes allow count rate for activity allow atoms for nuclei ignore mass of substance/sample	2
(ii)	lines drawn on graph indicating an activity and half of that activity; half-life = 19 (minutes);	e.g. line drawn across from 600 and down to 19 accept any answer that rounds to 19 (minutes) for 2 marks	2
(d)	data point taken from graph; constant correctly calculated using data point; constant correctly calculated from a second data point taken from graph; conclusion consistent with calculated constants;	 Time / Activity / Constant 0 / 1200 / 0 5 / 1000 / 5000 10 / 840 / 8400 11-11.5 / 800 / 8800-9200 15 / 700 / 10 500 19 / 600 / 11 400 20 / 580 / 11 600 25 / 480 / 12 000 30 / 400 / 12 000 35 / 330-340 / 11 550-11 900 dependent on first three marks being awarded (DOP) conclusion must be clearly linked to a comparison of the constants	4

Total for Question 4 = 11 marks

Question number	Answer	Notes	Marks
5 (a)	at least three horizontal, straight field lines, parallel and equally spaced; at least one arrow on field line from N to S;	judge by eye reject any contradictory field line directions for this mark	2
(b)	vertical arrow; downwards;	allow arrow drawn anywhere on diagram DOP	2
(c)	**any three from:** MP1. wire/coil/current has a magnetic field; MP2. field of wire/coil/current interacts with field of magnet; MP3. idea of there being a force **on wire AB or CD**; MP4. idea that **forces** are in opposite/different directions; MP5. (because) the currents (in the sides of the coil) are in opposite/different directions; **with one from:** MP6. forces do not change direction; MP7. idea that current cannot swap direction; MP8. lack of split-ring / commutator;	 allow idea that fields overlap ignore cutting field allow if shown on diagram allow upward **force** on one side and downward **force** on other side ignore references to movement allow idea that there is no (net) moment (when the coil is vertical) allow current is not a.c. allow idea that a split-ring / commutator is needed	4

Total for Question 5 = 8 marks

Question number	Answer	Notes	Marks
6 (a)	**any three from:** MP1. means of recording position of block; MP2. means of recording rays; MP3. mark normal where light enters/leaves the block; MP4. measurement of angles of incidence and refraction; MP5. repeat for range of angles of incidence; **with any two from:** MP6. sin(i)÷ sin(r) used to calculate n; MP7. for different angles of incidence and averaged;	 allow drawing around block on paper allow drawing paths of rays, marking positions of incident/emerging rays allow if shown in diagram allow graph plotted of sin(i) against sin(r) allow use of gradient to determine n	5
(b) (i)	sin(c) = 1/n;	allow any correct rearrangement allow word formula	1
(ii)	substitution OR rearrangement; evaluation; e.g. sin(c) = 1 / 1.2 OR c = $\sin^{-1}(1/n)$ (c = $\sin^{-1}(1/1.2)$ =) 56 (degrees)	allow sin(c) = 0.83… allow 56.4… (degrees) allow answers that round to 56 (degrees)	2
(iii)	any two from: MP1. idea that all light is reflected inside a medium; MP2. for light travelling from a higher refractive index to a lower refractive index; MP3. (when) angle (of incidence) is greater than critical angle;	 allow if seen in a diagram allow idea that all light is reflected rather than being refracted allow higher (optical) density to lower (optical) density	2
(c) (i)	24 (degrees);	allow 22-26 (degrees)	1
(ii)	ray emerges into air; ray refracts correctly, bending away from the normal;	allow dashed lines arrow not required judge by eye ignore reflected rays	2

Total for Question 6 = 13 marks

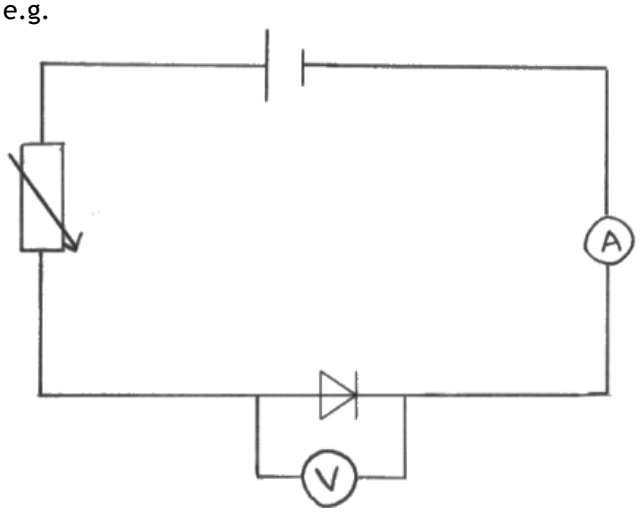
Question number	Answer	Notes	Marks
7 (a) (i)	weight / gravitational (force) / gravitational pull (of Earth);	ignore gravity	1
(ii)	one vertical upwards arrow and one vertical downwards arrow; two arrows are equal length;	allow if drawn anywhere on diagram ignore any horizontal arrows ignore labels on arrows DOP judge by eye	2
(b) (i)	pressure (difference) = density × *g* × height;	allow standard symbols e.g. p = *ρ* × *g* × h condone d for density, condone gfs for *g* ignore gravity	1
(ii)	substitution; evaluation in kPa; e.g. pressure = 1030 × 10 × 38 (pressure =) 390 (kPa)	allow use of *g* = 9.8, 9.81 391 400 (kPa) scores 1 mark allow 391(.4) (kPa) allow 380, 383, 384, 383.5…, 383.9… (kPa)	2
(c) (i)	idea of collisions between particles and **the walls** of the storage tank; idea of particles exerting a force on the walls; idea of a force exerted over an area gives a pressure;	allow atoms, molecules for particles allow equivalent expressions for collisions e.g. bounce, hit etc. condone air exerts a force on the walls allow p = F/A quoted	3

(ii)	conversion of either temperature in kelvin; substitution into given formula; rearrangement; evaluation; e.g. T = 275.5 (K) or T = 291 (K) 410 / 275.5 = p_2 / 291 p_2 = 410 × 291 / 275.5 (p_2 =) 430 (kPa)	allow if seen anywhere in working allow ecf for °C values used or incorrect kelvin temperatures accept calculation of constant value i.e. 410 ÷ 275.5 = 1.488… −1 for POT error 3000, 2952 (kPa) scores 3 marks (not converting to kelvin) allow 433.1, 433.0… (kPa)	4

Total for Question 7 = 13 marks

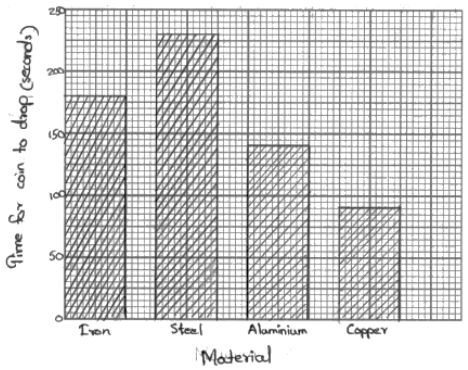
Question number	Answer	Notes	Marks
8 (a)	reference to vibrations / oscillations; (vibrations/oscillations) are parallel to direction of wave/energy transfer for longitudinal AND (vibrations/oscillations) are perpendicular to direction of wave/energy transfer for transverse;	both marking points can be awarded from clearly labelled diagrams ignore up and down, forwards and backwards allow equivalent statements of parallel/perpendicular	2
(b)	wavefronts (at whale B) are compressed / wavelength (at whale B) is smaller; speed of sound is constant; frequency = speed of sound ÷ wavelength (therefore frequency increases);	allow alternative phrases for compressed allow any rearrangement of the formula allow symbols for formula	3
(c)	substitution into speed = frequency × wavelength; rearrangement; evaluation; e.g. 3.0×10^{8} = frequency × 5.4×10^{-7} frequency = 3.0×10^{8} / 5.4×10^{-7} (frequency =) 5.6×10^{14} (Hz)	 −1 for POT error if no other marks scored, allow selection of correct formula for 1 mark allow 6×10^{14}, $5.55\ldots \times 10^{14}$ (Hz) reject 5.5×10^{14} (Hz)	3

Total for Question 8 = 8 marks

Question number	Answer	Notes	Marks
9 (a)	complete circuit with correct symbols for cell, ammeter and voltmeter; variable resistor in series with diode; ammeter in series with diode; voltmeter in parallel with diode; e.g.  	condone more than one cell / battery drawn ignore orientation of diode relative to cell circuit symbol must be correct condone incorrect orientation of symbol reject if voltmeter drawn in parallel with variable resistor and diode	4
(b) (i)	0.38 (A);		1
(ii)	voltage = current × resistance;	allow standard symbols and rearrangements e.g. R = V / I ignore c, C for current	1
(iii)	substitution OR rearrangement; evaluation; e.g. 2.9 = 0.15 × R OR R = V / I (resistance =) 19 (Ω)	 allow 19.3… (Ω)	2
(iv)	MP1. calculation of resistance in diagram 2; MP2. idea that resistance is larger in diagram 2; MP3. calculation of current in diagram 2;	allow 19(.3) + 13 or 32(.3) (Ω) seen allow ecf from (iii) allow 12.6 Ω used for R_B allow RA award this mark if MP1 awarded allow ecf from MP1	4

	MP4. conclusion that current is smaller in diagram 2;	e.g. I (= 2.9 / 32(.3)) = 0.09 (A) dependent on one of MP1-MP3 being awarded allow RA	

Total for Question 9 = 12 marks

Question number	Answer	Notes	Marks
10 (a) (i)	metal/material;	ignore unqualified “type of rod”	1
(ii)	time (taken for coin to fall off);	allow how long it takes (for the coin to fall off)	1
(iii)	any two from: MP1. rods the same length; MP2. rods the same diameter/thickness/width/area; MP3. coins of the same mass; MP4. same mass/amount of wax;	allow a mark for “rods same size/volume” if MP1 or MP2 have not been awarded allow same type of wax	2
(iv)	repeat the experiment; calculate the mean (time for each rod);	reject if method modified e.g. testing additional metals allow calculate the average allow identify/ignore anomalies	2
(b) (i)	suitable linear scale for time axis; time axis labelled with quantity and unit AND material axis labelled; all bars correct length to within ½ small square; e.g.  	reject multiples of 30, 45, 60, 80 for 10 small squares allow use of false origin scale should be such that length of tallest bar must be at least half the grid condone missing “material” label if bars are labelled iron, steel etc. Material / Time for coin to drop in seconds: iron 180; steel 230; aluminium 140; copper 90	3
(ii)	material/data is categoric/discrete/not continuous;	allow discontinuous for not continuous	1

Total for Question 10 = 10 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>11 (a)</td><td>D - nuclear fusion;

A is incorrect as the abundance of nuclei with high proton number is too small
B is incorrect as the energy release per decay is too small
C is incorrect as fusion below Fe-57 is endothermic</td><td></td><td>1</td></tr>
<tr><td>(b)</td><td>all numbers written in the correct rows = 4 marks;;;;
any three numbers written in the correct rows = 3 marks;;;
any two numbers written in the correct rows = 2 marks;;
any one number written in the correct row = 1 mark;
e.g.
<table><tr><th>Stages of development</th><th>Order number</th></tr><tr><td>a black hole is formed</td><td>5</td></tr><tr><td>heavy elements are made in the core of the star</td><td>3</td></tr><tr><td>the star becomes a red supergiant</td><td>2</td></tr><tr><td>the star explodes in a supernova</td><td>4</td></tr><tr><td>the core of the star runs out of hydrogen</td><td>1</td></tr></table></td><td></td><td>4</td></tr>
</table>

Total for Question 11 = 5 marks

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