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Mark Scheme (Results)
Summer 2010

IGCSE

IGCSE Physics (4420) Paper 2H

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aps accept phonetic spelling

ecf error carried forward

dna do not allow

dop dependent on previous

nwn no working necessary

owtte or words to that effect

Question Number	Acceptable Answers	Extra Information	Mark
1(a)	(semiconductor) diode	accept light emitting diode/LED (half-wave) rectifier	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
1(b)	can change the resistance of a variable (resistor) variable (resistor) can change current/voltage	or the converse or the converse must refer to I, V or R ignore reference to symbol	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
1(c)(i)	(6 volt) battery (of cells)	dna power supply	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
1(c)(ii)	6 (V)		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
1(c)(iii)	2.2 (V)	ecf candidate's cii – 3.8	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
1(d)	40 (mA)…….40 (mA).	both required	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
2(a)(i)	1.6 (s)		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
2(a)(ii)	4.4 (s)		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
2(b)(i)	increase(d)/longer /more	dna slower/slowed it down	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
2(b)(ii)	no effect/no change/stays the same/ no difference/none/nothing		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
2(c)	wet/slippery/icy/greasy/ loose surface/muddy /snow/rain /smooth /gravel /oil	dna poor condition of the tyres or brakes	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
2(d)(i)	Single straight arrow pointing downwards and on a vertical line through **C**	judge by eye ignore labels	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
2(d) (ii)	friction (between lorry and air)/air resistance/drag	dna wind resistance	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
3(a)(i)	Twice amplitude/double amplitude/2× amplitude/ amplitude x 2	dna just 'amplitude'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
3(a)(ii)	wavelength	Accept phonetic spelling dna just 'λ'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
3(b)	(f =) 30 ÷ 60 or (T =) 60 ÷ 30 or T = 2 (s) = 0.5 (Hz)	 allow ½ (Hz)	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
3(c)(i)	transverse (waves)	accept phonetic spelling	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
3(c)(ii)	Any one from • oscillates • vibrates • up and down • vertical • perpendicular to wave direction or water surface	allow (simple) harmonic motion/s.h.m. ignore any horizontal motion	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
4(a)(i)	chemical chemical energy chemical potential chemical potential energy	accept phonetic spelling	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
4(a)(ii)	kinetic KE	dna 'movement' (energy) ignore 'heat' 'sound'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
4(a)(iii)	electrical electric	Allow 'electricity'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
4(b)	gravitational potential gravitational potential GPE Kinetic KE	 accept 'movement'	1 1
	Heat thermal sound acoustic	accept if a correct pair are given e.g. heat and sound dna noise	1
			(3)

Question Number	Acceptable Answers	Extra Information	Mark
5(a)	14	number at the top left-hand side of the symbol	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
5(b)	…protons ….nucleus	both required in the correct order accept phonetic spelling dna 'neutron'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
5(c)	isotopes	Ignore 'radioactive'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
5(d)(i)	alpha/α beta/β	either order	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
5(d)(ii)	random spontaneous	accept erratic/irregular /not regular/not steady /not constant /not predictable	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
6(a)	Electromagnet	accept Electric magnet	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
6(b)	any two, (1) each, from: • to prevent a short/shorting/short circuit • iron is a conductor • (so that) current/electricity goes through wire/coil/each turn • to prevent current/electricity going through nail	dna any response related to heat insulation or safety	
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
6(c)(i)	it will pick up magnetic materials **or** show field pattern using iron filings **or** it will repel (one pole/end of) a magnet/compass needle	allow any example of a magnetic material e.g. (iron) filings/allow paperclips ignore 'attract to magnet'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
6(c)(ii)	idea that when circuit switched off/nail removed from coil, nail quickly loses its magnetism	not 'will lose its magnetism over a period of time'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
7(a)	(negative) <u>electrons</u> (dry) cloth ….. balloon friction	dna 'negative charges' both required correct order essential	1 1 1
			(3)

Question Number	Acceptable Answers	Extra Information	Mark
7(b)	positive /+ opposite/unlike	 Accept 'different'	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
8(a)	ice		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
8(b)(i)	melting/melt(s)	accept 'change of state'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
8(b)(ii)	evaporation/evaporating	accept phonetic spelling dna 'boiling'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
8(c)	close packed random/irregular/erratic	do not accept 'close packed regular' accept 'in different directions' /'at different speeds' /'at different velocities'	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
9(a)	B (2nd definition) C (3rd definition)	if more than two crosses, -1 for each additional cross	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
9(b)(i)	electron (flow)		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
9(b)(ii)	electrons travel from –/towards + /electrons are negative(ly charged) **dop**		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
9(b)(iii)	ammeter in series voltmeter in parallel with resistor or battery	allow extra ammeters if in series but not in middle of battery	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
9(c)(i)	$Q = I \times t$ = 0.75 x 120 = 90 (C)	0.75 x 2 = 1.5 (C) scores 1st mark only	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
9(c)(ii)	($E = IVt$ =) 0.75 x 3.0 x 120 = 270 (J) **or** ($E = QV$ =) 90 × 3 = 270 (J)	do not penalise use of t = 2 here if already penalised in c(i), in which case an answer of 4.5 (J) scores 2 ecf their value of Q from c(i) e.g. 1.5 x 3 = 4.5 (J) scores 2	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
10(a)	normal(s)		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
10(b)	$n = 1 \div \sin c$ / $\sin c = 1 \div n$ / $c = \sin^{-1}(1 \div n)$ / n sin $c = 1$		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
10(c)(i)	35° < critical angle / critical angle > 35° refraction/speeds up/enters less dense medium/lower *n*		1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
10(c)(ii)	60° > critical angle / critical angle < 60° total internal reflection/TIR		1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
10(d)	idea that the critical angle is not known / is not one of the angles on diagram		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
10(e)(i)	$n = \sin i \div \sin r$	allow $n = \sin r \div \sin i$ may be scored in either e(i) or e(ii) but don't award if contradiction	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
10(e)(ii)	(*n* =) sin 50° ÷ sin 35° = 1.3 [1.33556]	allow sin 35° ÷ sin 50° = 0.75 [0.74875] but if then using this to get 48.5° scores 0	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
11(a)	240 x 10 x 2.5 = 6000 (J)	5880 (J) using 9.8 5886 (J) using 9.81	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
11(b)(i)	240 × 10 × 1.25 = 3000 (J) **or** ½ × 6000 = 3000 (J)	2940 (J) / 2943 (J) ecf answer from (a)	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
11(b)(ii)	240 × 10 × 1.25 = 3000 (J) **or** 6000 – 3000 = 3000 (J)	2940 (J) / 2943 (J) ecf answers from (a) and b(i)	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
11(b)(iii)	(KE =) ½mv^2 stated or used 3000 = ½ × 240 × v^2 v = 5 (m/s) [4.9 (m/s) if 9.8 or 9.81 used] **or** $v^2 = u^2 + 2as$ stated or used 1 **or** ½$mv^2 = mgh$ stated **then** v^2 = 2 × 10 × 1.25 1 v = 5 (m/s) 1	 ecf from <u>b(ii)</u> 1.58 m/s if (b)(ii) = 300 ecf from b(ii)	1 1 1
			(3)

Question Number	Acceptable Answers	Extra Information	Mark
12(a)	changing magnetic field/magnetic field lines cut e.m.f./voltage induced	 allow 'current induced'	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
12(b)	(induced)current is direct/in one direction diode only allows current in one direction /only one of the diodes is facing the correct way (to conduct this current) /diodes facing opposite directions		1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
12(c)	show current in other direction when magnet moves up	ignore references to alternating current	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
12(d)	less voltage/current (induced) **plus** any two, (1) each, from: • air resistance/drag • movement of magnet slower • idea of less rate of change of magnetic field • magnet further from solenoid	 dna 'magnet gets weaker'	1 1 1
			(3)

Question Number	Acceptable Answers	Extra Information	Mark
12(e)	any two, (1) each, from: • stronger/more powerful magnet • heavier magnet • weaker spring • more turns/coils (on solenoid) • magnet closer/longer spring • CRO/datalogger/centre zero galvanometer (instead of LEDs)	allow any other sensible suggestions e.g. mechanical device to move magnet dna 'bigger magnet' /'add another magnet' /'thicker wires'	 1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
13(a)	*W* = *mg* = 300 x 10 = 3000 (N)	 2940 (N), 2943 (N)	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
13(b)(i)	arrow vertically downwards by eye **and** labelled 3000 (N) / weight/ *W* / *mg*	arrow starting from ball (allow from an edge) ecf value from (a)	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
13(b)(ii)	arrow vertically upwards by eye	within width of ball ignore any label	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
13(b)(iii)	air resistance/drag/air friction/ upthrust	dna 'friction'	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
13(c)	upward force/air resistance/drag increased idea of upward force = downward force/no net force/forces balance/forces in equilibrium no acceleration		1 1 1
			(3)

Question Number	Acceptable Answers	Extra Information	Mark
14(a)	top right : control rod		1
	bottom left : fuel rod / control rod		1
	bottom right : moderator / coolant		1
			(3)

Question Number	Acceptable Answers	Extra Information	Mark
14(b)	boron/cadmium uranium graphite/(heavy) water/carbon concrete/steel/lead	4 correct scores 2 2 or 3 correct scores 1	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
14(c)(i)	fuel rod	uranium	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
14(c)(ii)	any four, (1) each, from: • neutron strikes/fired at/absorbed by nucleus/atom • nucleus splits/breaks apart /daughter nuclei formed • neutrons released • chain reaction • energy (**not** heat) released	marks can be awarded from a clearly labelled diagram	1 1 1 1
			(4)

Question Number	Acceptable Answers	Extra Information	Mark
15(a)	nucleus roughly at centre electron(s) <u>on</u> circumference or clearly shown on other orbits around nucleus	ignore size	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
15(b)(i)	idea that most of atom is (empty) space /path is too far from nucleus /nucleus is very small	ignore all reference to electrons ignore 'not hit nucleus' without a reason	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
15(b)(ii)	path shown deviating/rebounding	initial path must be aimed nearer to centre than that given in Fig.3 must deviate/rebound between front edge and centre by eye	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
15(b)(iii)	positively charged/same (sign of) charge (as alpha)/massive (compared to alpha)	ignore solid/dense /repulsion /reference to protons	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
16(a)	1.0 (N)		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
16(b)	1.5 (N) right/arrow drawn to right i.e. $\rightarrow$/east		1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
16(c)	has size/magnitude/amount but no direction	mark independently has <u>only</u> size/magnitude scores both marks	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
16(d)	vector		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
17(a)	200 (K)		
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
17(b)(i)	100 ÷ 200 = p ÷ 150 p = 75 (kPa)	ecf their '200' from (a)	1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
17(b)(ii)	any two, (1) each, from: • constant volume/size of container • constant mass/amount of gas/number of particles / no leaks • constant density • gas has not changed state	dna 'same gas'	 1 1
			(2)

Question Number	Acceptable Answers	Extra Information	Mark
17(c)(i)	0/absolute zero marked on graph at zero of temperature axis	may use arrow to show position but must be clear that it is the zero of the temperature scale	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
17(c)(ii)	idea that it is not a straight line	gradient/slope changes gradient/slope not constant graph curves	
			(1)

Question Number	Acceptable Answers	Extra Information	Mark
17(c)(iii)	kinetic energy average **dop**	allow 'square of speed' 'speed squared' ignore references to pressure and volume	1 1
			(2)

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