

Mark Scheme (Results)

Summer 2013

International GCSE Physics (4PH0) Paper 1PR

Science Double Award (4SCO) Paper 1PR



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Question number	Answer	www.dynamicpap Notes	
1 (a)	total internal reflection	Accept TIR	1
(b) (i)	prism drawn in correct orientation (by eye)	Accept a freehand sketch of the triangular prism Size of prism unimportant, e.g. can fill the entire square, but horizontal and vertical edges must be drawn	1
(ii)	correct reflection of rays (by eye):	Accept freehand sketch Accept correct external reflection e.g. reflection as shown below gets 1 mark for 1(b)(ii) despite the error in the 1(b)(i) response	1

Question number	Answer	Notes	Marks
2 (a) (i)	B- 2 cm		1
(ii)	C- 8 cm		1
(b)	Idea that in a transverse wave the direction of vibration is perpendicular to the direction of the wave; (May be shown with labels on the diagram) Idea that longitudinal wave the direction of vibration is parallel to the direction of the wave; (May be shown with labels on the diagram) A named freehand sketch of either wave indicating the two directions; e.g. transverse Longitudinal	 Allow (for vibration) oscillation / displacement / disturbance (for direction of wave) direction of travel / energy / transfer (for perpendicular) at right angles, is ⊥ to (for parallel) the same as, // the minimum labeliing is to name of the type of wave they have drawn. Allow sine waves with appropriate arrows Allow diagrams indicating compression and rarefaction e.g. in a spring Allow for 1 mark (but only if other mark is scored) a comparison of the directions of vibration of both waves without relating them to the direction of the wave e.g. transverse vibrates up and down but longitudinal vibrates back and forward 	3
(c)	any two of		2

	MP1 can travel through vacuum OR needs no medium;	www.dynamicpape	ers.com
	MP2 speed (in a vacuum) OR speed = 3 X10 ⁸ (m/s);	"speed in a vacuum" where seen, scores 2 marks (MP1 and MP2)	
	MP3 obeys laws of reflection / refraction;	Accept reflect, refract, diffract	
	MP4 obeys wave equation OR speed = frequency × wavelength;		
	MP5 carries energy/ information;		
	MP6 they are transverse		
(d) i	D - X-rays		1
ii	A – absorbed by the bone		1
iii	X-rays OR gamma rays	allow symbol γ do not allow UV	2
	idea of causing damage to cancer cells e.g. cells killed/mutated/ionised/destroys;	Independent mark	

Question number	Answer			Notes	Marks		
3 (a)	one mar	temperature in °C in Kelvin	boiling point of nitrogen -196	boiling point of water 373		ignore -273	2



Question number	Answer	Notes	Marks
4 (a)	any three of MP1 idea that there is current (in the wire/coil);		3
	MP2 idea that (the coil has) a magnetic field;	Allow ideas of electromagnetic field, electromagnet	
	MP3 idea that coil's magnetic field interacts with field of permanent magnet;	Allow - 'magnetic fields touch / overlap' Ignore - 'cutting of magnetic fields'	
	MP4 idea that there is a force on the coil/wire;	Allow ideas of LHM rule, Fleming's LHR, catapult field, attraction, repulsion	
	MP5 Idea that current or force reverses every half turn;	Allow action of a commutator described	

(b) (i)	any two of			2
	MP1 increase magneti magnets closer or mag	c field(e.g. stronger magnets or gnets curved round coil);		
	MP2 increase current (OR voltage Or more cells;	Allow "use thicker wire"	
			Ignore "stronger battery"	
	MP3 increase number	of turns (on coil);		
	MP4 a sensible alterna sets of coils at angles,	ative suggestion e.g. use two or more lubricate axle;	Allow idea of 3 phase supply, iron stator	
(ii)	Suggestion that clearly	results in reversal of		1
	the current OR the cell	connections OR the magnet's field;		
(c)	any two of			2
	MP1 Idea that force is	increased (by stronger field);	Allow idea that iron is magnetised	
	MP2 Idea of radial mag	gnetic field (rather than a uniform one);	Allow idea that magnetic field acts "all the way around"	
	MP3 Coil remains in th	e field for a longer time;	Allow idea that force acts over a larger part of a cycle	

	Question number		Answer	Notes	Marks	
5	5 (a) B D		constant velocity of <u>5 m/s</u> Idea that velocity/speed = 0	Allow speed is <u>5 m/s</u> Allow "stops", "stationary","at rest"	2	
	(b)		Idea of greater slope (for stage E); e.g. the gradient is steeper	Allow reverse argument, provided stage A is identified e.g. "stage A has a shallower slope" Allow attempts to demonstrate through - calculation of both gradients - qualitative comparison of data	1	
	(c)		distance = speed x time OR distance = area under graph; attempt to find any area; attempt to total correct areas (or use trapezium method); evaluation; e.g. distance = area under graph 7×7 or $\frac{1}{2} \times 7 \times 3$ $(7 \times 7) + (\frac{1}{2} \times 7 \times 3) = 49 + 10.5$ 59.5 (m)	The correct relationship can be implicit in the working 59.5 (m) with no working = full marks Allow the trapezium method - e.g. $7 \times ((7+10) \div 2) = 7 \times 8.5$ = 59.5 (m)	4	
	(d)		Correct equation shown ; e.g. (average speed) = distance (moved) / time (taken) Substitution of correct distance and suitable time; Correct evaluation ; e.g.106.5/27 3.94 (m/s)	Allow d/t Allow (ecf) max 2 4.26 (m/s) (use of time = 25 s) 3.55 (m/s) (use of time = 30 s) Allow reverse argument max 2 e.g. 106.5 \div 4 = 26.6 (s)	3	

Question number		Answer	Notes	Marks
6 (a) (i)		any three of		3
		Idea of collisions / impact (with walls);	Ignore collisions between particles	
		Continuous bombardment;		
		force produced;	Allow idea of momentum changing	
		Pressure = force ÷ area;		
(ii)		Idea that the student is right OR the pressure decreases;		3
		AND any two of	Both marks depend on previous correct response (e.g. pressure decreases)	
		The number(or mass) of molecules stays the same;		
		The gas volume increases;	Allow idea that area of can in contact with gas increases OR gas particles have more space	
		Pressure is inversely proportional to volume;	Allow mention of $p_1V_1 = p_2V_2$ in this context	
		Particles collide with the wall less frequently;	Allow "longer time between collisions"	
(b)		(Average speed) increases;		1

Question number		Answer	Notes	Marks
7 (a)	(i)	pressure difference = height (or depth) x density x g ;	Allow h × ρ × g (and rearrangements)	1
			Reject "gravity" for g in $7(a)(i)$	
	(ii)	substitution into correct equation;	Allow standard form	2
		evaluation;		
		e.g. 1028 X 10 X 700		
		7 196 000 (Pa)	Allow use of g = $9.8(1) \rightarrow 7\ 059\ 276$ or 7 052 080	
	(iii)	(total pressure =) 72 x10 ⁵ + 1 x 10 ⁵ (Pa);	Allow 7 296 000 (Pa) OR answer to 7(a)(ii) + 100 000	1
(b)	(i)	pressure = force/area	Allow $p = F/A$	1
	(ii)	Substitution into correct equation:	Substitution and transposition either order	З
	(11)	Transformation:	substitution and transposition entiter order	5
		Evaluation:		
		e.g. $41 \times 10^5 = F/3.1$		
		$F = 41 \times 10^5 \times 3.1$		
		$1.271 \times 10^7 (N)$	12 710 000, 127.1 x 10 ⁵ , 1.3 x 10 ⁷	
(c)		because fresh water has a lower density than sea water OR reverse		1
		argument;		
(d)		any five of		5
(u)		MP1 suitable measuring instruments mentioned	Allow scales	Ŭ
		e.g. measuring cylinder and (electronic) balance	Janore newtonmeter, weighing machine	
		MP2 method of obtaining correct mass:	Ignore weight	
		e.g. subtract mass of container, use of tare		
		MP3 detail to ensure accuracy of liquid volume:	Allow keep temperature constant	
		e.g. burette, pipette, density bottle, account taken of meniscus		
		MP4 equation stated - density = mass ÷ volume;	Allow ρ=m/V	
		MP5 suitable units used,		
		e.g. g for mass and cm ³ for volume	Allow ml, l	
		MP6 Idea of appropriate repeating or averaging at any stage	Allow "discard anomalous results"	

Question number	Answer			Notes	Marks	
8 (a)	all 3 any	6 for both marks;; two for 1 mark ;			each incorrect tick = -1	2
		item	Tick if needed			
		ammeter				
		steel spring				
		retort stand and clamp	\checkmark			
		rubber band	given 🗸			
		ruler	\checkmark			
		thermometer				
		mass hanger	\checkmark			
		mass	given 🗸			



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		-				
9	(a)	i	0.45; Power = current × voltage;	NO UNIT PENAITY Allow P = I × V and rearrangements	1	
		iii	Substitution; Evaluation; e.g. 1.5= I x 0.45 I = 3.3 (A) (answer to at least 2 s.f.)	Allow reverse argument yielding <u>1.35</u> (W) for 1mark	2	
	(b)	i	conversion of time to seconds; substitution into correct equation (E = $I \times V \times t$); evaluation; e.g. time = $7 \times 5 \times 60 \times 60$ (= 126 000) E = $3.3 \times 9 \times 7 \times 5 \times 60 \times 60$ 3 742 000 (J)	Allow solution in stages i.e. from P=IV and P =E/t Allow for full marks $3 \ 402 \ 000 \ (J) \ (from use of 3 A given above)$ $3 \ 780 \ 000 \ (J) \ (from 1.5 x 20 x 7 x 5 x 60 x 60)$ Allow max of 1 if time not in seconds, e.g. $1040 \ (J) \ (from 3.3 x 9 x 7 x 5, time in hours)$ $62400 \ (J) \ (from 3.3 x 9 x 7 x 5 x 60, time in minutes)$	3	
		ii	A description to include electrical;	Reject "electricity" for the first mark	2	
			to light (and heat);	Allow chemical to electrical to light for 1 mark only		
				Total	9	

Question number		Answer	Notes	Marks
	1 (a I 0)	 MP1 Any circuit including correct circuit symbols for battery /cell / d.c. power supply ammeter voltmeter ; 	ignore other components for MP1	3
	ii	MP2 ammeter clearly measures current through the wire; MP3 voltmeter clearly across wire;	allow even if voltmeter in series with ammeter allow circuit line drawn through meter allow voltmeter across a section of the test wire	3
		Idea of measuring current through the wire; Idea of measuring voltage across the wire; Idea of a range of values (of I and V); e.g. alter variable resistor OR repeat for different voltages		
	(b) i	any one of		1
		resistance changes (with temperature);	Reject incorrect relationship between R and Θ	1
	II	wire gets hot and melts/burns/catches	Ignore damage to wire	1
		V proportional to Lonly at constant temperature:	Reject insulating the wire	
	(c)	Ohms Law is only true if temperature constant;	Allow to return to room temperature	
	i	any one of putting the wire in a water bath ; taking the reading quickly; switching off between readings; using only small currents; voltage = current × resistance ;	Allow V = I \times R and rearrangements	
L	ii	horizontal line above axis;		1

		www.dupamiepapare.com
	Total	

Question number	Answer	Notes	
11 (a) i	$GPE = mass \times g \times height;$	Allow GPE = $m \times g \times h$ and rearrangements	1
ii	Substitution into correct equation; Evaluation; e.g. 0.25 x 10 x 1.75 4.375 (J)	Reject "gravity" for g in 11(a)(i) 4.4, 4.38 Allow use of 9.81 (or 9.8) \rightarrow 4.29 for full marks	2
(b)	Value given in 11(a)(ii);		1
(c) i ii	$KE = \frac{1}{2} \times mass \times speed^2$;	Allow $KE = \frac{1}{2} \times m \times v^2$ and rearrangements	1 3
	Substitution into correct equation; Transformation; Evaluation;	Substitution and transposition either order	
	e.g. $3.1 = \frac{1}{2} \times 0.25 \times v^2$ $v^2 = 3.1 \div \frac{1}{2} \times 0.25$ v = 4.98 (m/s)	Accept 5.0, 5 and allow truncation e.g. 4.97 m/s	
		Total	11

Question number	Answer	Notes	Marks
12 (a)	A description to include any 5 of MP1 nucleus absorbs neutron OR nucleus hit by neutron; MP2 splits into (two) fragments/parts OR daughter atoms OR daughter nuclei; MP3 extra neutrons released; MP4 (kinetic) energy released; MP5 released neutrons hit further nuclei OR uranium nuclei; MP6 moderator slows down the neutrons/ makes it more likely for a neutron to be absorbed; MP7 control rods absorb extra neutrons; MP8 idea that control rods help prevent a "runaway" chain reaction;	Correct process using consistently incorrect particle instead of neutron (e.g. electron) = max 4 NB uranium, U-235 or nucleus must be mentioned Reject cells, molecules, more uranium Ignore heat allow atoms OR uranium atoms	5
(b)	kinetic/movement energy;		1
(c)	Idea that the shielding absorbs radiation / particles / energy;	Allow "stops radiation /particles from escaping" Ignore "radioactvity" escaping	1
		Total	12

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number	Answer	Notes	Marks	
13 (a) i	there is a voltage;		2	
I	And one of (because there is a) change of flux OR field (lines) are cut; (which is) an induced voltage / emf; greater deflection/voltage; Idea that rate of change of flux (linkage) is greater; eg more magnetic field lines cutting coil (per second)	Allow induced current ignore speed of magnet	2	
(b) i	Idea that deflection is smaller;		1	
ii	Idea that deflection is greater;		1	
111	Idea that deflection is in opposite direction;		1	
		Total	7	

Question number	Answer Notes		Marks
14 (a) i	(Nuclei / atoms) with same number of protons OR same atomic number; different number of neutrons OR different mass number;	Ignore electrons Allow "(nuclei) of the same element" Allow different number of nucleons	2
ii	(stable isotopes) do not emit (ionising) radiation OR (stable isotopes) do not emit alpha, beta and gamma radiation ;	Ignore "radioactive", "decay" ignore idea of remaining the same element for ever	1
(b) i	210 – 84 OR 126		1
ii	ideas that proton number increases by 1; neutron number decreases by 1;	allow a calculation / nuclear equation Ignore discussion of "number of nucleons"	2
	beta decay	allow β or β⁻ or β ⁺	1
(c)	Any two of idea that gamma is not a particle; e.g. gamma rays have no (rest) mass gamma rays do not have a proton number gamma rays do not contain any protons or neutrons gamma rays are electromagnetic radiation OR energy; no particles are lost (from the nucleus) when a gamma ray is emitted;	Allow photons	2
		Total	9

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