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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

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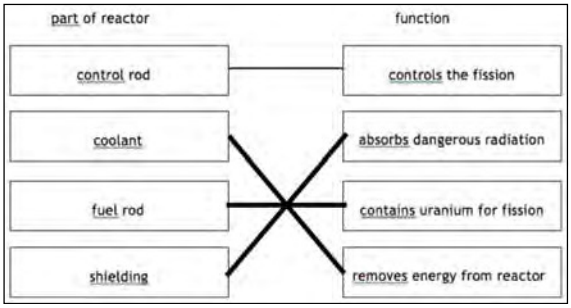
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General Marking Guidance

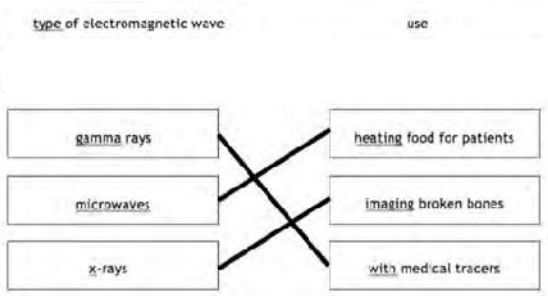
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should 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)	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 neutrons/reduces KE of neutrons; and any one from (which)allows fission to continue; (which) causes (induced) fission; (so) neutrons can be absorbed by uranium;	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  		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

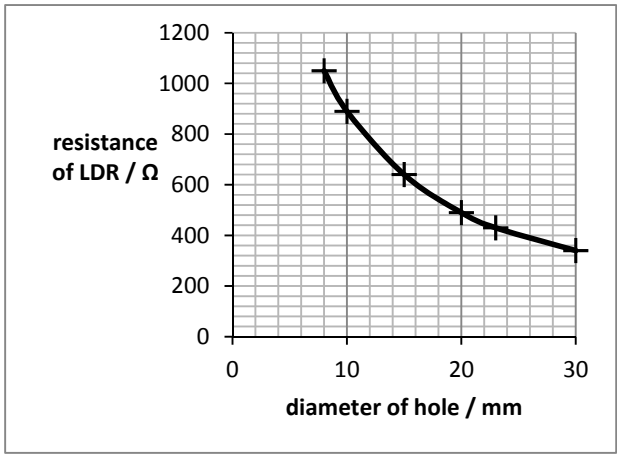
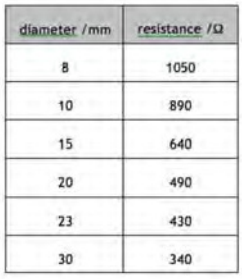
Question number	Answer	Notes	Marks
4 (a)	Substitution into given equation; Rearrangement; Calculation; e.g. $101 \times 1700 = p_2 \times 12$ $p_2 = 101 \times 1700 \div 12$ = 14 000 (kPa)	NB Equation is given on page 2 of QP Substitution and rearrangement in either order Accept working in Pa or kPa, litres and/or m^3. 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 (kPa)	 Allow $g=9.8 m/s^2$ 113 (kPa) 113080 Pa Allow 111 kPa or 110818 Pa(from $g=9.8 m/s^2$)	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

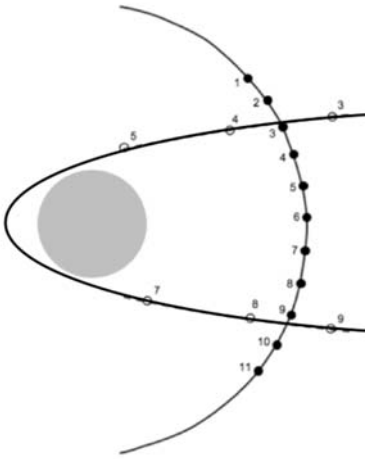
Total 9 marks

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	4
(ii)	line of best fit;	reject dot to dot allow a reasonably smooth curve, points should be evenly distributed about the line	1
			
(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

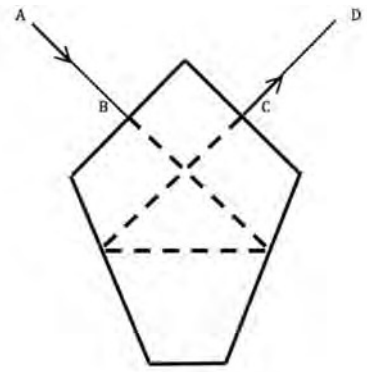
Question number	Answer	Notes	Marks
6 (a) (i)	Comet orbit behind Sun completed correctly;	Dashed or solid curved line	1
(ii)	X marked anywhere in grey area;	No need to label X as "Sun" X should be left of the imaginary 5-7 line, reject X placed outside the orbit	1
	e.g. 	the curve should be 'pointy' not a part of a circle, such that distance week6-week 5 > distance week 5-week4	
(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 × π × 150 000 000 ÷ (365 x 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

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>7 (a)</td><td>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>×</td></tr><tr><td>every ray entering the semicircular glass block is reflected by total internal reflection</td><td>×</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></td><td></td><td>2</td></tr>
<tr><td>(b)</td><td>MP1 only two internal reflections attempted;
MP2 horizontal line from first TIR to second TIR;
MP3 ray does not deviate on exit;


</td><td>horizontal line by eye

ignore arrows</td><td>3</td></tr>
</table>

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 = 41.8º …….worth 3	 Value of c (or n) to at least 3 s.f. Allow reverse argument for max 2. Sin 42º = 0.669, giving n = 1.49 ("about 1.5") Sin 42 x 1.5 =1.0036 ≈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= speed $_1$/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 ~20°;	 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 × current;	Accept symbols P=I×V Condone a mix of correct symbols and words	1
(ii)	Substitution and calculation; Conversion to megawatts; e.g. P=I×V P= 4000 × 600 = 2 400 000 (W) = 2 400 000 ÷ 1 000 000 = 2.4 (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 × distance (moved)	Accept symbols W=F×d W =Fd	1
(ii)	Substitution; Calculation; e.g. Work = 400 000 × 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 ÷ t……worth 1 t = 67 ÷ 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 ÷ 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
10 (a) (i)	5.4 ± 0.1 (cm);; if out of range allow 1 mark for 5.4 ± 0.2 (cm) if answer quoted to 3 or more SF, then deduct 1 mark	In the range 5.3 to 5.5 = 2 marks 5.2 OR 5.6 = 1 mark	2
(ii)	5.12 (cm)	Accept 5.1	1
(iii)	Substitution; Calculation; e.g. circumference = 1.510 × 3.142 = 4.744 cm	 Accept 4.7, 4.74 condone 5 with working credit alternative values of π e.g. 1.510 x 3.14 = 4.741 2 marks for correct answer without working POT error max 1 mark	2
(b)	Any four of :- General - MP1. Different precision / use of significant figures; MP2. Calculation error / value for π / unit error; MP3. Unskilled use of equipment; MP4. width of pen mark; String - MP5. Stretches / bends / has inconsistent tension; MP6. Thickness of string makes the circumference larger; MP7. Parallax error (when using ruler); Calliper - MP8. Zero error / calibration error; MP9. Pipe damaged / pipe not quite circular / equation assumes pipe is circular;	Allow a reverse argument where appropriate ignore 'accurate' Can't do a true circle (only a helix) e.g. may not draw dots in a straight enough line, may not get the calliper at 90 degrees to the pipe, may crush the pipe with calliper Ignore unqualified 'human error' Total 9 Marks	4

Question number	Answer	Notes	Marks
11 (a) (i)	kinetic energy = ½ × mass × velocity^2	Accept symbols KE = ½ × m × v^2	1
(ii)	Conversion of units; Substitution and rearrangement into correct formula; Calculation; e.g. 18 MJ = 18 000 000 J v^2 = 18 000 000 × 2 ÷ 250 000 (= 144) v = 12 (m/s)	at any stage POT error max 2 marks e.g. 3.8 x 10^n or 1.2 x 10^n	3
(iii)	Energy is transferred to surroundings;	Allow to heat, sound, other forms / energy decreases	1
(b) (i)	Any two of - MP1. 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. KE → 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. GPE → 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	

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

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