edexcel

Mark Scheme (Results)

Summer 2015

Pearson Edexcel International GCSE Physics (4PH0) Paper 1PR

Pearson Edexcel International GCSE Science Double Award (4SC0) Paper 1PR

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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)	any 3 of: MP1. neutron absorbed by (U) **nucleus**; MP2. (U nucleus) splits; MP3. (producing 2) daughter nuclei; MP4. extra **neutrons** released;	accept collides with/hits/bombards/eq n for neutron condone breaks up must be plural reject 'daughter cells' for MP3 must be plural	3
(b)	kinetic (energy)	accept phonetic spellings e.g. 'kenetic'	1

Total 4 marks

Question number	Answer	Notes	Marks
2 (a)	any 2 of: MP1. so that lamps work independently;	so that can light some rooms without all being on or off/each lamp has its own switch/if 1 lamp blows the others will still work	2
	MP2. so that they all get mains/same voltage/230V;	allow no reduction in light output for main voltage	
	MP3. so that different areas/rooms can have different brightness/power/light intensities of lamps;	allow different currents	
(b)	D 1.38 A;		1
(c)	any 3 of: MP1. **current** increases over max value of fuse; MP2. fuse wire melts; MP3. cuts off current; MP4. prevents wire(s) in circuit from overheating;	allow **current** gets too high blows/breaks breaks circuit ignore 'stops electricity' ignore electric shocks	3
(d) (i)	power = voltage x current	allow in standard symbols or in words	1
(ii)	substitution into correct equation; evaluation; e.g. 0.26 X 230 60 (W)	allow 240 V for mains but not incorrect current (62.4 W) allow 59.8 (W) condone 317(.4) (W) for 1 mark	2
(iii)	answer from (d)(ii) x **180** ; evaluation; unit; e.g. 60 X 180 11000 joules/J	accept correct use of E = V x I x t allow ecf from (d)(ii) mark independently allow 10800, 10764	3

2	(e)	(i)				allow 1 mark when middle two rows blank, but otherwise correct allow 1 mark when top and bottom rows blank but otherwise correct	2

S_1 position	S_2 position	lamp is lit
W	X	(yes)✓
W	Y	(no) ×
Z	X	(no) ×
Z	Y	(yes)✓

any three correct;
all 4 correct;;

	(ii)	any sensible suggestion of 2 way switching; e.g. on a corridor on stairs basement/cellar bedroom/kitchen light room with 2 doorways	allow clear description of 2 switches controlling the same light	1

Total 15 marks

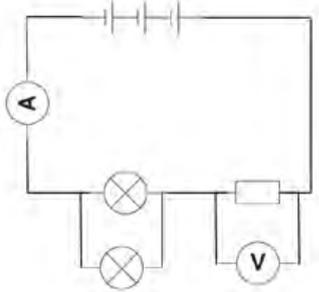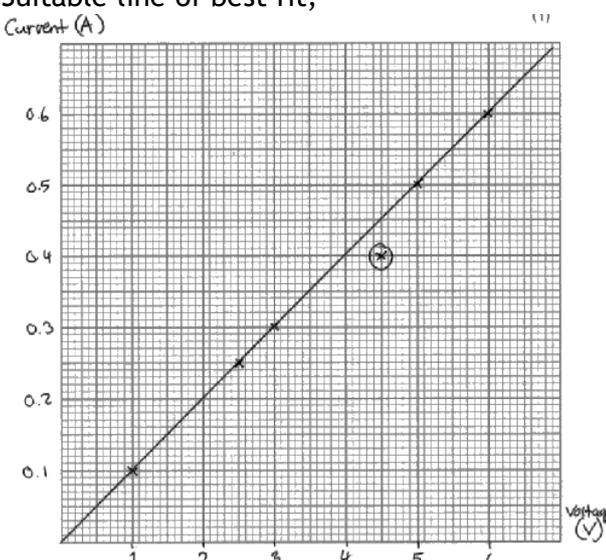| Question number			Answer	Notes	Marks
3	(a)	(i)	D refraction;		1
		(ii)	any 2 of: MP1. waves **slow down**; MP2. waves change direction/bend/angle; MP3. wavelength **decreases**;	allow 'light' for waves do not allow 'curved' allow wavefronts closer together	2
	(b)	(i)	line at 90° to the surface at point of contact;	judge by eye label not required	1
		(ii)	angle between normal and incident ray clearly indicated;	allow ecf from normal line drawn in (b)(i) allow measured value in degrees	1

Total 5 marks

Question number			Answer	Notes	Marks
4	(a)	(i)	C (ultra violet);		1
		(ii)	A (longitudinal);		1
		(iii)	C (internal structure of objects);		1
	(b)	(i)	any sensible use further detail e.g. sterilising medical equipment; gamma kills bacteria; OR treating cancer/mutates cancer **cells**; radiotherapy/**focused** gamma rays; OR detecting cancer; PET scanner/(radioactive) tracers/gamma camera;	ignore CT scan, CAT scan, MRI scan allow kills cancer/cells allow scintillation counter	2

		(ii)	any 2 of:
			
			MP1. any one sensible comment about risk for either;
			    e.g.
			    increased risk of cancer/mutation of cells
			    damage to neighbouring/good/healthy cells
			
			MP2. a further detail of the risk;
			    e.g.
			    radiation is ionising
			    gamma has high/highest energy
			
			MP3. statement about the relative risk/exposure of doctor or patient;
			    e.g.
			    patient is only exposed for a short period of time
			    doctor has continual (low level) exposure
					2

		(iii)	any one sensible method; e.g. (use for a) limited time idea of working at a distance/in another room	ignore protective clothing, lead shielding, lead apron etc.	1

Total 8 marks

Question number	Answer	Notes	Marks
5 (a) (i)	weight (of toy car);	allow mass	1
(ii)	speed (of toy car);	allow: velocity time (to go down the slope)	1
(b)	any 2 of: MP1. angle/gradient/incline/steepness/height of slope; MP2. same car/eq; MP3. surface of slope; MP4. force at launch; MP5. initial speed; MP6. starting height/position/point (of car); MP7. distance travelled/length of slope;	ignore weather conditions	2
(c)		allow clear alternative indications e.g. - crosses - shading	2

battery	
joulemeter	
micrometer	
newtonmeter	✓
ruler	(✓)
stopwatch	✓
thermometer	

one correct tick;
two correct ticks;;

if more than 2 ticks, -1 for each incorrect tick

(d)	any **5** of:	Allow	5
	MP1. measure weight/mass;	'find out' for measure	
	MP2. measure distance (down slope)/start from same point;		
	MP3. measure time/speed (with light gate);		
	MP4. equation seen or described in words: speed = distance / time;		
	MP5. idea that different weights used;		
	MP6. repeat experiment AND average/remove anomalies;		
	MP7. method to improve accuracy, e.g. use of light gates, reaction time considered;		

Total 11 marks

Question number			Answer	Notes	Marks
6	(a)		mark each of these independently: MP1. a **resistor** in series with the lamp only; MP2. a second lamp in parallel with the first lamp; MP3. a voltmeter that measures the voltage across the **resistor**; MP4. an ammeter that measures the total current in the circuit;	circuit symbols used must be correct (no square voltmeter/ammeter etc.) 	4
	(b)	(i)	labels on axes including units; scales on axes; plotting;;	axes can be either way round must occupy >50% in each direction -1 for each error	4
		(ii)	I = 0.4, V = 4.5 clearly indicated;		1
		(iii)	Suitable line of best fit; 	Voltage in V / Current in A 1.0 / 0.10 2.5 / 0.25 3.0 / 0.30 4.5 / 0.40 5.0 / 0.50 6.0 / 0.60	1
		(iv)	voltage = current x resistance;	in words or standard symbols	1
		(v)	substitution into correct equation using any suitable pair of values taken from the graph line or table; evaluation of R = 10 (Ω);	allow (0.1,1), (0.6,6) etc	2

Total 13 marks

Question number			Answer	Notes	Marks
7	(a)	(i)	force = mass x acceleration;	in words or in accepted symbols e.g. F=ma	1
		(ii)	substitution; evaluation; e.g. 38 x 1.5 57 (N)	 57000 (N) scores 1 mark	2
		(iii)	any suitable suggestion; e.g. friction between snow/ground and sledge ground is not level towing rope/direction at an angle to the ground/direction of movement	allow air resistance/drag	1
	(b)	(i)	acceleration = **change** in velocity; time (taken)	in words or in accepted symbols e.g. $a=\dfrac{\Delta v}{t}$ $a=\dfrac{v-u}{t}$ not 's' for 'v'	1
		(ii)	*working must be shown* rearrangement of equation OR substitution; evaluation to at least 2SF; e.g. t= $\dfrac{2.8}{1.5}$ = 1.9 (s)	Calculation of velocity or acceleration scores 1 mark max. allow 1.87 no unit required	2

(c)	(i)	MP1. statement of total distance = area under graph; MP2. any 1 correct distance for a segment of journey; e.g. calculation of distance during acceleration (½ x 3.25x 2.5 = 4.1 m) calculation of distance during constant speed (3.25x 8 = 26 m) calculation of distance during deceleration (½ x 3.25x 4 = 6.5 m) MP3. correct total distance 36.6 (m);	may be assumed by an attempt at sum of the areas allow range of 36-37 (m)	3
	(ii)	(average) speed = $\dfrac{\text{distance (moved)}}{\text{time (taken)}}$;	in words or in accepted symbols e.g. v=s/t condone s=d/t	1
	(iii)	substitution; evaluation; e.g. 36.6/14.5 2.52 (m/s)	allow ecf from (c)(i) for distance ignore s.f. allow answers that round to 2.5 or 2.6 (m/s)	2

Total 13 marks

Question number			Answer	Notes	Marks
8	(a)	(i)	-273 (°C)		1
		(ii)	any 3 of: MP1. idea of (continuous) **random** motion; MP2. collide/impacts/eq; MP3. with walls (of container); MP4. idea that force is produced (by bombarding molecules); MP5. idea of pressure as force on an area;	bombard, hit, impact upon allow Newton's 2nd Law momentum argument p=F/A	3
	(b)	(i)	pressure = density x g x height;	in words or accepted symbols e.g. p = ρgh not 'gravity' for g	1
		(ii)	use of correct pressure; substitution; rearrangement; evaluation; e.g. 104-100 = 4 kPa 4000 =1000 x 10 x h h = 4000/(1000x10) 0.4 (m)	sub and rearrange in either order deduct 1 mark for each of the following: • conversion error from kPa to Pa • use of wrong pressure e.g. use of 104 or 100 kPa and not changing to Pa gets 2 marks max	4

Total 9 marks

Question number			Answer	Notes	Marks
9	(a)	(i)	MP1. minimum of 3 straight lines evenly spaced (by eye); MP2. at least one arrow showing direction from N to S;	ignore field outside the rectangle defined by the magnets	2
	(b)	(i)	any sensible suggestion; e.g. otherwise large heat loss/overheating thin wire would melt to reduce the resistance so it does not sag/bend/eq		1
		(ii)	any 3 of: MP1. magnetic field of wire/current; MP2. interacts with; MP3. magnetic field of (2) magnets; MP4. Fleming's left hand rule;	For MP1 and MP3 must refer to what is causing the magnetic field	3
		(iii)	MP1. reduce current; MP2. use less powerful magnets/greater separation of magnets;	ACCEPT Use thinner wire, switch off, reduce voltage not 'smaller' magnets allow rotate the wire so that the angle with the magnetic field is smaller	2

Total 8 marks

Question number		Answer	Notes	Marks
10	(a)	Venus;		1
	(b)	because it has the largest mass;	ignore references to diameter/size	1
	(c) (i)	density = $\dfrac{mass}{volume}$;	in words or accepted symbols e.g. ρ = m/V condone D for density	1
	(ii)	changing diameter to radius; substitution; evaluation; e.g. $\rho = \dfrac{100 \times 10^{24}}{[4/3 \times 3.14 \times 25000^3]}$ 1.5×10^{12} (kg/km^3)	if diameter used instead of radius (gives 1.9×10^{11}) max 2 -1 for POT error allow answers rounding down to 1.5×10^{12} (kg/km^3)	3
	(d)	change of time into seconds (seen anywhere); use of orbital radius as 150×10^6 km; evaluation; e.g. $v = \dfrac{2 \times 3.14 \times (150 \times 10^6)}{365 \times 24 \times 60 \times 60}$ 29.9 (km/s)	no mark for eqn as this is given allow 30 (km/s)	3
	(e)	an evaluation to include 3 of: MP1. identifying period as time of orbit; MP2. correct **detail** of why statement is right/wrong; MP3. correct use of data comparing 2 planets; MP4. period depends on distance from the Sun;	can refer to either mass or diameter of planet for 'size' must name planets must name planets	3

Total 12 marks

Question number			Answer	Notes	Marks
11			any **six** points from the following 2 groups:		6
			Relating to energy and position		
			MP1 statement re KE values e.g. KE is zero at top and bottom OR KE is greatest/4J in the middle;		
			MP2 statement re GPE values e.g. GPE is greatest/25J at the top OR GPE is least/5J at the bottom;	allow GPE decreases as the ball moves down	
			MP3 statement re EPE values e.g. EPE is greatest/21J at the bottom OR EPE is least/1J at the top;	allow EPE increases as the ball moves down	
			MP4 the change in GPE/EPE is 20J OR the change in KE is 4J;	allow ball moves through height of 2 metres	
			MP5 change in GPE/EPE > change in KE;		
			MP6 total energy is constant (in all three charts)/eq;		
			Relating to speed and position		
			MP7 in the middle speed is greatest;		
			MP8 in the middle v = 2.8 (m/s);		
			MP9 ball is stationary at the top/bottom;		

Total 6 marks

Question number	Answer	Notes	Marks
12 (a) (i)	<table><tr><td>safety precaution</td><td>needed</td><td>not needed</td></tr><tr><td>not touch the source with bare hands</td><td>(✓)</td><td></td></tr><tr><td>use tongs</td><td>✓</td><td></td></tr><tr><td>wear gloves</td><td></td><td>(✓)</td></tr><tr><td>wear goggles</td><td></td><td>✓</td></tr><tr><td>students sit at least two metres away</td><td>✓</td><td></td></tr><tr><td>wear a lead apron</td><td></td><td>✓</td></tr><tr><td>store source in a lead box</td><td>✓</td><td></td></tr></table> 3 ticks **correct** in first column; 2 ticks correct in second column;	Ignore incorrect ticks in first column (award 1 mark as long as the three correct boxes are ticked)	2
(b) (i)	(because distance is a) controlled variable;	allow idea of fair test/affecting results ignore comments relating to accuracy, reliability	1

(ii)	MP1. idea of background radiation;
	
	MP2. any ONE sensible source;
	    e.g.
	    cosmic rays
	    rocks/Earth/buildings
	    some foodstuffs (coffee)
	    radon
		allow 'sources of radiation all around us'
		allow nuclear weapons testing/disasters
			2

(iii)	MP1. lead;			3
	MP2. idea of best absorber giving lowest count rate;	dependent on MP1		
	MP3. for Ba-133/can't evaluate using Sr-90 data;	dependent on MP1		
(iv)	any 3 of:	no mark for 'I agree with this conclusion /OWTTE' allow stone best absorber for Sr-90		3
	MP1. stone absorbs better than {plastic / wood / paper} for Sr-90/beta;			
	MP2. stone worst absorber for Ba-133/gamma;			
	MP3. use of data to justify MP1 or MP2;	e.g. the count rate for plastic is about half that of stone for Ba-133		
	MP4. may not be worse absorber than paper as paper much thinner/not tested for Ba-133;			
(v)	MP1. beta;	allow 'beta and gamma'		3
	MP2. it's not alpha *because* {alpha would not reach the detector at this distance/ alpha would not go through paper};	allow 'it goes through paper'		
	MP3. it's not gamma *because* gamma is not stopped by metals ;	allow 'it doesn't go through metals' MP2 and MP3 dependent on MP1		
(vi)	reading would be too high/eq;			1
(vii)	idea that count rate needs to be constant during the investigation/ORA;	allow either idea that would not need to replace the source often/ORA; or idea that shorter half-life has higher activity and therefore is more hazardous;		1

Total 16 marks