

Mark Scheme

Summer 2016

Pearson Edexcel International GCSE

Physics (4PH0) Paper 1P

Science Double Award (4SC0) Paper 1P

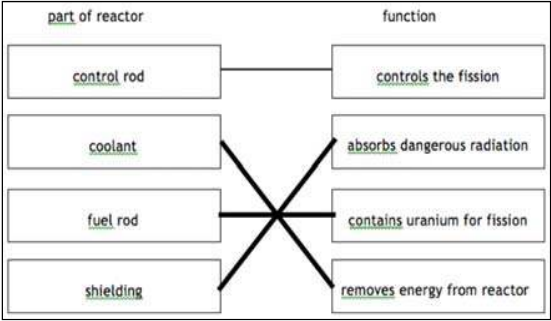
Pearson Edexcel Level 1/Level 2 Certificate

Physics (KPH0) Paper 1P

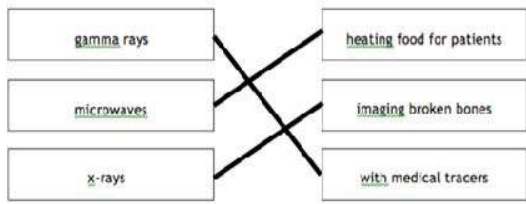
Science (Double Award) (KSC0) Paper 1P

Question number	Answer	Notes	Marks
1 (a)	B – the horizontal part of the line;		1
(b)	A – the area under the line;		1
(c)	B – the distance moved divided by the time taken;		1

Total 3 marks

Question number	Answer	Notes	Marks
2 (a)	All lines correct = 2 marks Any correct added line = 1 mark 		2
(b)	kinetic energy;		1
(c)	slows <u>neutrons</u>/reduces KE of <u>neutrons</u>; and any one from (which)allows fission to continue; (which) causes (induced) fission; (so) neutrons can be absorbed by <u>uranium</u>;	makes the neutrons thermal/eq ignore moderator absorbs neutrons ignore - neutrons collide with uranium - successful collisions	2
(d)	any three of - MP1 each fission (of a nucleus) caused by a single neutron; MP2 each fission releases more than one neutron; MP3 excess neutrons can speed up the reaction; MP4 (more) fissions release excess energy; MP5 control rods absorb neutrons; MP6 control rods regulate the rate of fission/reaction;	e.g. a nucleus splits when neutron has been absorbed ignore 'block'/ eq allow control rods speed up/slow down rate of fission	3

Total 8 marks

Question number	Answer	Notes	Marks
3 (a) (i)	C – speed in free space;		1
(ii)	All lines correct = 2 marks Any correct line = 1 mark type of electromagnetic wave use 		2
(iii)	(direction of vibration) perpendicular to (direction in which the wave travels);	allow at right angles to or 90° to	1
(b) (i)	D – 45 000 Hz;		1
(ii)	Any two of - wave travels there and back; depth is half total distance travelled; time (to target) is half total (travel) time;	ignore phrase about reflection received as in stem	2
(iii)	wavelength is longer in patient or wavelength shorter in air; and one of:- (because) $v = f \times \lambda$; OR (because) frequency does not change;	allow wavelength is longer in more dense medium ignore • speed related to medium • as speed increases wavelength increases Total 9 marks	2

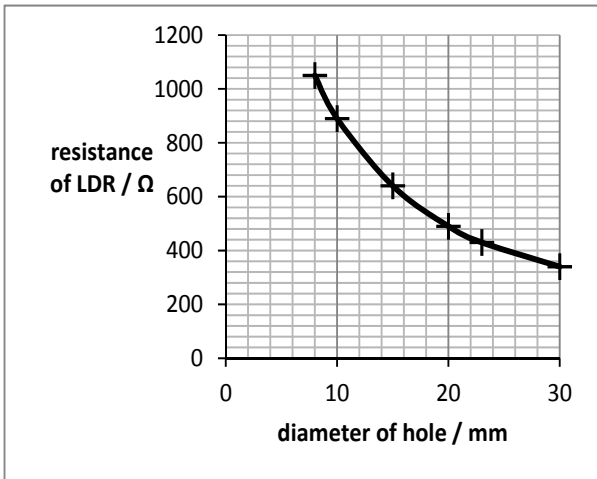
Question number	Answer	Notes	Marks
4 (a)	Substitution into given equation; Rearrangement; Calculation; e.g. $101 \times 1700 = p_2 \times 12$ $p_2 = 101 \times 1700 \div 12$ $= 14\,000 \text{ (kPa)}$	NB Equation is given on page 2 of QP Substitution and rearrangement in either order Accept working in Pa or kPa, litres and/or m³. POT error = -1 mark 14300 (kPa) 14 MPa correct answer without working scores 3 marks	3
(b) (i)	In words or $p = h \times \rho \times g$;	For g Accept "acceleration due to gravity" Reject "gravity" For h Accept depth or height For p accept pressure or pressure difference or as Δp	1
(ii)	Substitution; Calculation; e.g. $p = 11 \times 1028 \times 10$ $= 110 \text{ (kPa)}$	Allow $g = 9.8 \text{ m/s}^2$ 113 (kPa) 113080 Pa Allow 111 kPa or 110818 Pa (from $g = 9.8 \text{ m/s}^2$)	2
(iii)	Answer to (b)(ii) + 101 (kPa);	Allow 210 (kPa) 211 214 Reject answer if new PoT error	1

Question number	Answer	Notes	Marks
(c)	EITHER MP1 pressure decreases (with decreasing depth)/ $p = h \times \rho \times g$; MP2 pV is constant (for fixed mass of gas)/ $p_1 \times V_1 = p_2 \times V_2$; OR MP3 Sea may be warmer near the surface; MP4 (causing the pressure inside the bubble to increase) which causes the volume to increase	v is inversely proportional to p MP4 is DOP on MP3	2

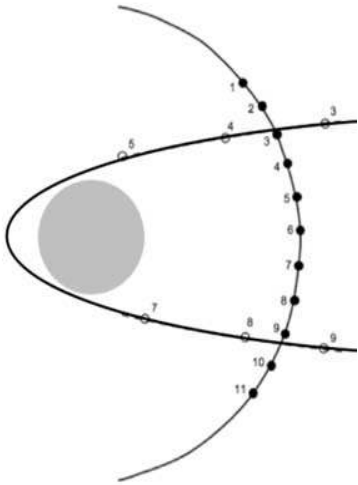
Total 9 marks

Question number	Answer	Notes	Marks
5 (a)	(i) Voltmeter connected in parallel with a component; component is LDR;	not in parallel with wire	2
	(ii) measure current / take current reading; divide voltage (reading) by current (reading);	accept • number of amps for current • p.d. or number of volts for voltage • $R = V/I$ Ignore triangle mnemonics	2
(b)	(i) B – the diameter of the hole;		1
	(ii) C – the distance from the card to the LDR;		1
	(iii) Any one of - Move ruler to cover half the hole/halfway down the hole; Draw guide lines; Use set square;	idea of measuring across/over the diameter at right angles to ruler Placed against ruler Ignore: move ruler nearer the hole/start from 0 on the ruler	1

Continued

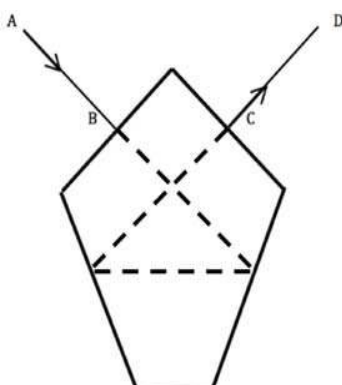
Question number	Answer	Notes	Marks														
5 (c) (i)	suitable scales; axes labelled; Plotting of points;;	Must use > half width and half height of grid units on axis labels ignore orientation of graph to nearest ½ square, up to two marks available for this, -1 each error reject dot to dot allow a reasonably smooth curve, points should be evenly distributed about the line	4														
(ii)	line of best fit; <table data-bbox="1074 978 1303 1261"><thead><tr><th>diameter / mm</th><th>resistance / Ω</th></tr></thead><tbody><tr><td>8</td><td>1050</td></tr><tr><td>10</td><td>890</td></tr><tr><td>15</td><td>640</td></tr><tr><td>20</td><td>490</td></tr><tr><td>23</td><td>430</td></tr><tr><td>30</td><td>340</td></tr></tbody></table>		diameter / mm	resistance / Ω	8	1050	10	890	15	640	20	490	23	430	30	340	1
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(iii)	MP1 Idea of an inverse relationship; OR Pattern sentence linking resistance and diameter; MP2 Idea of a non-linear relationship;	ignore 'negative correlation' e.g. "the bigger the diameter, the lower the resistance" allow exponential decrease	2														

Total 14 marks

Question number	Answer	Notes	Marks
6 (a) (i)	Comet orbit behind Sun completed correctly;	Dashed or solid curved line	1
	(ii) X marked anywhere in grey area; e.g. 	No need to label X as "Sun" X should be left of the imaginary 5-7 line, reject X placed outside the orbit the curve should be 'pointy' not a part of a circle, such that distance week6-week 5 > distance week 5-week4	1
	(iii) Any one of the following ideas- MP1. comet was behind/near the Sun; MP2. comet was obscured/eclipsed by Sun; MP3. light from comet could not reach astronomer; MP4. Sun too bright to allow observation; MP5. we should not look directly at the Sun;	Allow labelled sketch	1
	(iv) C – week 9;		1
	(v) Any two of - MP1. Same time between observations; MP2. Different distances between observations; MP3. Speed = distance ÷ time;	Allow specific reference to 'a week' as the same time between observations	2

(vi)	Any one of - Energy argument – transfer of GPE to KE (ORA); Force argument, e.g. pulled by the Sun's gravitational force;	Ignore - unqualified 'pulled by gravity' - gravitation from other bodies	1
(b)	Substitution into given formula; Conversion from days to hours; Calculation; e.g. $v = 2 \times \pi \times 150\,000\,000 \div (365 \times 24)$ = 110 000 (km/hour)	24 seen 107 589/108 000 (km/hour) Allow due π (ONLY) a number that rounds to 110 000 $2\,582\,130 = 2$ (no 24 hr) $43\,036 = 2$ (used 60 instead of 24)	3

Total 10 marks

Question number	Answer	Notes	Marks												
7 (a)	3 or more correct lines = 2 marks Any two correct lines = 1 mark <table><tr><th>Notes about the total internal reflection of light</th><th>Right or wrong</th></tr><tr><td>the angle of incidence equals the angle of reflection</td><td>✓</td></tr><tr><td>light changes speed when it is internally reflected</td><td>x</td></tr><tr><td>every ray entering the semicircular glass block is reflected by total internal reflection</td><td>x</td></tr><tr><td>if $i = 0$ then the ray does not deviate</td><td>✓</td></tr><tr><td>the refractive index of glass is bigger than the refractive index of air</td><td>✓</td></tr></table>	Notes about the total internal reflection of light	Right or wrong	the angle of incidence equals the angle of reflection	✓	light changes speed when it is internally reflected	x	every ray entering the semicircular glass block is reflected by total internal reflection	x	if $i = 0$ then the ray does not deviate	✓	the refractive index of glass is bigger than the refractive index of air	✓		2
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if $i = 0$ then the ray does not deviate	✓														
the refractive index of glass is bigger than the refractive index of air	✓														
(b)	MP1 only two internal reflections attempted; MP2 horizontal line from first TIR to second TIR; MP3 ray does not deviate on exit; 	horizontal line by eye ignore arrows	3												

Question number	Answer	Notes	Marks
7 (c) (i)	Statement of $\sin c = 1/n$; Substitution; Calculation; e.g. $\sin c = 1/n$worth 1 $\sin c = 1/1.5$worth 2 (= 0.667) so $c = 41.8^\circ$worth 3	Value of c (or n) to at least 3 s.f. Allow reverse argument for max 2. $\sin 42^\circ = 0.669$, giving $n = 1.49$ ("about 1.5") $\sin 42 \times 1.5 = 1.0036 \approx 1$ ($\sin 42 = 1/1.5$) Beware spurious maths that gives about 42 degrees	3
(ii)	Any two of the following ideas:- • $RI = \sin i / \sin r$ • $RI(n)$ is (only) a <u>number /ratio</u> ; • a sine is a number /ratio;	allow $n = \text{speed}_1 / \text{speed}_2$ $n = 1/\sin c$ proportion for ratio units cancel out	2
(d) (i)	Plot at 1.5, 42;	no tolerance	1
(ii)	Any one of - Fits the trend/pattern; (point is on) an extrapolation of line to;	May be shown on graph OR e.g. "where the line would go"	1
(iii)	Any two of - MP1. Idea that a reduced scale gives full(er) use of grid; MP2. RI is always more than 1 (for incidence in air) MP3. angle c greater than $\sim 20^\circ$;	allow reduced scale fits the data ranges (of RI or c) ignore $RI > 0$ allow angle c never zero	2

Total 14 marks

Question number	Answer	Notes	Marks
8 (a)	(metre) ruler;	allow set square, tape measure, digital callipers ignore metre stick	1
(b)	Up to five marks, no more than 3 from each section:- Recording data Any three of - MP1. measure original length; MP2. add a (known) weight/force/load/mass; MP3. measure the new length / extension; MP4. Repeat for range of values of load; MP5. Experimental detail; Handling data / conclusions Any three of - MP6. Calculate extension; MP7. Plot graph of extension/length against force/weight/load; MP8. Graph should be a straight line; MP9. Extension graph should pass through origin; MP10. Force proportional to extension;	e.g. - distance measurements from the same point each time - use of pointer/indicator - reduce parallax - repeats and average (for each load) Allow length, but not mass calculate k from data k is constant Not for length graph allow load for force	5

Total 6 marks

Question number	Answer	Notes	Marks
9 (a)	(i) Current that passes in one direction only ;	ignore current varies	1
	(ii) Any three of - MP1 provides a connection / current to the coil/commutator; MP2 idea of reverses the current in the coil; MP3 Every half turn; MP4 Reverses (coil) field /polarity (every half turn); MP5 So that the force is always in the same direction; MP6 So that the motor keeps turning (the same way);	allow swops the contacts/ ensures that current always flows clockwise through the coil/eq so the moment is always in the same direction	3
	(iii) Any one of - Still spins clockwise; No (overall) effect/direction remains the same; The two changes cancel out/nothing changes;	Ignore "nothing happens" unless clear that rotation continues	1
(b)	(i) power = voltage $\times$ current;	Accept symbols $P=I \times V$ Condone a mix of correct symbols and words	1
	(ii) Substitution and calculation; Conversion to megawatts; e.g. $P=I \times V$ $P=4000 \times 600 = 2\,400\,000 \text{ (W)}$ $= 2\,400\,000 \div 1\,000\,000$ $= 2.4 \text{ (MW)}$	division by 10^6 or 1 000 000 seen correct answer without working scores two marks	2

Continued

Question number	Answer	Notes	Marks
9 (c) (i)	work done = force $\times$ distance (moved)	Accept symbols $W = F \times d$ $W = Fd$	1
(ii)	Substitution; Calculation; e.g. Work = 400 000 $\times$ 190 76 000 000 (J)	Accept 76 MJ with correct unit 7.6×10^7 (J) 76×10^6 (J)	2
(d) (i)	Substitution into given equation; $P = W/t$ Rearrangement; Calculation; e.g. $1.9 = 67 \div t$worth 1 $t = 67 \div 1.9$worth 2 $= 35$ (s).....worth 3	No mark for the equation as it is given in QP Substitution and rearrangement in either order Or (in joules and watts) $67\,000\,000 \div 1\,900\,000$ (35.26) correct answer without working =3	3
(ii)	Any one of :- Takes longer /eq; More time needed to raise coal; Load moves more slowly;	Ignore: unqualified comments about the amount of work done	1

Total 15 marks

Question number	Answer	Notes	Marks
11 (a) (i)	kinetic energy = $\frac{1}{2} \times \text{mass} \times \text{velocity}^2$	Accept symbols $\text{KE} = \frac{1}{2} \times m \times v^2$	1
(ii)	Conversion of units; Substitution and rearrangement into correct formula; Calculation; e.g. $18 \text{ MJ} = 18\,000\,000 \text{ J}$ $v^2 = 18\,000\,000 \times 2 \div 250\,000 (= 144)$ $v = 12 \text{ (m/s)}$	at any stage POT error max 2 marks e.g. 3.8×10^n or 1.2×10^n	3
(iii)	Energy is transferred to surroundings;	Allow to heat, sound, other forms / energy decreases	1
(b) (i)	Any two of - MP1. $\text{GPE} = m.g.h$; MP2. passengers have moved to a higher point/upwards; MP3. work is done to move the passengers; MP4. passengers are further from the centre of the earth;	allow 'lift' for 'passengers' 'gravity force' (still) acts below ground level, reject 'gravity' moved in opposite direction to force of gravity	2
(ii)	max of 3 from each list to total of 4 When entering station- MP1. $\text{KE} \rightarrow \text{GPE}$; MP2. Less work done by the brakes (to stop the train); MP3. Less (braking) force needed (to stop) ; MP4. train stops more quickly OR brakes are needed for less time (to stop); When leaving station- MP5. $\text{GPE} \rightarrow \text{KE}$; MP6. Less work done by the motor (to accelerate); MP7. Less force needed (to accelerate	Allow energy for work an effect on the brakes, e.g. don't get so hot / are quieter / last longer / are less worn Allow less power/ current	4

	the train); MP8. train accelerates more quickly OR force needed for a shorter time (to reach a given speed);	needed motor lasts longer / is less worn	
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Total 11 marks

Question number	Answer	Notes	Marks
12 (a)	two correct comparative statements about temperature:- MP1 Bear('s fur) and snow about the same temperature; MP2 Bear's head/nose/eyes warmer (than fur); MP3 Bear's eyes are warmer than eyes/nose OR bear's eyes are the warmest; MP4 Sky/air is cooler than bear/snow OR sky/air is the coldest;	allow reverse arguments bear's nose is cooler than its eyes bear/snow warmer than air	2
(b) (i)	Any two of - MP1. (hollow) hair / fibres contains an <u>insulator</u>; MP2. air is an insulator/poor conductor (of thermal energy); MP3. air is kept / trapped near the body (by fur); MP4. convection currents cannot form between hairs; MP5. white fur is a poor emitter of thermal energy / I R;	hair is an insulator only small convection currents can form	2
(ii)	Any three of - MP1. Black (skin) is a good emitter/radiator of thermal energy; MP2. White (fur) is a good reflector of thermal energy; MP3. Black (skin) is a good absorber of thermal energy; MP4. the reflected thermal energy is absorbed by the black (skin);	Allow white fur is a poor emitter.	3
(c) (i)	Any two of- MP1. Snow reflects UV OR does not absorb UV; MP2. Sky absorbs UV OR does not reflect UV; MP3. Bear('s fur) absorbs UV OR does not reflect UV; MP4. Bear's eyes reflect UV OR do not absorb UV;	ignore other verbs such as emits radiates	2

(ii)	Any one of- Sky absorbs UV; Sky not emitting UV; Sun not included in image;	allow air or atmosphere for sky ignore 'blocks out' Accept sky doesn't reflect or only reflects UV diffusely	1
(iii)	Any two of - MP1. UV/light travels in air, not in glass or hair (material); MP2. UV is absorbed by hair; MP3. TIR does not happen; MP4. explanation of why TIR can't happen ;	light/UV always travels in the less dense medium ORA for optical fibre Allow reflection in hair is external, not internal there is no critical angle	2

Total 12 marks