



Mark Scheme (Results)

January 2020

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

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 half 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

Question number	Answer	Notes	Marks
2 (a)	9 (kPa);		1
(b)	(liquid) pressure = depth (of liquid) $\times$ density $\times$ 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 $9\,000 = d \times 960 \times 10$ $d = 9000 / (9600)$ $d = 0.94 \text{ (m)}$	allow ecf from (a) allow use of $g = 9.8(1) \text{ m/s}^2$ 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

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 $\times$ 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. $590000 = 46000 \times \text{distance}$ $d = 590000/46000$ $d = 13 \text{ (m)}$	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

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

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. $v^2 = u^2 + (2 \times a \times s)$ $v^2 = 0^2 + (2 \times 10 \times 13)$ $v^2 = 260$ $v = \sqrt{260} = 16.1 \text{ (m/s)}$	accept $mgh = 1/2mv^2$ accept use of $g = 9.8(1) \text{ m/s}^2$ 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

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. $V = 7.8 \times 10^{-3} \times 73$ $V = 0.57 \text{ (V)}$	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. $V_{\text{cell}} = 1.5 = V_{\text{LDR}} + V_{\text{resistor}}$ $V_{\text{LDR}} = 1.5 - 0.56(94)$ $V_{\text{LDR}} = 0.93 \text{ (V)}$	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

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 $\times$ 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 $\times$ time;	allow standard symbols and rearrangements	1
(ii)	substitution and re-arrangement; conversion of ms to s; evaluation; e.g. charge = current $\times$ time current = $2.9 \times 10^{-8} / 0.68 \times 10^{-3}$ current = 4.3×10^{-5} (A)		3
		accept conversion to microamps or milliamps provided micro- (μ) or milli- (m) clear on answer line	
		allow 4.265×10^{-5} (A)	

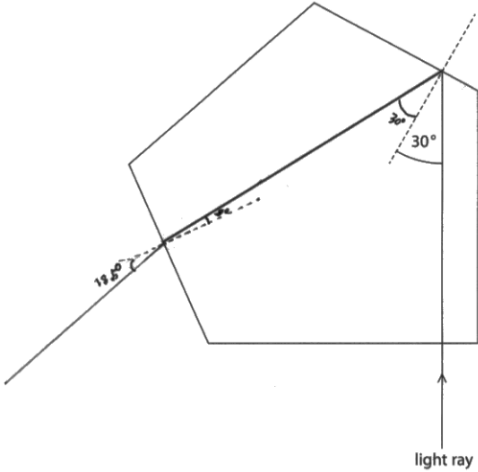
Total for Question 7 = 9 marks

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/cm³ density = 2.7 g/cm³ 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

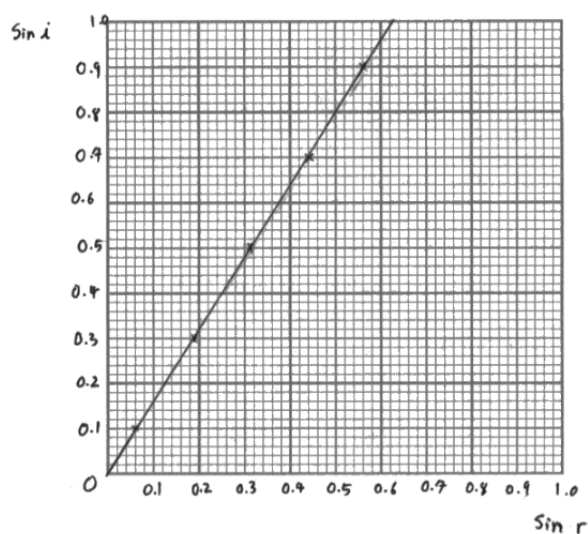
Total for Question 8 = 11 marks

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

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
			

(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 $\frac{1}{2}$ 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

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. $101 \times 110 = p_2 \times 140$ $p_2 = 101 \times 110 / 140$ $p_2 = 79\,000 \text{ (Pa)}$	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

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. $W = 0.0065 \times 10$ $W = 65 \text{ (mN)}$	ignore POT for this mark accept use of $g = 9.8(1) \text{ m/s}^2$ 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 = $65 - 34 = 31 \text{ mN}$ resultant force = $31 \times 10^{-3} = 6.5 \times 10^{-3} \times a$ $a = 31 \times 10^{-3} / 6.5 \times 10^{-3}$ $a = 4.8 \text{ (m/s}^2\text{)}$	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 $g = 9.81 \text{ m/s}^2$ 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