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Mark Scheme (Results)

June 2011

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

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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.

ecf - error carried forward
dop - dependent on previous
ora - or reverse argument
owtte - or words to that effect

Question number	Answer	Notes	Marks
1 (a) (i)	gravitational		1
(ii)	elastic		1
(iii)	kinetic		1
(b) (i)	bounces lower / less / smaller / shorter / not as high (each bounce)	ACCEPT: refs to diagram e.g. "loops / dotted lines less tall" ACCEPT: distance between bounces gets smaller	1
(ii)	(transferred away to) thermal energy	ACCEPT: heat / sound REJECT: other forms of energy e.g. light / chemical ACCEPT: refs to where the energy goes e.g. "to the air", "to the ground", "to the surroundings" IGNORE: friction	1

Total 5 Marks

Question number	Answer	Notes	Marks
2 (a)	A – <u>visible</u> (light)	REJECT: rainbow REJECT: 'light' alone	1
	B – X-rays	ACCEPT: X / X - radiation	1
(b)	C		1
(c)	B		1
(d)	B		1

2 (e)	For first chosen region of the spectrum corresponding hazard; corresponding risk reduction; For second chosen region of the spectrum corresponding hazard; corresponding risk reduction; NB No mark for naming the type of radiation	e.g. microwaves - heating of tissue / perceived risk of cancer close oven door / hands-free cell phone / monitor exposure e.g. infra red – risk of skin burning / cell damage avoid hot places / reflective clothing / avoid exposure (to sun) e.g. visible light eye damage sun glasses / avoid exposure (to sun) e.g. ultraviolet – risk of {skin / eye} damage / blindness IGNORE: sunburn skin cream / sunglasses / avoid exposure (to sun) e.g. x-rays – risk of cancer / cell damage (lead) shielding / monitor exposure e.g. film badge / avoid exposure e.g. gamma - risk of cancer / cell damage (lead) shielding / monitor exposure e.g. film badge / avoid exposure	4

Total 9 Marks

Question number	Answer	Notes	Marks
3 (a)	16.5 ± 0.2; cm;	ACCEPT: 2nd dp if in this range ACCEPT: centimetres / cms ACCEPT: 165 mm ± 2 for 2 marks ACCEPT: 0.165 m ± 0.002 for 2 marks	1 1
(b)	Any two of: line up (end of) pencil with zero / any other scale mark ; avoid parallax / look straight down / take reading at right angles OWTTE ; use 0.5 cm scale / other side of ruler ;	 REJECT: line up with end of ruler IGNORE: put pencil on top of ruler REJECT: use mm scale IGNORE: repeat readings / average	2

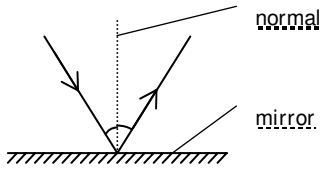
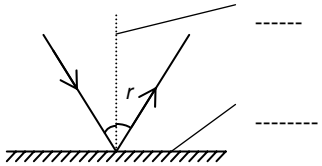
Total 4 Marks

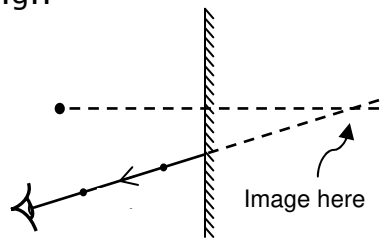
Question number	Answer	Notes	Marks
4 (a)	Any two of: current (in the coil) ; {in / produces} a magnetic field ; (resultant) force / interaction of magnetic fields ;	 IGNORE: electrical to kinetic energy / induced current IGNORE: unqualified refs to LHR IGNORE: refs to push / pull	2
(b)	Any two of: increase current / more cells (in battery) ; stronger magnet(s) ; more turns (on coil) ;	 ACCEPT: stronger current / more (battery) voltage REJECT: 'larger' batteries REJECT: 'bigger' magnet IGNORE: magnets closer together REJECT: more coils	2
(c)	Any two of: coil / wire cuts through (magnetic) field ; induced voltage / current ; current <u>in lamp</u> / complete circuit ; correct refs to an energy transfer e.g. kinetic to electrical (to light) ;	 ACCEPT: coil moves / breaks field ACCEPT: 'electromagnetic induction' ACCEPT: generated / produced OWTTE IGNORE: "lights lamp"	2

Total 6 Marks

Question number	Answer	Accept	Reject	Marks
5 (a) (i)	moment = force x distance	Correct equivalent e.g. moment = F x d If (i) is blank, but correct equation written in (ii), then credit.	m for moment equation "triangles"	1
(ii)	Substitution 4.2 x 0.25; Calculation 1.05 (N m);	Correct answer gets both marks ACCEPT: 1.1 (N m)		2
(b)	(Moment of) weight of lid; Acts in same direction as closing force / anticlockwise;	Pull / force of gravity Acts downwards Reverse argument related to opening lid IGNORE: any reference to energy	Bald "gravity" for weight	2

Total 5 Marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>6 (a)</td><td>
<table>
<tr><td>statement</td><td>tick</td></tr>
<tr><td>the image in a plane mirror is virtual</td><td>✓</td></tr>
<tr><td>light from the object passes through the image in a plane mirror</td><td></td></tr>
<tr><td>light waves are longitudinal</td><td></td></tr>
<tr><td>the angle of incidence equals the angle of reflection</td><td>✓</td></tr>
<tr><td>the incident ray is at right angles to the reflected ray</td><td></td></tr>
</table>
</td><td>Three ticks – max 1 mark
Four or more ticks – no mark</td><td>2</td></tr>
<tr><td>(b) (i)</td><td> 
</td><td></td><td>2</td></tr>
<tr><td>(ii)</td><td> 
</td><td></td><td>1</td></tr>
</table>

Question number	Answer	Notes	Marks
6 (c) (i)	First suitable line extended; Second suitable line extended; Image indicated correctly <u>at crossing point of suitable lines</u> ; e.g.:  	Suitable lines include: sighting pin line line from object perpendicular to mirror candidates own sighting line from another position Image may be indicated with any clear mark or label	1 1 1
(ii)	EITHER Appropriate additional drawing; e.g. extend perpendicular / second sighting line check line passes through image; OR Measure distance(s) (to mirror); Object distance = image distance; OR pin placed in image position; method of no parallax named or described;	Any additional drawing should be complementary to 6(c)(i) answer	2

Total 10 marks

Question number	Answer	Accept	Reject	Marks
7 (a)	B			1
(b)	Any two of Energy transfer from supply / electrical energy; Energy transfer to thermal energy (heat) / particle vibration; There is a current (in the heating element); Heating effect of resistance /a resistor;	Electrical → thermal /heat for 2 marks IGNORE: electricity		2
(c) (i)	Power = current x voltage;	Or equivalent, e.g. Power = voltage x current Voltage = power ÷ current Current = power ÷ voltage P= I x V If (i) is blank, but correct equation written in (ii), then credit.	equation "triangles"	1
(ii)	Substitution 2000 / 230; Calculation 8.7 (A);	ACCEPT: 8.69 (A)		2
(iii)	13 A; Only one above working current; dop	OWTTE ORA e.g the others would blow		2

Total 8 marks

Question number	Answer	Accept	Reject	Marks
8 (a) (i)	(average) speed = distance / time;	Or equivalent – distance = speed x time, time = distance ÷ speed, or correct symbols e.g. v = d / t If (i) is blank, but correct equation written in (ii), then credit.		1
(ii)	Substitution 9000 / 900; Calculation 10; Unit m/s;	ACCEPT: e.g. 9/15 = 0.6 km/minute 9/0.25 = 36 km/hour 9000/15 = 600 m/min 9/900 = 0.01 km/s i.e. any unit that is consistent with the number		2 1
(iii)	Any two from: speed not constant ; OWTTE slow at (some) points / stations ; fast at (other) points / between stations ;	 ACCEPT: this idea implied e.g slower (1) at stations (1)		2

8 (b) (i)	use of acceleration = change in velocity / time (taken) OR attempt at use of gradient ; Substitution 30 / 100 ; Calculation 0.3 (m/s^2) ;	Or equivalent – Change in vel = accn x time Time = change in vel ÷ accn Bald answer gets 3 marks		1 1 1
(ii)	Area under graph (clear evidence of attempt); (½ x 30 x 100) + (30 x 100) + (½ x 30 x 100); 6000 (m);	ACCEPT: trapezium method ½ x (300 + 100) x 30 ACCEPT: answers where the unit is consistent with the number. Bald answer gets all three marks		3

Total 12 marks

Question number	Answer	Notes	Marks
9 (a) (i)	(gravitational potential) energy = m x g x h;	ACCEPT: E = mass x gravity x height REJECT: E = W x h	1
(ii)	Substitution 18 x 10 x 5 ; Calculation 900 (J) ;	If (i) is blank, but correct equation written in (ii), then credit. ACCEPT: 882 (J)	2
(iii)	equal / the same / =	ACCEPT: equivalent REJECT: proportional IGNORE: 900 J	1
(b)	Up to five marks in all – up to two for each mechanism Conduction air / gas is a poor conductor / insulator ; air molecules are (relatively) far apart ; fibres are insulating ; Convection air / gas (between fibres) cannot move ; thus no / reduced convection <u>currents</u> ; Radiation aluminium foil / shiny surface is a poor radiator ; thermal energy / heat/ / radiation is reflected (back inside) ; aluminium foil / shiny surface is poor absorber ;	 IGNORE: conductor of electricity ACCEPT: particles cannot transfer energy as they don't collide often ACCEPT: emitter	5

Total 9 marks

Question number	Answer	Notes	Marks
10 (a) (i)	thermistor labelled correctly	ACCEPT: ringed thermistor	1
(ii)	correct voltmeter symbol ; connected in parallel with thermistor ;	REJECT: connected in parallel with battery	2
(b) (i)	voltage = current x resistance	Or equivalent – resistance = voltage ÷ current V = I x R	1
(ii)	Substitution 12 = 0.002 x R; Calculation R = 12 / 0.002 = 6000 (Ω);	If (i) is blank, but correct equation written in (ii), then credit. 12 = 2 x R = 6 (Ω) gets 1 mark Bald answer 2 marks 6 kΩ gets 2 marks	2
(iii)	Suitable size chosen (>50% of grid used); Axes labelled with quantities and units (either way around); Plotting to nearest half square (minus one for each plotting error);; Curved line of best fit acceptable;	ACCEPT: ° OR C REJECT: joining the dots Bar chart for 4 max	5
(iv)	current increases with temperature ; non-linear relationship OWTTE ;	ACCEPT: positive correlation	2
(v)	Any two of student is wrong ; because current increases with temp (for constant voltage) ; so resistance decrease with temp ;	"student is correct" scores 0 marks Because it is an ntc thermistor for 1 mark ACCEPT: relevant use of figures for resistance from graph/table	2

Total 15 marks

Question number	Answer	Notes	Marks
11 (a)	Mass of cylinder + unit = 325 ; Mass of cylinder = 106 ; Mass of liquid in cylinder = 219 ; Volume of liquid = 176 ; Mass unit: g ; Volume unit: cm^3 / ml ;	 ACCEPT: ecf on M1 and M2 ACCEPT: either unit used appropriately at least once	6
(b)	Any two from: equation; correct substitution made or correct mass indicated; density = between 1.24 and 1.25; density unit (g/cm^3 OR g/ml);	 ecf from 11(a) Correct and consistent alternative e.g. 1240 kg/m^3 1.24 kg/dm^3	2
(c)	Any two from: more sensitive equipment ; check balance zero ; calibrate any equipment ; avoid parallax when reading measuring cylinder / bottom of meniscus ; use larger volume of liquid ;	 ACCEPT: measure to more dp / use burette IGNORE: repeat experiment IGNORE: refs to "use more accurate…"	2

Total 10 marks

Question number	Answer	Notes	Marks
12			4
M1	pressure greater in the full cup / less in the half-full cup ;		
M2	reference to equation / p = W ÷ A / p = h x ρ x g ;	ACCEPT: F in place of W IGNORE: amount of coffee different	
M3	{depth / mass / weight} of liquid / force different in each cup ;		
M4	density / g / area the same for each cup ;		

Total 4 marks

Question number	Answer	Notes	Marks
13 (a) (i)	77		1
(ii)	115		1
(b)	(nuclei with) same number of protons / same atomic number / same element ; different numbers of {neutrons / nucleons} / different mass number;	ACCEPT: atoms / elements for nuclei REJECT: molecules / substances for nuclei IGNORE: electrons	2
(c)	192; 78;		2
(d)	alpha not penetrating enough (of the tumour) / ionises before reaching whole tumour ; gamma too penetrating / travels straight through /too weakly ionising / OWTTE ; beta will penetrate the tumour but no further / stays in tumour and doesn't affect horse / ionises within tumour (but no further) / OWTTE ;	IGNORE: doesn't penetrate skin IGNORE: bald 'weak' or 'strong' IGNORE: general properties of alpha, beta and gamma	3
(e) (i)	C		1
(ii)	activity decreases over time ; relate activity to situation e.g. C remains sufficiently active (over the treatment) / A and B not effective over period of treatment / A and B would need source to be replaced / D continues to be radioactive / cause damage (after treatment) ;	ACCEPT: calculation of period of activity IGNORE: bald 'weak' or 'strong'	2

Total 12 marks

Question number	Answer	Notes	Marks
14 (a)	two protons labelled ; two neutrons labelled ;	ACCEPT: a proton and a neutron for 1 mark ACCEPT: correct labels inside circles	2
(b) (i)	Any two of: to avoid / reduce absorption / ionisation / loss of energy of alpha particles ; to avoid / reduce chance of collisions between air molecules and alpha particles ; to allow sufficient range for alpha particles / would stop in few cm of air / does not reach foil ;	ACCEPT: ideas of alpha particle absorption, collision and range expressed in other words IGNORE: speed of alpha particles	2
(ii)	Any two of: electrostatic (force) ; repulsion ; between like charges ;	ACCEPT: electric (force) IGNORE: magnetic / poles	2

14 (b) (iii)	Any five of: Undeflected alpha particles show – there are gaps between nuclei/atoms mostly empty space; Deflections show – a repulsive force operates; (if electrostatic force) then nuclei have same charge as alpha particles (or both positive charge); (only some) deflected so nuclei are a <u>small</u> target; Large deflections show – nuclei have enough mass for alphas to bounce back; <u>mass</u> of a nucleus is <u>more</u> than the mass of an alpha particle; <u>high</u> density related to mass and <u>small</u> size;	ACCEPT: correct reverse arguments	5

Total 11 marks

PAPER TOTAL: 120 MARKS

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