

Mark Scheme (Results)

Summer 2023

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

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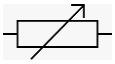
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General Marking Guidance

- 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)	A (becquerel); B is incorrect because it is the unit of mass C is incorrect because it is the unit of force D is incorrect because it is the unit of pressure		1
(b)	A (time taken for the activity of a substance to halve); B is incorrect because the substance will not completely decay C is incorrect because the substance will not completely decay D is incorrect because the substance cannot decay twice		1
(c) (i)	stopwatch; GM tube;		2
(ii)	point at t = 20s identified;		1
(iii)	any indication of a halving in activity;	e.g. 50→25 40→20 etc. seen in working allow ÷2, ×½ seen in working	2
	half-life = 15 (s);	allow full credit in range 14–16 (s)	
(iv)	any indication that decay is random;	allow unpredictable allow references to background radiation/count varying	1

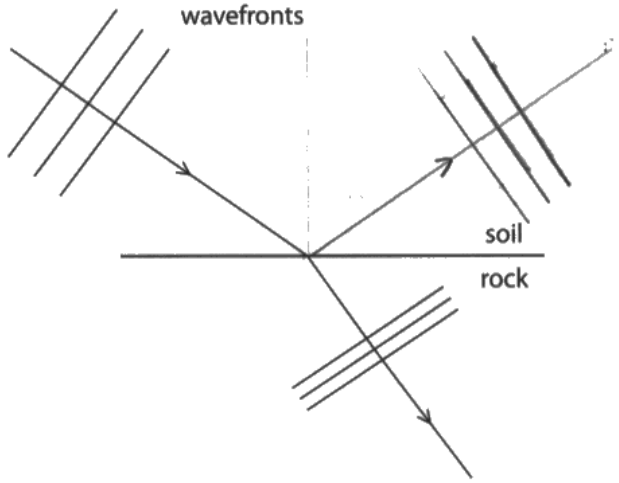
Total for Question 1 = 8 marks

Question number	Answer	Notes	Marks
2 (a)	correct circuit symbols for **all** of; • suitable power source • ammeter • voltmeter • filament lamp	allow cell, battery or power supply for power source allow  or  filament lamp symbol condone lines drawn through ammeter and voltmeter symbols	4
	ammeter drawn in series with lamp; voltmeter drawn in parallel with lamp;	allow voltmeter drawn in parallel with power source if no other resistive components in circuit	
	means of varying current or voltage i.e. variable resistor/variable power supply;	ignore thermistor or LDR allow  or  for variable resistor	
(b) (i)	current increases as voltage increases;	condone proportional relationship for this mark only	2
	idea of non-linear relationship;	reject this mark if proportional relationship described allow decreasing gradient, current increases at a decreasing rate condone slowing rate	
(ii)	voltage = current × resistance;	allow rearrangements and standard symbols e.g. R = V/I ignore 'c' or 'C' for current ignore formulae expressed in units e.g. V = A × Ω	1
(iii)	substitution; rearrangement; evaluation; e.g. 7.2 = 2.40 × R R = 7.2/2.40 R = 3.0 (Ω)	allow current = 2.40-2.45 (A) allow R = V/I seen anywhere in working allow 2.9-3.0 (Ω)	3

Total for Question 2 = 10 marks

Question number	Answer	Notes	Marks
3 (a)	substitution into given formula; rearrangement; correct evaluation; e.g. 0.27 = energy / 43 200 energy = 0.27 × 43 200 (energy =) 12 000 (J)	ignore units allow E = P × t -1 for not converting units or converting units incorrectly if no other mark scored then evidence of 43 200 seen in working scores 1 mark allow 11 700, 11 660, 11 664 (J) 3.24 (J), 194.4 (J) or answers rounded from these values score 2 marks	3
(b) (i)	idea that current exceeds the fuse rating; fuse (wire) melts; idea that device is isolated;	allow when current is too high, surge of current etc. ignore current increasing allow fuse breaks, fuse blows ignore fuse burns allow idea that circuit is broken	3
(ii)	any two from: MP1. idea that fuse rating is much higher than normal current; MP2. idea that there is still current (even if there is a fault); MP3. idea that (connecting lead/TV) will overheat/cause a fire;	allow fuse value is too high allow fuse will not melt/break/blow allow idea of causing damage to TV / circuit	2

Total for Question 3 = 8 marks

Question number	Answer	Notes	Marks
4 (a) (i)	speed = frequency × wavelength;	allow rearrangements and standard symbols e.g. $\lambda = v/f$ allow s for speed	1
(ii)	substitution; rearrangement; evaluation; e.g. $3.0 \times 10^8 = 170 (\times 10^6) \times \lambda$ $\lambda = v/f$ OR $\lambda = 3.0 \times 10^8 / 170 (\times 10^6)$ (wavelength =) 1.8 (m)	ignore units -1 for POT error from not converting units or an incorrect attempt at converting units allow 1.76(4…) (m)	3
(b) (i)	reflected ray/wavefronts drawn to right of 'normal' and above rock; wavefronts perpendicular to reflected ray; wavefronts parallel to each other and spacing consistent with incident wavefronts; e.g.  	normal does not need to be drawn reflection angle does not need to be correct ignore if wavefronts extended in to the rock can only be scored if first mark awarded judge by eye can only be scored if first mark awarded judge by eye	3
(ii)	any three from:		3

	MP1. wavefronts closer together; MP2. idea that rock is (optically) denser than soil; MP3. idea of reduction in speed; MP4. idea of constant frequency; MP5. correct reference to wave speed equation / speed = frequency × wavelength;	ignore wavelength is smaller allow wave refracts towards normal allow idea that rock has a larger refractive index can only be scored if MP3 or MP4 awarded	

Total for Question 4 = 10 marks

Question number	Answer	Notes	Marks
5 (a)	any four from: MP1. measurement of area of foot/feet; MP2. idea of drawing round foot/feet on squared/grid/graph paper (to measure area); MP3. measurement of weight / use of W = mg; MP4. use of a balance / scale(s) (to measure weight/mass); MP5. use of p = F ÷ A;	 allow if weight referred to in a calculation allow newtonmeter expressed in words or symbols	4

(b)	weight = 6600 (N);
	
	substitution into p = F / A;
	correct evaluation;
	
	e.g.
	weight = 660 × 10 = 6600 (N)
	pressure = 6600 / 1300
	(pressure =) 5.1 (N/cm^2)
		allow use of g = 9.8, 9.81 (N/kg) to get weight = 6468, 6474.6 (N)
		
		-1 for POT error
		allow 5 (N/cm^2) if supported by working
		
		using mass instead of weight to get 0.51 (N/cm^2) scores 2 marks max.
		
		allow 5.076… (N/cm^2)
		condone 5.0 (N/cm^2)
		allow 4.975…, 4.980… (N/cm^2) from use of different values of g
			3

Total for Question 5 = 7 marks

Question number	Answer	Notes	Marks
6 (a) (i)	(travel at) {same speed/speed of light/in vacuum}; OR idea that waves can travel through space / a vacuum;	allow can be reflected / refracted / diffracted allow don't need a medium to travel	1
(ii)	(excessive exposure may cause) cancer;	allow cell mutations, cell damage, DNA damage, DNA mutations, radiation sickness	1
(iii)	mention of oscillations/vibrations; {oscillation/vibrations/particle movement} are **parallel** to {direction of wave (travel) / direction of energy transfer} of wave for longitudinal; {oscillation/vibrations/particle movement} are **perpendicular** to {direction of wave (travel) / direction of energy transfer} of wave for transverse;	all marks can be awarded from clearly labelled diagram allow along the line of travel allow right angles, 90° for perpendicular	3
(b)	use of relevant pieces of measuring apparatus for mass AND volume; idea of use of displacement method for volume; further correct detail of displacement method; further experimental accuracy detail;	e.g. • balance • measuring cylinder ignore scale(s) e.g. • using a eureka can • placing in a measuring cylinder e.g. • collect displaced water from eureka can to measure volume • measure initial and final volumes in measuring cylinder to calculate volume e.g. • not splashing • totally submerged • filling eureka can completely to the spout • collecting all drips from eureka can spout • reading measuring cylinder at eye level • balance on flat surface • ensure balance is zeroed • measure mass of dry bone	4

(c)	correct formula selected; substitution; evaluation; answer given to 2 sf; e.g. density = mass / volume density = 17 / 13 density = 1.3… (g/cm^3) density = 1.3 (g/cm^3)	seen or implied by working -1 for POT error mark independently	4

Total for Question 6 = 13 marks

Question number	Answer	Notes	Marks
7 (a)	0 / none / zero (J);		1
(b)	substitution into given formula E = V × I × t; correct evaluation to at least 3 s.f.; e.g. energy = 7.1 × 3.9 × 0.42 energy = 11.6… (J)	allow use of P = E/t and P = VI	2
(c)	energy transferred to motor electrically from battery 12 J; kinetic energy store of motor 10 J; thermal store of the surroundings 2 J;	allow electric, electrical condone heat	3
(d)	useful and total energies correctly selected; substitution into efficiency formula; evaluation; e.g. 10 (J) and 12 (J) seen in working efficiency = 10/12 (×100%) efficiency = 83 (%)	allow ecf from (c) allow lack of 100 i.e. 0.83 if % sign removed from answer line allow 83.3… (%)	3

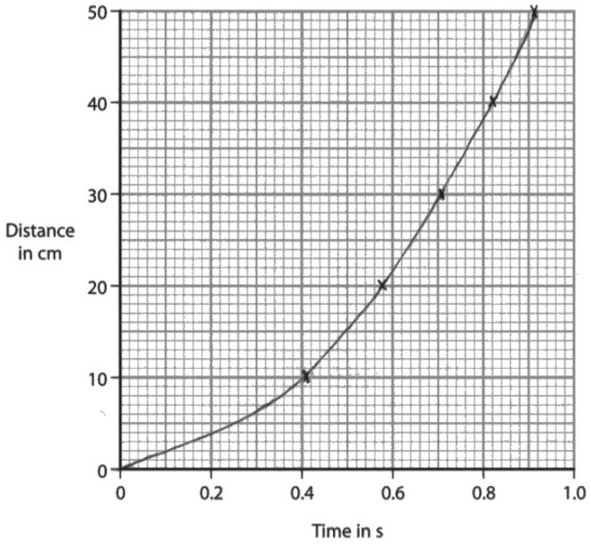
Total for Question 7 = 9 marks

Question number	Answer	Notes	Marks
8 (a)	any reference to absorption or reflection (of infra-red/heat); idea that snow/white objects are poor absorbers/good reflectors (of infra-red/heat);	 also scores first mark	2
(b)	any two from: MP1. idea that ground / drain cover is warmer than snow; MP2. idea that drain cover / metal is a good conductor; MP3. energy transfers from drain cover to snow;	 allow RA condone heat for energy must be correct direction of energy transfer	2
(c)	any two from: MP1. idea that warmer air rises; MP2. idea that colder air is nearest the snow; MP3. (rate of) energy/heat transfer (from air) to snow decreases;	 allow RA allow warm particles rise ignore nearest the ground	2

Total for Question 8 = 6 marks

Question number	Answer	Notes	Marks
9 (a)	substitution into given formula; evaluation; e.g. pressure difference = 14 000 × 10 × 0.094 pressure difference = 13 000 (Pa)	allow use of g = 9.8, 9.81 N/kg -1 for POT error but only if not due to omitting g allow answers rounding to 13 000 (Pa) allow 13 200, 13 160 (Pa)	2
(b) (i)	idea that distance is area under graph; correct values read from graph; working arriving at 4.7 (cm);	expressed explicitly or implied from working allow alternative method that distance = **average** speed × time expect 47 and 0.20 to be seen in working DOP	3
(ii)	any viable attempt at a gradient; correct use of 47 and 0.20 in gradient calculation; acceleration in range (−)230 to (−)240 (cm/s^2);	allow use of $v^2=u^2 + 2as$ allow other suitable values for gradient e.g. 35 (cm/s) in 0.15 (s)	3
(c)	idea of (gas) particles speeding up; idea of more **frequent** collisions between particles and liquid/walls/container; idea of harder collisions between particles and liquid/walls/container;	allow KE of particles increases allow force (on container) increases	3

Total for Question 9 = 11 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>10 (a)</td><td>one mark for each correct row;;;;
<table><tr><th></th><th>Independent</th><th>Dependent</th><th>Control</th></tr><tr><td>Surface of slope</td><td></td><td></td><td>✓</td></tr><tr><td>Angle of slope</td><td></td><td></td><td>✓</td></tr><tr><td>Distance travelled</td><td>✓</td><td></td><td></td></tr><tr><td>Time taken</td><td></td><td>✓</td><td></td></tr></table></td><td>reject mark for row if more than one tick</td><td>4</td></tr>
<tr><td>(b) (i)</td><td>all points correct;

</td><td>within ½ small square</td><td>1</td></tr>
<tr><td>(ii)</td><td>curve goes through all points;</td><td>judge by eye
ignore curve before first data point</td><td>1</td></tr>
<tr><td>(iii)</td><td>constant correctly calculated for one row of table;
constant correctly calculated for another row of table;

statement/expression comparing constants;

consistent conclusion about relationship based on comparison of constants;</td><td><table><tr><th>Distance in cm</th><th>Time in s</th><th>Constant</th></tr><tr><td>10</td><td>0.41</td><td>59.49</td></tr><tr><td>20</td><td>0.58</td><td>59.45</td></tr><tr><td>30</td><td>0.71</td><td>59.51</td></tr><tr><td>40</td><td>0.82</td><td>59.49</td></tr><tr><td>50</td><td>0.91</td><td>60.38</td></tr></table>allow even if comparison suggests the constants are not equal
DOP</td><td>4</td></tr>
</table>

Total for Question 10 = 10 marks

Question number	Answer	Notes	Marks
11 (a)	idea that voltage across resistor is difference between cell and diode voltage; rearrangement of V = IR; evaluation in A; conversion to mA; e.g. voltage across resistor = 1.5 − 0.63 = 0.87 (V) I = V/R = 0.87/95 current = 0.00915… (A) current = 9.2 (mA)	allow 0.87 seen or 1.5−0.63 seen condone use of incorrect voltage to give 0.0066, 0.0224, 0.0158 (A) = 1 mark 6.6, 22.4, 15.8 (mA) = 2 marks allow current = 9.15…(mA)	4
(b)	any four from: MP1. resistance (of circuit) decreased; MP2. (because) extra path in circuit; MP3. resistance (of circuit) halved; MP4. idea that voltage across parallel branches is the same (as previous voltage); MP5. current (in ammeter) increased; MP6. current (in ammeter) doubled;	 also scores MP1 allow calculation of resistance (=81.9Ω) reject if idea that cell voltage is shared between branches allow current in ammeter is sum of currents in branches also scores MP5 allow calculation of current (=18mA)	4

Total for Question 11 = 8 marks

Question number	Answer	Notes	Marks
12 (a)	idea of a current (in the coil);	ignore references to electromagnets	1
(b) (i)	d.c. travels in one direction only; idea of a.c. continuously changing direction;	 allow keeps changing direction, changes direction constantly etc.	2
(ii)	idea of changing magnetic field (from transmitter coil); idea of gold ring cutting field lines; idea of induced **voltage** for gold ring;	 allow field moving through ring ignore ring interacting with field ignore induced current	3
(c)	any four from: MP1. alternating current in **loudspeaker**; MP2. magnetic fields interact (in loudspeaker); MP3. causing a force (on loudspeaker cone); MP4. a.c. causes changing force direction; MP5. loudspeaker (cone) vibrates;	 ignore fields cutting allow coil for cone allow coil for cone allow description of vibrations e.g. “back and forth”	4

Total for Question 12 = 10 marks

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