



Mark Scheme (Results)

Summer 2015

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

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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.

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. 900×15 14 000 unit = kg m/s OR N s;	13 500 Independent Allow kg ms^{-1}	3
		iii	$\text{KE} = \frac{1}{2} m.v^2$;	in words or accepted symbols allow speed for velocity	1
		iv	substitution; evaluation; e.g. $0.5 \times 900 \times 15^2$ 100 000(J)	101 250 Allow 101 000	2
				total = 9 marks	

Question number		Answer	Notes	Marks																								
2	a	<table><thead><tr><th>Type of radiation</th><th>Deflected upwards</th><th>Deflected downwards</th><th>Not deflected</th></tr></thead><tbody><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></tbody></table> each correct ; ; ;	Type of radiation	Deflected upwards	Deflected downwards	Not deflected	alpha	(✓)			beta		✓		gamma			✓	neutrons			✓	protons	✓				4
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	b	i	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}	Allow RA condone phrases such as - air particles interact with alpha - air particles interfere with alpha ignore - react - diffracting - to create a vacuum	1																							
		ii	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};	NB: no mark for structure of atom or deductions allow bent allow for obtuse - large >90° for backscattered - bounced off the gold foil	2																							
	c		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;	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	4																							
			total = 11 marks																									

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. $2 \times 60 = 120$ (one mark) $2 \times 60 = 10 \times F_N$ (two marks) $F_N = \frac{2 \times 60}{10}$ $= 12 \text{ (N)}$ (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 $F_N = 62 \text{ (N)}$ 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 $\pm \frac{1}{2}$ 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. Resistance (Ω) Graph showing temperature varies against resistance in a thermistor. (1) <table border="1"> <thead> <tr> <th>Temperature in $^{\circ}\text{C}$</th> <th>Resistance in Ω</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>10 000</td> </tr> <tr> <td>10</td> <td>7 060</td> </tr> <tr> <td>20</td> <td>5 000</td> </tr> <tr> <td>40</td> <td>2 670</td> </tr> <tr> <td>60</td> <td>2 350</td> </tr> <tr> <td>80</td> <td>1 080</td> </tr> <tr> <td>100</td> <td>609</td> </tr> </tbody> </table>	Temperature in $^{\circ}\text{C}$	Resistance in Ω	0	10 000	10	7 060	20	5 000	40	2 670	60	2 350	80	1 080	100	609	
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	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; $\frac{0.60}{3.5} = 0.17 \text{ (m)};$	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) $1.8 \times 10^9 \text{ (Hz)}$ (3 marks)	allow ecf from ai $1.76 \times 10^9 \text{ (Hz)}$ $1.75 \times 10^9 \text{ (Hz)}$ 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 CO₂ 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 CO₂ 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	

