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Mark Scheme (Results)

January 2012

International GCSE Physics (4PH0) Paper 1P
Science Double Award (4SC0) Paper 1P

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INTERNATIONAL GCSE PHYSICS 4PH0 4SC0 /1P – JANUARY 2012

Question number	Answer	Notes	Marks
1 (a) (i)	A		1
(ii)	B		1
(b) (i)	C		1
(ii)	nearest above (DOP)		1
(iii)	Comment on device –		1
	(plastic) insulator / does not conduct;	(double) insulated / no current (through) / cannot become live	1
	Comment on user -		
	no risk of shock / electrocution;	No electricity reaches user / person cannot touch live parts	

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>density = mass/volume</td><td>ACCEPT equivalent rearrangement
ACCEPT suitable abbreviations e.g. = m/v or d = m/v
REJECT equation ‘triangles’ alone</td><td>1</td></tr>
<tr><td>(b)</td><td>D</td><td></td><td>1</td></tr>
<tr><td>(c)</td><td><table><tr><th>Measuring instrument</th><th>Quantity measured</th></tr><tr><td>measuring cylinder</td><td>volume</td></tr><tr><td>electronic balance</td><td>mass</td></tr></table></td><td>Reject weight</td><td>1</td></tr>
</table>

Question number	Answer	Notes	Marks
2 (d)	MAX TWO FOR EACH measuring cylinder – eyes to water level / perpendicular view; to avoid parallax; measurement at bottom of meniscus; measuring cylinder on flat surface / clean cylinder; electronic balance – place on stable surface /avoid disturbing balance; set to zero / check zero; finding mass without an with water – (tare or subtraction);	 Ignore repetition wherever seen Ignore clean balance	4
(e) (i)	temperature / type of water (e.g. salinity, not 'heavy')	DO NOT ACCEPT answers referring to keeping the apparatus the same	1
(ii)	can also affect the density / volume (DOP)	ACCEPT arguments that follow through e.g. increasing temperature will increase the volume, therefore decreasing the density REJECT idea that mass is affected by change in temperature	1

Question number	Answer	Notes	Marks
3 (a)	(stopping distance =) thinking distance + braking distance	Could be reversed	1
(b)	Any two of: as speed increases / car goes faster, the (thinking/braking/stopping) distance increases; as thinking distance increases so does braking distance; difference in pattern between thinking/braking distances identified; e.g: increase in thinking distance < increase in braking distance / increase in thinking distance is linear or proportional / increase (in braking / stopping) is non linear / WTTE	Ignore references to time Allow use of values from graph Reject: thinking distance proportional to braking distance	2
(c)	30 (m)	ALLOW any value from 28 to 32 m	1

Question number	Answer	Notes	Marks
3 (d)	use the minimum / lowest values obtained	REJECT find the average	1
(e) (i)	thinking distance – no change; depends on speed/ driver / reaction (time)		2
(ii)	braking distance – increase; less friction/ less grip	Ignore reference to time e.g. takes longer Ignore skidding, sliding, slippery road	2

Question number	Answer	Notes	Marks
4 (a)	change in direction of waves at a boundary	ALLOW change in speed ALLOW idea of 'boundary' such as changing medium, or examples such as 'going from air into a glass block'	1
(b)	correct label for *i* correct label for *r*	ALLOW labels written out in full as "incidence" or "angle of incidence" etc REJECT if angles are the wrong way around	2
(c) (i)	refractive index = sin *i* / sin *r*	ALLOW 'n' for refractive index REJECT speed in 1/speed in 2	1
(ii)	Method max 4 marks: draw around block; mark positions of incident and emergent rays; (remove block and) draw refracted ray; measure i; measure r; measure angle(s) to the normal; range of values; Data max 2 marks: (graph of) sin i against sin r; graph is straight line; DOP gradient gives refractive index; DOP	Accept pin or pencil method Ignore mention of protractor i.e. different values of i not just repeating	MAX 6

Question number	Answer	Notes	Marks
5 (a)	D		2
	parallel field (DOP)	ACCEPT equally spaced and straight / equally spaced and do not change direction	
(b)	two (permanent / bar) magnets	ACCEPT points made on an annotated diagram	3
	pole pieces arranged correctly e.g. North facing South	REJECT description of poles as positive / negative	
	idea of magnets being the correct distance apart	ACCEPT “close together”, “not touching” ACCEPT idea that field is produced in the space between the N pole of one magnet and the S pole of the other REJECT answers that are clearly referring to electromagnets	

Question number	Answer	Notes	Marks
6 (a) (i)	rocks / radon (gas) / space / cosmic / Sun / medical sources / from carbon atoms in living things	REJECT named radiation e.g. gamma	1
(ii)	Any three from Remove source / with no source present; measure background / count; repeat / find mean / average value; subtract (background value) from experimental values (with source);	ACCEPT take readings (of background) / read background	Max 3
(b) (i)	GRAPH S A P P L	Orientation unimportant Quantity and unit on both axes Single smooth curve	5
(ii)	value consistent with graph (should be 0.9 – 1.4 minutes)		1
(c)	(gamma) can be detected outside the body /can pass through; half life related to use – long enough to get around the body (for use as tracer); half life related to patient safety - falls to low levels soon after use;	Ignore ionising ability Reject “cause less damage” without reference to activity or time	3

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>7 (a)</td><td>ANY THREE
vibration / oscillation of (air) molecules / particles;
longitudinal;
directions of vibration and propagation are parallel;
compression / rarefaction /pressure wave;</td><td>
need to include what is vibrating

no need to mention molecules / particles</td><td>3</td></tr>
<tr><td>(b) (i)</td><td>0.01 s</td><td>ALLOW 2 s.f. / 2 sig figs / 2 significant figures</td><td>1</td></tr>
<tr><td>(ii)</td><td>speed = distance / time</td><td>ACCEPT equivalent rearrangement
ACCEPT suitable abbreviations e.g. s = d/t or v = s/t
REJECT equation ‘triangles’ alone</td><td>1</td></tr>
<tr><td>(iii)</td><td><table><tr><th>Student</th><th>Mean time in s</th><th>Speed of Sound in m/s</th></tr><tr><td>Andrew</td><td>0.45</td><td>330</td></tr><tr><td>Kefe</td><td>0.5</td><td>300</td></tr></table></td><td>1 mark each correct COLUMN (ignoring sf);;
mean time values as shown in mark scheme
speed = 150/mean time (allow ecf)

1 mark for all significant figures correct;
(i.e. 2 s.f. in first row, 1 s.f. in second row)</td><td>3</td></tr>
</table>

Question number	Answer	Notes	Marks
7 (c)	ANY 5 relevant points, e.g. Explanation of what reaction time is; Reaction time affects readings / reaction time does matter; Reaction times vary; Reaction times do not cancel out; Reaction time should be considered / allowed for; Kefe is right (about reaction times); reaction time typically at least 0.1 s; which is large compared to measured times / large % error; time should only be to 1 s.f.; so final value should also be to 1 s.f. / Kefe's value more suitable; 3 s.f. inappropriate; closer to accepted value does not mean more accurate;	Answers should ideally relate to how *appropriate* the precision of the measurements was, linking this to the number of significant figures merited Consideration of reaction time and its measurement may score a number of marks	MAX 5

Question number	Answer	Notes	Marks
8 (a) (i)	voltage = current x resistance	ACCEPT equivalent rearrangement ACCEPT suitable abbreviations e.g. V = I x R REJECT V = I x REJECT equation 'triangles' alone	1
(ii)	1.2 x 4.0; 4.8 (V);		2
(iii)	12 – 4.8; 7.2 (V);	ECF on (ii)	2
(iv)	E = VIt (NO MARK) time conversion to seconds (5.0 x 60); 7.2 x 1.2 x (5.0 x 60); 2600 (J);	ECF on (iii) Allow 2592 or 2590 ALLOW 2500/2520 (J) for full marks (using 7 V) ALLOW 42 (J) or 43.2 (J) for 2 marks (using 5 mins)	3
(v)	idea of energy losses rate of energy loss = rate of energy supply (at steady temp)	 NB this statement alone scores (2) as it includes idea of energy loss	2

Question number	Answer	Notes	Marks
8 (b) (i)	X – series, Y – parallel	BOTH REQUIRED for the mark	1
(ii)	THREE SUITABLE, e.g.- series advantage – fewer wires; series advantage – lower resistance values; series disadvantage – one fails, circuit fails; series disadvantage – no independent control;	ALLOW REVERSE ARGUMENTS in terms of parallel circuits but do not award the same mark twice IGNORE refs to efficiency ACCEPT correct answers that link to battery voltage / current, etc	Max 3

Question number	Answer	Notes	Marks
9 (a)	gravity		1
(b) (i)	6960 (km)		1
(ii)	equation quoted (NO MARK) conversion of km OR min; $v = (2 \times \pi \times 6\,960\,000) / (96 \times 60)$; 7600;	 ECF on (i) Allow for rounding errors	3
(c)	EITHER grav pe reduces when closer; (so) ke increases; because total energy conserved; OR gravitational attraction / field strength increases when closer; mass remains constant; so accelerates;	 Grav force increases so ke increases = 1 (mixing arguments) REJECT 'gravity higher' 'gravity stronger' ACCEPT 'pull of gravity' 'force of gravity'	3
(d) (i)	electromagnetic (spectrum)	Accept transverse (waves)	1
(ii)	Any **two** from X-rays have shorter wavelength; ORA X-rays have higher frequency; ORA X-rays have higher energy; ORA X-rays have greater penetration range; ORA X-rays have greater effects on living tissue; ORA	Idea of comparison must be there REJECT 'visible light can be seen' / eq	2

Question number	Answer	Notes	Marks
10 (a) (i)	GPE = mass x g x height	ACCEPT equivalent rearrangement ACCEPT suitable abbreviations e.g. GPE = mgh ACCEPT 'gravity' or 'gravitional field strength' or 'acceleration due to gravity' for g	1
(ii)	78 x 10 x 5; 3900 (J);		2
(iii)	3900; J / joule;	Accept 4000 J REJECT 'Nm' for 'J' ALLOW kJ only if it matches the value (i.e. 3.9)	2
(b) (i)	efficiency = useful energy output / total energy input	ALLOW 'power' for 'energy'	1

(ii)	in one second –
	useful energy out = (30 x 3900) / 60;
	efficiency = 1950 / 7500;
	0.26 / 26%
		Allow
		useful energy out = (30 x 4000) / 60;
		efficiency = 2000 / 7500;
		0.27 / 27%
		
		CQ on a(ii)
			3

(c)	right general shape reasonably correct proportions / 3kW and 12 kW seen correctly labelled	 ACCEPT "input / waste / useful" or "electrical / kinetic or GPE / waste heat or sound"	3

Question number	Answer	Notes	Marks
11 (a)	78 seen; = 78 / 60; 1.3;	 acceleration = (final v – starting v)/time; CORRECT ANSWER WITH NO WORKING = (3)	3
(b)	air resistance (when moving); increases as velocity / speed increases; reducing resistant force;	ACCEPT drag IGNORE wind resistance IGNORE friction with ground 'friction' alone needs qualification REJECT 'reaches terminal velocity'	3

Question number	Answer	Notes	Marks
12 (a)	ANY FOUR – Conduction from hot plate to pan; conduction through pan; conduction from pan to water; convection in the water; conduction from water to potato; conduction through potato;		Max 4
(b)	ANY THREE – microwaves are electromagnetic waves; penetrate (a few cm) into the food; cause water molecules to vibrate more / heat water; conduction through the rest of the potato	no marks for whether or not the statement is true needs ref to water, not just particles / molecules needs conduction ref, not just spreads out	Max 3
(c)	Any five from Electromagnetic induction; coil creates magnetic field around it; which cuts through the metal pan; field alternates / changes; inducing a voltage in the pan; causing a current in the pan; current makes the pan get hot; which heats the water by conduction; water convects energy to potato;	Effect named – not just ‘induction’ (given in question) Pan heating must be linked to current, not just ‘the pan gets hot’	Max 5

PAPER TOTAL: 120 MARKS

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