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Mark Scheme (Results)

January 2020

Pearson Edexcel International GCSE
in Physics (4PH1)
Paper 1PR

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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.

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Question number	Answer	Notes	Marks
1 (a)	D – arrow S; A is incorrect as arrow P shows twice the amplitude B is incorrect as arrow Q shows the wavelength C is incorrect as arrow R shows half of the wavelength		1
(b)	B – arrow Q; A is incorrect as arrow P shows twice the amplitude C is incorrect as arrow R shows have of the wavelength D is incorrect as arrow S shows the amplitude		1
(c)	D – transverse; A is incorrect as water waves are not electromagnetic B is incorrect as gravitational waves are not detectable by water C is incorrect as the water molecules vibrate at right angles to the direction of travel of the wave.		1
(d)	substitution into given equation 'f= 1/T'; evaluation; e.g. frequency = 1/2.7 frequency = 0.37 (Hz)	accept any value that rounds to 0.37 Hz	2

Total for Question 1 = 5 marks

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Question number	Answer	Notes	Marks
2 (a)	9 (kPa);		1
(b)	(liquid) pressure = depth (of liquid) × density × *g*;	accept d, h, height for depth rho, ρ for density g.f.s or gravitational field strength for *g* reject gravity for *g*	1
(c)	substitution; rearrangement; evaluation; e.g. pressure difference = 9 kPa 9 000 = d × 960 × 10 d = 9000 / (9600) d = 0.94 (m)	allow ecf from (a) allow use of g = 9.8(1) m/s^2 giving 0.96 m allow 0.937(5) POT error penalty of 1 mark, except if formula is incorrect i.e. no 'g'	3

Total for Question 2 = 5 marks

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Question number	Answer	Notes	Marks
3 (a) (i)	B – consumption of alcohol by the driver; A is incorrect because condition of tyres only affects braking distance C is incorrect because mass of vehicle only affects braking distance D is incorrect because wet road only affects braking distance		1
(ii)	D – speed of the vehicle; A is incorrect because condition of brakes only affects braking distance B is incorrect because condition of road only affects braking distance C is incorrect because mass of vehicle only affects braking distance		1
(b) (i)	work done = force × distance;	allow correct rearrangements allow standard symbols i.e. W/E/WD for work done, F/f for force, d/D/s for distance	1
(ii)	substitution; rearrangement; evaluation; e.g. 590000 = 46000 × distance d = 590000/46000 d = 13 (m)	allow subs and re-arrange in either order allow 12.8 (m), 12.83 (m) etc	3
(c) (i)	thermal;		1
(ii)	mechanic(ally);		1

Total for Question 3 = 8 marks

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Question number	Answer	Notes	Marks
4	MP1 nebula/gas cloud; MP2 protostar; MP3 main sequence (then red supergiant); MP4 supernova; MP5 neutron star/ black hole;	1 mark penalty for any incorrect sequence	5

Total for Question 4 = 5 marks

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Question number	Answer	Notes	Marks
5 (a)	substitution into given equation $v^2 = u^2 + (2 \times a \times s)$; evaluation of v^2; evaluation of v to 3sf or more i.e. 16.1 (m/s); e.g. $v^2 = u^2 + (2 \times a \times s)$ $v^2 = 0^2 + (2 \times 10 \times 13)$ $v^2 = 260$ $v = \sqrt{260} = 16.1$ (m/s)	accept $mgh = 1/2mv^2$ accept use of $g = 9.8(1)$ m/s^2 giving v = 16.0, 15.97 etc.	3
(b)	any FIVE from: MP1 ball has weight; MP2 ball accelerates; MP3 drag increases (while accelerating); MP4 resultant force decreases; MP5 (so) acceleration decreases; MP6 drag = weight / resultant = 0 / forces balanced; MP7 terminal velocity/constant speed /acceleration=0;	 allow 'has gravitational force' REJECT 'has gravity' REJECT 'balls slows down' allow 'air resistance' for 'drag'	5

Total for Question 5 = 8 marks

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Question number	Answer	Notes	Marks
6 (a)	correct symbol for voltmeter in parallel with any component; voltmeter drawn in parallel with the LDR;		2
(b) (i)	$V = I \times R$;	allow any re-arrangement allow word equation condone 'i' for current reject 'c' or 'C' for current	1
(ii)	substitution; evaluation; e.g. $V = 7.8 \times 10^{-3} \times 73$ $V = 0.57$ (V)	POT error gives 1 mark penalty allow 0.5694 (V) for both marks '0.6 (V)' scores 1 mark	2
(iii)	idea that voltages of two resistors in series adds up to supply voltage; calculation of correct voltage; e.g. $V_{cell} = 1.5 = V_{LDR} + V_{resistor}$ $V_{LDR} = 1.5 - 0.56(94)$ $V_{LDR} = 0.93$ (V)	 allow ecf from 6(c)(ii) allow 0.9306 (V) for both marks	2
(c) (i)	resistance decreases (with increasing L.I); non-linear/decreasing rate/curve;		2
(ii)	increases;		1
(iii)	larger current means larger voltage across fixed resistor; total voltage remains constant;		2

Total for Question 6 = 12 marks

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Question number	Answer	Notes	Marks
7 (a) (i)	B – joule per coulomb; A is incorrect because this is not a correct unit for volt C is incorrect because this is not a correct unit for volt D is incorrect this is not a correct unit for volt		1
(ii)	energy (transferred) = charge × voltage;	allow standard symbols and rearrangements	1
(iii)	substitution; conversion of kV to V; evaluation; e.g. energy = $1.6 \times 10^{-19} \times 150 \times 10^{3}$ energy = 2.4×10^{-14} (J)		3
(b) (i)	charge = current × time;	allow standard symbols and rearrangements	1
(ii)	substitution and re-arrangement; conversion of ms to s; evaluation; e.g. charge = current × time current = $2.9 \times 10^{-8} / 0.68 \times 10^{-3}$ current = 4.3×10^{-5} (A)	accept conversion to microamps or milliamps provided micro- (μ) or milli- (m) clear on answer line allow 4.265×10^{-5} (A)	3

Total for Question 7 = 9 marks

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Question number	Answer	Notes	Marks
8 (a)	any FIVE from: MP1 use a balance (to measure the mass); MP2 mention a displacement method; MP3 measure the mass first; MP4 (because) a wet rock weighs more; MP5 use of eureka/displacement can or measuring cylinder; MP6 mention of eye-level or parallax avoidance; MP7 **make sure** rock completely submerged; MP8 make sure no water splashes out/put rock in gently;	ignore • geometry equations • use of a ruler to measure rock • density = mass / volume Can be implied from order of response. explicit mention only	5
(b) (i)	density = mass / volume;	accept correct rearrangements accept symbols i.e. rho, m/M, v/V	1
(ii)	substitution; evaluation; answer to 2 sf; e.g. density = 32/12 density = 2.66… g/cm^3 density = 2.7 g/cm^3 to 2 sf	 2 sf marked independently	3
(iii)	quartz; as the density of rock X is the same as the density of quartz;		2

Total for Question 8 = 11 marks

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Question number	Answer	Notes	Marks
9 (a) (i)	4; 2;		2
(ii)	removal of electron(s) (from an atom);	allow gaining electron(s)	1
(iii)	alpha particles are **absorbed** by/cannot **penetrate/ stopped** by a few cm **in air**; so alphas do not reach the workers;	allow do not penetrate **casing** (of deionser) condone 'do not penetrate skin/clothes'	2
(b) (i)	time taken; for (radio)activity/mass/number of (remaining) nuclei to half;	accept any synonym e.g. period/amount of time/	2
(ii)	evidence of halving of 70; 420 days means 3 half-lives; evaluation of 8.75 (kBq);	 accept however presented i.e. 70→35→17.5→8.75 allow 9 (kBq)	3

Total for Question 9 = 10 marks

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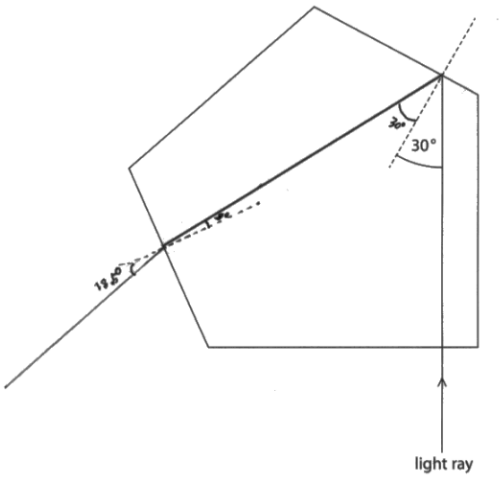
Question number	Answer	Notes	Marks
10 (a) (i)	n =1/sin(c);	accept any rearrangement or word equation	1
(ii)	substitution; evaluation; e.g. n = 1/sin(26) n = 2.3	 allow 2.28…	2
(iii)	correct TIR at first boundary; refraction at boundary at 7 o'clock; refraction away from the normal at exit point;  	 allow ECF for incorrect TIR and correct subsequent boundaries.	3

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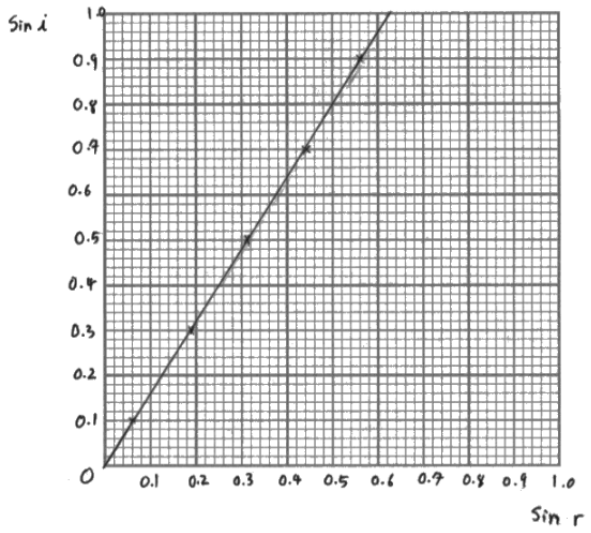
(b)	(i)	any FOUR from: MP1 any method of recording an incident ray; MP2 any method of recording a refracted ray; MP3 range of angle of incidences; MP4 normal lines drawn; MP5 angles measured using a protractor;	accept marks on a clear, labelled diagram	4
	(ii)	axes labelled; appropriate scale with data enclosed by 3 x 3 grid or larger; points plotted correctly within ½ a square;		3
	(iii)	best fit straight line drawn with ruler;	judge by eye	1
	(iv)	evidence of gradient triangle used; evaluation of 1.6;  	accept markings on graph or evidence of a gradient calculation. accept answer in range 1.55 – 1.65 consistent with candidate's LoBF allow ecf from candidate's LoBF	2

Total for Question 10 = 16 marks

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Question number	Answer	Notes	Marks
11 (a)	any THREE from: MP1 walls further apart; MP2 fewer collisions between particles and walls per second/lower frequency of collisions; MP3 means (average) force on walls lower; MP4 lower force means lower pressure for same wall surface area;	 reject unqualified 'fewer collisions' accept idea that force per collision is the same ignore references to particles colliding with each other accept	3
(b)	substitution into given equation "$p_1 \times V_1 = p_2 \times V_2$"; rearrangement to give p_2; evaluation of p_2; e.g. $101 \times 110 = p_2 \times 140$ $p_2 = 101 \times 110 / 140$ $p_2 = 79\,000$ (Pa)	 allow 79357.1… (Pa), 79(.4) kPa , standard form	3
(c)	any THREE from: MP1 pressure outside balloon is lower than inside balloon; MP2 pressure difference causes a force; MP3 force is outwards on balloon; MP4 force causes extension of balloon;	 accept 'stretching'	3

Total for Question 11 = 9 marks

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Question number	Answer	Notes	Marks
12 (a)	A – arrangement W; B cannot be correct as arrangement X would give a downwards force C and D cannot be correct because at the position of the wire, the magnetic field is zero, so there cannot be a magnetic force on the wire		1
(b) (i)	substitution into "W = mg"; evaluation; e.g. W = 0.0065 × 10 W = 65 (mN)	ignore POT for this mark accept use of g = 9.8(1) m/s^2 giving 63.7 or 63.8 (mN)	2
(ii)	resultant force is difference between weight and magnetic force; resultant force = 31 mN; substitution in "F=ma"; re-arrangement; evaluation; e.g. resultant force = 65 – 34 = 31 mN resultant force = 31 × 10^{-3} = 6.5 × 10^{-3} × a a = 31 × 10^{-3} / 6.5 × 10^{-3} a = 4.8 (m/s^2)	 allow ecf from (b)(i) POT error gives 1 mark penalty 5.2(3) scores 3 MAX (no evidence of resultant idea) allow 4.76(9) (m/s^2) use of g = 9.81 m/s^2 gives 4.57 (m/s^2)	5
(iii)	EITHER • increase the current; • by increasing the voltage of power supply; OR • increase the magnetic field strength; • by using stronger magnets/moving the poles closer together;	 ignore unqualified reference to increasing the turns/creating a coil	2
(iv)	use a.c. rather than d.c.; since a.c. current has alternating/changing current direction;		2

Total for Question 12 = 12 marks

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