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Mark Scheme (Results)

Summer 2015

Pearson Edexcel International GCSE in Physics (4PH0) Paper 2PR

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Summer 2015
Publications Code UG042367

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;		1
			E;		1
	b	i	p = m.v	in words or accepted symbols do not accept 'M' for momentum	1
		ii	substitution; evaluation; e.g. 900 x 15 14 000 unit = kg m/s OR N s;	 13 500 Independent Allow kg ms^{-1}	3
		iii	KE = ½ m.v^2;	in words or accepted symbols allow speed for velocity	1
		iv	substitution; evaluation; e.g. 0.5 x 900 x 15^2 100 000(J)	 101 250 Allow 101 000	2
				total = 9 marks	

<table>
<tr><th colspan="3">Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2</td><td>a</td><td></td><td colspan="2">
<table>
<tr><th>Type of radiation</th><th>Deflected upwards</th><th>Deflected downwards</th><th>Not deflected</th></tr>
<tr><td>alpha</td><td>(✓)</td><td></td><td></td></tr>
<tr><td>beta</td><td></td><td>✓</td><td></td></tr>
<tr><td>gamma</td><td></td><td></td><td>✓</td></tr>
<tr><td>neutrons</td><td></td><td></td><td>✓</td></tr>
<tr><td>protons</td><td>✓</td><td></td><td></td></tr>
</table>
each correct ;;;;</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>b</td><td>i</td><td>any sensible suggestion (however phrased);
e.g.
• alpha has a small range in air
• alpha would not hit the gold leaf
• alpha would be deflected
• alpha would collide with the air {particles/molecules/RA}
• alpha would ionise the {air/ particles/molecules}</td><td>Allow RA
condone phrases such as
• air particles interact with alpha
• air particles interfere with alpha

ignore
• react
• diffracting
• to create a vacuum</td><td>1</td></tr>
<tr><td></td><td></td><td>ii</td><td>any TWO results from:

MP1. most went (straight) through;

MP2. (the paths of)a few were deflected at an acute/small angle;

MP3. (the paths of) very few were {deflected through an obtuse angle / backscattered};</td><td>NB:
no mark for structure of atom or deductions

allow bent

allow
for obtuse
• large
• >90°
for backscattered
• bounced off the gold foil</td><td>2</td></tr>
<tr><td></td><td>c</td><td></td><td>MP 2, 4 can be shown on a diagram
any FOUR explanations or deductions from:

MP1. Small nucleus;
MP2. mostly empty space;
MP3. because not many α deflected / because most α go straight through;

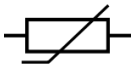
MP4. Positive OR high mass nucleus;
MP5. which causes deflection of positive (or low mass) α;</td><td>Ignore
ALL comments about electrons

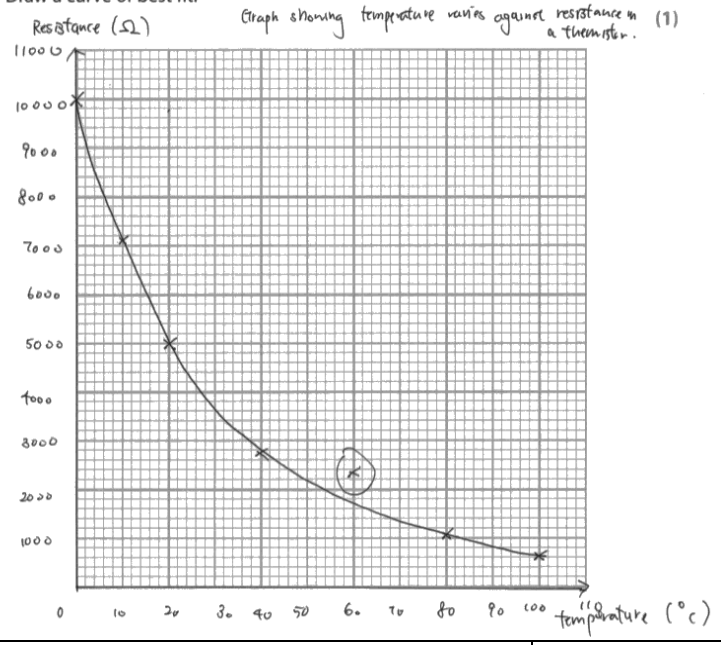
NB to get MP 3, 5 a causal link is needed

allow
protons are in the centre
repulsion, recoil
idea that α same charge as nucleus</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">total = 11 marks</td></tr>
</table>

Question number			Answer	Notes	Marks
3	a	i	moment = force x (perpendicular) distance (from pivot)	in words or accepted symbols	1
		ii	MP1. calc of 1 correct moment (about the pivot); MP2. stated equivalence of clockwise moment= anticlockwise moment /principle of moments; MP3. final value; e.g. 2 x 60 =120 (one mark) 2 x 60= 10 x F_N (two marks) $F_N = \frac{2 \times 60}{10}$ =12 (N) (three marks)	in words or in numbers allow working in cm or m	3
	b		MP1. Increases (force on newtonmeter); MP2. (because) weight of bar has a moment; MP3. in same direction (clockwise) as 2 N weight;	may be shown by a calculation allow F_N = 62(N) for three marks	3
				total = 7 marks	

Question number			Answer	Notes	Marks
4	a		**one** of: iron is (soft) magnetic; iron loses its magnetism easily;	allow RA for steel	1
	b		**these can be shown on a labelled diagram** MP1. current carrying (insulated) wire; MP2. wrapped into coil; MP3. wrapped on **iron** core;	allow wire shown connected to a battery solenoid = MP2 only	3
	c		Any two **ideas** from: MP1. current/ voltage reduces OR eq; MP2. magnetic field of em reduces; MP3. (magnetic) force holding the iron plate to the magnet no longer present;	do not give marks for • 'the door closes'/eq • electricity • power allow current stops circuit broken • iron plate no longer magnetised	2
				total = 6 marks	

Question number			Answer	Notes	Marks
5	a		D 		1
	b	i	Any two ideas from: MP1. it acts as water bath; MP2. gives more gradual heating or cooling OR gives (easier/better) control of temperature; MP3. protects the thermistor against direct heating/prevents intense heating;	allow water distributes temperature (more) evenly /RA for air very high temperature	2
		ii	B; in parallel across the thermistor in series with the thermistor		1
	c	i	ignore orientation of the graph suitable scales marked on both axes (> 50% of grid used); both axes labelled with quantity and unit; points within ± ½ small square;;		4
		ii	anomalous point at 60, 2350;		1
		iii	LOBF; should go through 60, 1750 approx no obvious abrupt changes of gradient		1

			(iii) Draw a curve of best fit. Graph showing temperature varies against resistance in a thermistor. (1)  **Temperature in °C** / **Resistance in Ω** 0 / 10 000 10 / 7 060 20 / 5 000 40 / 2 670 60 / 2 350 80 / 1 080 100 / 609		
	d	i	water boils at 100°C/OWTTE;		1
		ii	any sensible **method** to get temp between 0 and 20; e.g. add ice to water use cold water from tap/fridge	doing experiment in a fridge is not sensible, but allow if 'walk-in' fridge is mentioned	1
				total = 12 marks	

Question number			Answer	Notes	Marks
6	a	i	number of waves/cycles = 3.5; $\frac{0.60}{3.5}$ = 0.17 (m);	3.5 seen or implied 0.1714 (m) 17 cm 17.14 cm For 1 mark only 17 (m), 17.14(m), 0.2 (m), 0.15 (m), 0.085 (m)	2
		ii	wave speed = frequency x wavelength	allow words or accepted symbols and rearrangements	1
		iii	substitution; rearrangement; evaluation; eg. $3.0 \times 10^8 = 0.17 \times f$ (1 mark) $3.0 \times 10^8 / 0.17$ (2 marks) 1.8×10^9 (Hz) (3 marks)	**allow ecf from ai** 1.76×10^9 (Hz) 1.75×10^9 (Hz) POT = -1	3
	b	i	diffraction;		1
		ii	any two from: MP1. microwaves not diffracted as much; MP2. diffraction (only seen) when size of barrier/gap comparable to wavelength; MP3. radio-waves have (much) longer wavelength than microwaves/RA;	 must have quantifier-e.g 'little' ignore 'microwaves not diffracted' wavelength of microwaves (much) smaller than size of barrier allow an implied comparison	2
				total =9 marks	

Question number			Answer	Notes	Marks
7			6 marks from with a MAX of 2 from any one area **benefits of nuclear fuel** MP1. no CO_2 emitted / no smoke emitted; MP2. does not contribute to global warming; MP3. reliable/not weather dependant; MP4. small volume of waste; MP5. concentrated energy source/ not much transport costs to bring fuel; MP6. power stations are relatively small; **disadvantages of nuclear fuel** MP7. difficult to dispose of **waste**; MP8. accidents can spread radiation widely / risk of radiation leak; MP9. nuclear fuel is toxic / harmful / radioactive / difficult to handle / long half-life; MP10. decommissioning costs are very high; MP11. increased security risk/ terrorist attack; **benefits of biomass** MP12. abundant sources / uses waste products from farms /houses/renewable; MP13. uses materials which would produce CO_2 anyway, so no net emission; MP14. can be used to create different products (e.g. manure) as well as energy; MP15. reduces landfill; MP16. (source is) relatively cheap; **disadvantages of biomass** MP17. relatively inefficient; MP18. can increase methane in atmosphere/can increase green-house gases; MP19. may require more land; MP20. high transport costs to collect raw material; MP21. can be smelly; MP22. often seasonal power source /variable output source; MP23. can be storage costs for biogas;	allow other sensible points no green-house effect Allow waste causes acid rain	6
				total = 6 marks	

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