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Mark Scheme (Results)

Summer 2013

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

Edexcel Level 1/Level 2 Certificate
Physics (KPH0) Paper 1P
Science (Double Award) (KSC0)
Paper 1P

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Question number	Answer	Notes	Marks
1 (a) (i)	B - 1 joule per second (1 J/s)		1
(ii)	C - 1 newton per square metre (1 N/m^2)		1
(b) (i)	A - the direction of a magnetic field		1
(ii)	A - has uniform strength		1
		Total	**4**

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td><table><tr><td>longest wavelength</td><td>⟶</td><td>shortest wavelength</td></tr><tr><td>infrared</td><td>visible (light)</td><td>ultraviolet</td></tr></table></td><td>All three must be correct for the mark

Allow IR for infrared
Allow visible (without light)
Allow UV for ultraviolet</td><td>1</td></tr>
<tr><td>(b)</td><td>Any two of:

Radio (waves);
Microwave(s);
x-rays;
Gamma (rays);</td><td>Allow T-rays

γ - rays or γ</td><td>2</td></tr>
<tr><td>(c) (i)</td><td>Any two of

1. killing bacteria e.g. in water purification OR in hand driers in toilets OR sterilisation of equipment;

2. medical uses e.g. setting dental fillings OR detection of bacteria OR treatment of (named) skin diseases;

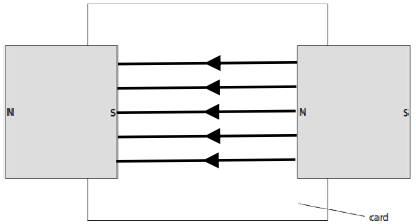
3. security markings e.g. for checking banknotes;

4. fluorescent lamp e.g. tanning machines, black-light, detecting blood /other body fluids;

5. data reading e.g. blu-ray devices</td><td>Must be specific, ignore vague answers such as ‘used in a hospital’, ’for CSI’

Allow other sensible suggestions for each MP</td><td>2</td></tr>
</table>

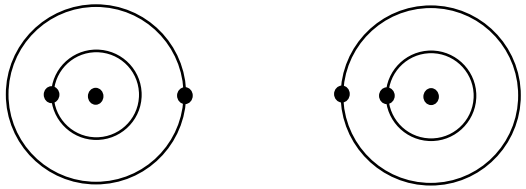
Question number	Answer	Notes	Marks
2 (ii)	Any two of 1. cell damage e.g. (skin) cancer, cell mutation; 2. Sunburn/skin aging; 3. eye damage e.g. cataracts, blindness;	Must be specific, do not allow vague answers such as 'causes burns' 'danger to skin' 'burns skin'	2
		Total	**7**

Question number	Answer	Notes	Marks
3 (a) (i)	1. at least one arrow showing direction from N to S (right to left); 2. one **horizontal** line between shaded faces; 3. minimum of 3 horizontal lines evenly spaced (by eye); e.g.  	Reject contradictory arrows For MP2,3 ignore any lines outside the rectangle between the shaded faces allow field lines that almost touch the faces	3
(ii)	1. a method **to show shape**; e.g. use compass(es) Use of iron **filings/ powder** 2. Use of (plotting) compass **to show direction**; 3. a further **method detail**; e.g. mark card /move compass/multiple compasses idea of another line or lines added sprinkle (iron filings evenly on card) tap card (to distribute iron filings)	**Ignore** Position of card /Cling film **Ignore** pour/place/ drop /spill	3

Question number	Answer	Notes	Marks
(b)	any **two** of 1. (Fleming's) Left Hand (Motor) rule OR (current generates) magnetic field **around** the rod; 2. Idea that there is a force (on rod); 3. (translational) movement of rod; 4. Correct direction given, i.e. out of the paper;	allow LHM rule/LH rule/motor rule/ motor effect **Ignore** upwards rod is magnetic	2
		Total	**8**

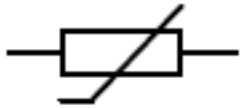
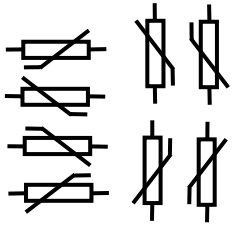
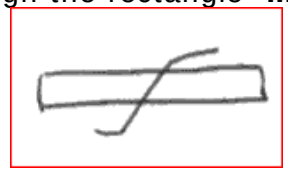
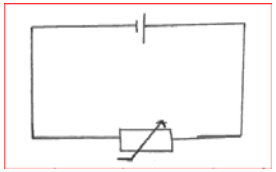
Question number	Answer	Notes	Marks
4 (a)	Student is right / wrong = no mark Any **two** of 1. Balance might not be levelled; 2. zero error; 3. mass could be worn; 4. mass could be mislabelled; 5. value could be within acceptable accuracy of the mass (e.g. ± 2g); 6. battery of scales is running down/eq;	Ignore idea of anomaly accept tare, reset error rusty inaccurate marking it rounds to 500 g	2
(b)	Any **two** of MP1 - Measure/find volume; MP2 - Using a displacement method; MP3 - A sensible experimental **precaution** e.g. tied to thread OR awareness of meniscus OR repeat readings OR average; *PLUS* Any **one** of MP4 - Formula to use (density = mass ÷ volume); MP5 - A correct density unit mentioned (e.g. kg/m^3);	For MP2 Ignore calculation of volume geometry	3
		Total	**5**

Question number	Answer	Notes	Marks
5	Any **5** of 1. determine / measure distance; 2. determine / measure time; 3. Appropriate measuring instrument for distance **OR** time; 4. Use a suitable distance /count laps (of known length); 5. repeat experiment/**calculate** average; 6. Speed = distance / time OR finding the gradient ; 7. Suitable experimental precaution, e.g. reaction time considered, consistent height on track, time from a predetermined consistent point;	Allow idea of published track length use of split times e.g. 1 lap or circuit Ignore 'human error'	5
		Total	**5**

Question number	Answer	Notes	Marks
6 (a)	D – the Sun		1
(b) (i)	Substitution; Calculation; speed = $\frac{2 \times \pi \times 250\,000\,000}{690}$ = 2 300 000 (km/day) (correct to 2SF)	If answer given to more than 2SF, then allow range of 2 275 000 → 2 280 000 max 1 for POT error in bald answer	2
(ii)	Any two of 1. Idea of different speeds; 2. idea of different orbits /radii; 3. Idea of variable relative motion, e.g. both on the same side of the Sun and then on opposite sides of the Sun; 4. Appropriate calculation e.g. difference or sum of radii, attempt to calculate speed of Earth; e.g. Diagram showing understanding of MP2 and MP3  Earth Sun Mars Mars Earth Sun	**Accept** appropriate labelled diagrams **Allow** for one mark: elliptical if no other mark scored e,g, orbit of Mars is more elliptical than Earth's **ignore** Mars labelled inside Earth's orbit	2

Question number	Answer	Notes	Marks
6 (c) (i)	Working;; e.g. 300 000 = $\frac{170\ 000\ 000}{t}$ 1 working mark (sub ONLY) t = $\frac{170\ 000\ 000}{300\ 000}$ both working marks (sub AND rearrange) Calculation; e.g. = 570 (566.7) (s) 1 mark (ans to > 1 SF)	'show that' question, working must be shown for full marks REVERSE CALCS: maximum mark =2 (correct calc plus a comparison statement e.g. 283 333 ≡ 300 000 180 000 000 ≡ 170 000 000) Allow (without the subject of the equation) for 2 marks, $\frac{170\ 000\ 000}{300\ 000}$	3

Question number	Answer	Notes	Marks
6 (c) (ii)	Any **two** of 1. IDEA of HOW THE LOW SPEED AFFECTS DRIVING; **low speed** reduces stopping distance **low speed** helps to avoid obstacle 2. IDEA of THE EFFECT OF LOW SPEED ON COLLISION; momentum /low speed / low (kinetic) energy reduces damage if in collision 3. IDEA of WHAT THE TIME DELAY DOES; **time delay** affecting reaction time / stopping distance / steering 4. IDEA of WHAT THE TIME (DELAY) IS; it takes a **long** time to get the signal (the communication delay is) ≈ **1200** (s) (we see images which are) **600s** delayed light and radio waves travel at the same speed in a vacuum	Allow idea that rover could travel up to 48 m between commands RA ignore better photos/detail of the planet /eq	2
		Total	**10**

Question number	Answer	Notes	Marks
7 (a)	 Symbol can be in any orientation, e.g. 	the line through the rectangle **must** be correct  =0 Ignore the size Ignore the rest of the circuit e.g.  =0 as the line through is incorrect Allow without the connection leads  =1	1
(b) (i)	Voltage = current x resistance;	Allow V = IR Allow rearrangements ignore a bald 'triangle'	1
(ii)	Convert milliamps to amps OR kilo-ohms to ohms; Substitution into *correct* equation & rearrangement; Calculation to greater than 1SF; 2.6 mA = 0.0026 A (R) = $\frac{13.2}{0.0026}$ = 5077 (Ω)	'show that' question, working must be shown for full mark Allow 5080, 5076 (truncation) 5.080 with working is worth 2 marks 5.08 with no working is worth 1 mark	3

Question number	Answer	Notes	Marks
7 (c)	Any **five** of *ABOUT A* 1. Resistance of A decreases with temperature; 2. For A, {largest slope / rate of change} is at lower temperature ORA {smallest slope /rate of change} is at higher temperature; 3. A is a thermistor (ntc); *ABOUT B* 4. Resistance of B increases with temperature; 5. For B, {largest slope / rate of change} is at higher temperature(s) ORA {smallest slope /rate of change} is at lower temperature; 6. For B, resistance is constant below 50 °C; *ABOUT BOTH* 7. More results for B/ fewer results for A; 8. stated both relationships are non-linear; 9. Range of (temperature/resistance) values for both is similar; 10. data comparison e.g. both have the same resistance at 80 °C;	**Accept** • (MP1) for A, when the temperature is low, the resistance is high, ORA • (MP4) for B, when the temperature is low, the resistance is low, ORA **Allow** component B is a ptc thermistor ORA Up to 60 °C **Ignore:** inversely proportional positive/negative correlation Do **not** take implication of MP8 when MP 1,2,4,5 is given	5
		Total	**10**

Question number	Answer	Notes	Marks
8 (a) (i)	work done = force x distance moved ;	Accept W = F x d Allow rearrangements do not accept eqn in units only	1
(ii)	Substitution into correct equation; Calculation; 170 x 110 19 000 (J)	Accept **18 700** (J)	2
(iii)	exactly same as their answer to (ii);		1

Question number	Answer	Notes	Marks
8 (b) (i)	KE = ½mv^2	Accept word equation	1
(ii)	addition of masses before OR addition of energies after; Substitution into correct equation; Calculation; 1650 + 950 = 2600 (OR 436 425 + 251 275 = 687 700) ½ x 2600 x 23^2 688 000	Accept for 1 mark - either 436 000 or 251 000 accept for 2 marks - both 436 000 and 251 000 Accept for 3 marks- 687 700	3
(c)	Any **three** of 1. idea that mass and acceleration are inversely related; 2. Idea that (total) mass is less; 3. Idea of less (air) resistance / friction; 4. Idea of less work done/less energy used; 5. Idea of amount work related to amount of (chemical) energy from fuel;	allow F = m x a mentioned weight for mass drag doesn't have to use energy to pull the caravan	3
		Total	**11**

Question number	Answer	Notes	Marks
9 (a)	Any two of 1. ruler has a **mm** scale ; 2. idea of inappropriate precision; 3. paper is (very) thin;	**ignore** vague statements e.g. the ruler is too big **allow** scale is too big paper is thinner than 1 **mm**	2
(b) (i)	C 0.1 mm		1
(ii)	Any two of 1. parallax error; 2. gap left between ruler and paper; 3. ruler not perpendicular; 4. zero error;	**allow** • misreading or inaccurate reading of the ruler • damaged ruler • top sheet not flat **ignore** air gaps between sheets folded paper miscounting sheets different sizes of paper incorrect recording of measurements need for more precise instrument human error	2

Question number	Answer	Notes	Marks
(c) (i)	An explanation including any 2 of	ignore idea that the forces are acting at different points on the plane	2
		allow	
	1. acceleration needs an unbalanced force;	Newton I or Newton II unbalanced forces cause acceleration /deceleration / change of *velocity*	
		flying straight or not changing speed /direction	
	2. (constant velocity means) the aeroplane is not accelerating;		
		'no resultant force'	
	3. idea of absence of unbalanced/overall force;	statement that there is a suitable pair of named balanced forces	
(ii)	weight arrow vertically down; lift arrow upwards; drag arrow to the left;	allow labelled arrows anywhere on the diagram vertical to 45deg to the right inside the angle of the plane wings	3
(iii)	lost as (/dissipated to) heat, sound etc	**allow** lost to the surroundings/air absorbed by surroundings/air i**gnore** kinetic energy 'other types of energy'	1
		Total	**11**

Question number	Answer	Notes	Marks
10 (a) (i)	42 (m/s)	Allow range 42 - 43	1
(ii)	Attempt to calculate slope; Answer; Unit; 42 ÷ 15 2.8 m/s^2	Allow value from (i) e.g. 43 m/s → 2.9 m/s^2 42.5 →2.83 m/s^2 45 → 3 m/s^2 not 42/120 allow 42/20	3
(iii)	Attempt to calculate an area under graph line; Appropriate further working (e.g. adding areas); Answer; (½ x 15 x 42) + (80 x 42) + (½ x 25 x 42) 315 + 3360 + 525 4200 (m)	Allow value from (i) e.g. 43 m/s → 4300 m first 2 MP may be gained using the trapezium method, i.e. 42 x (120+80)/2 Bald correct answer scores 3	3

Question number	Answer	Notes	Marks
(b)	Any **three** from 1. Stopping distance affected by speed or mass; 2. For faster plane, stopping distance greater/ runway too short ; 3. for heavier plane stopping distance greater/ runway too short; 4. Attempt to calculate stopping distance from graph; 5. Data shows most/all of runway already used;	ignore time = 500/40 Allow a momentum argument for MP1, 2, 3	3
		Total	**10**

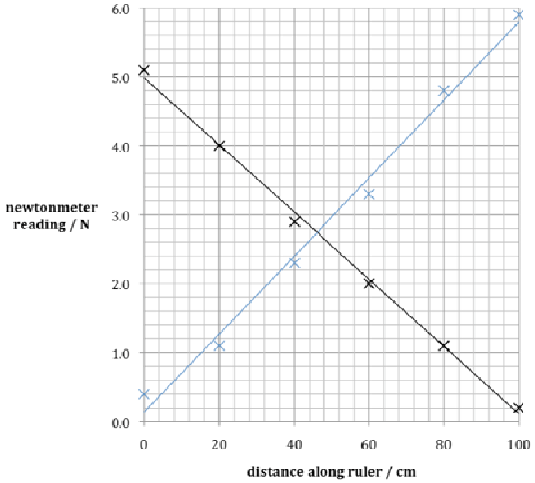
Question number	Answer	Notes	Marks
11 (a)	Idea of (correct) change of speed OR wavelength; (Refractive) index / (optical) density of glass > that of air (ORA);	Allow for 1 mark speed slower in glass OR wavelength shorter in glass (ORA) allow RI, n for refractive index	2
(b) (i)	sin c = 1/n ;	Allow rearrangements (n = 1/sin c) in words (incl critical angle)	1

Question number	Answer	Notes	Marks
11 (ii)	(n=) 1/sin 43 OR sin 43° = 0.682 ; n = 1.47 (≈ 1.5) ;	(0.68199836) (1.466279) Refractive index must be shown to > 2 sig fig Allow truncated values Reverse calculation can score 1 mark Reverse calculation with comparison can score both marks Bald answer can score 1 mark	1 2
(iii)	Any **three** of 1. larger RI means smaller c ; 2. TIR when **i>c;** 3. for diamond larg**er** range of angles for TIR ; 4. Some appropriate calculation, e.g. for diamond c = 25°; 5. 43° to 90° for TIR in opal;	**allow** c is smaller in diamond TIR happens at angles **smaller than** in opal/43° (1/2.4 = 0.417 → c=24.6°) Accept for 2 marks **25° to 90° for TIR in diamond; (MP2,4)** **Ignore** more of the rays going TIR (repeat of stem) diamond has a higher RI than opal	3
		Total	**8**

Question number	Answer	Notes	Marks
12 (a) (i)	<table><tr><th>Isotope</th><th>Proton number</th><th>Neutron number</th></tr><tr><td>Uranium-234</td><td>92</td><td>142</td></tr><tr><td>Uranium-235</td><td>92</td><td>143</td></tr><tr><td>Uranium-238</td><td>92</td><td>146</td></tr></table> 92 as shown; 146 as show;	**Reject** for the relevant mark	2
(ii)	Time taken; and either of • For **half** of (radioactive) nuclei / atoms /isotope to decay; For (radio)activity to halve;	‘half the time’ particles molecules ‘break down’ ‘reactivity’ nucleus halve in mass to completely/fully decay	2
(iii)	any **one** from: • Other isotopes have decayed more quickly; • It has the long**est** half-life;	Allow how long it takes Allow • reverse arguments • comparative e.g. longer rather than longest Ignore • number of neutrons purity /concentration	1

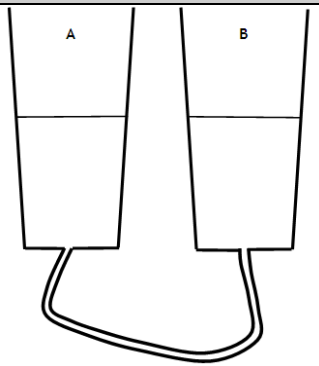
Question number	Answer	Notes	Marks
12 (b)	any **three** from 1. Neutrons; 2. (product) nucl**ei**/a named nucleus; 3. **Appropriate** qualification of **either** term above(DOP); 4. gamma (radiation)/thermal energy e.g. of MP3 neutrons - 2, 3, fast, high energy nuclei – daughter, lighter, e.g. for MP2 allowed nuclei include : krypton, barium, xenon,	 Allow two correct named nuclei as MP2 & MP3 **Ignore** extra as a qualifier for neutrons helium alpha beta atoms daughter atoms/cells	3
(c) (i)	Any one of to slow down neutrons/eq; to increase rate of fission; to increase absorption of neutrons by uranium/fuel;	allow reduce the (kinetic) energy of neutrons	1
(ii)	Any two of 1. rate of reaction increases; 2. fewer neutrons absorbed by control rod OR more neutrons collide with uranium; 3. temperature <u>increases</u>;	allow rate of fission increases control rods absorb neutrons <u>more</u> heat released (need for comparative) ignore risk of explosion	2

Question number	Answer	Notes	Marks
12 (d)	Any **five** of the following ideas *facts about radioactivity* 1. idea of harmful nature of radiation / danger to life; 2. high (activity) levels; 3. long half-life / half-lives; *consequences* 4. difficulties for (emergency) workers to access the area, e.g. short safe working times / need for protective clothing; 5. (requirement for) special handling equipment OR difficulty in removing material; 6. idea of extensive time OR distance (exclusion/hazardous) zone; *environmental effects local and distant* 7. idea of radioactive material mixing with the local environment e.g. soil, plants, water, air; idea of furth**er** /more distant spreading of material e.g. by fire, wind, water;	**Ignore** repeat of the stem, i.e. radioactive material has been spread into the surrounding area can't be seen **allow** MP1 toxic, can kill, causes mutation, ionises cells MP5 a lot of (contaminated) material to deal with MP6 still radioactive after a long time takes a long time to go away	5
		Total	**16**

Question number	Answer	Notes	Marks
13 (a) (i)	A – distance A		1
(ii)	D – force D		1
(b) (i)	Force (C) in N; or Force in newtons;	Allow: Reading from newton-meter in N	1
(ii)	Plotting ;; Line of best fit;  0 5.1 20 4.0 40 2.9 60 2.0 80 1.1 100 0.2	To nearest ½ square, penalise errors up to two marks Suited to candidate's plotting (allow a smooth curve) no double lines judge LoBF by balance of points about the line	3
(iii)	Reading from graph to ± 1 cm; e.g. 46	To nearest ½ small square	1

Question number	Answer	Notes	Marks
13 (c)	weight of ruler;	Accept other valid reasons allow force for weight ignore 'it's got a force acting' 'because of gravity'	1
		Total	**8**

Question number	Answer	Notes	Marks
14 (a) (i)	pressure difference = height x density x g	Accept P = hρg P= hdg	1
(ii)	Substitution into correct equation; Calculation; 0.91 x 1000 x 10 9100 Pa	correct answer with no working scores 2 marks Accept: • 9.1 kPa • 8918 Pa (from *g* = 9.8 m/s^2) • 8927 Pa (from *g* = 9.81 m/s^2) • h in cm / 910 000 Pa for a max of 1	2

Question number	Answer	Notes	Marks
14 (b) (i)	 the water level is the same on both sides	allow some wobbles on the B side area shaded	1
(ii)	Any **three** of the following ideas 1. pressure difference (relating to flow); 2. pressure equality (relating to flow ending); 3. reference to relevant pressure equation ; e.g. pressure causes force on water, pressure = force / area pressure = $h\rho g$; 4. (more) gravitational potential energy (in A) /ORA; (fluid) <u>pressure</u> acts in all directions;	Allow force or weight instead of pressure for either MP1 OR MP2 but not both MP3 allow 'pressure pushes water' 'height difference pushes water'	3
		Total	**7**
		Total for paper	**120**

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