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# Mark Scheme (Results)

## June 2014

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

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

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 1 (a) (i) | B; | | 1 |
| (ii) | A; | | 1 |
| (iii) | Similarity:-<br>any wave property e.g. transfer energy, reflection, refraction, vibration;<br><br>Difference:-<br>any one of<br>• longitudinal particles oscillate in {same direction/ parallel to} the direction of travel;<br>• transverse {particles oscillates/vibration} at right angles to the direction of travel; | Allow<br>diffraction<br>carry energy<br><br>Allow<br>• direction of energy transfer for direction of travel<br>• only transverse waves can be polarised<br>• transverse waves cannot travel through a liquid<br><br>Ignore<br>mention of vacuum/ medium | 1<br><br>1 |

(b)

| circle the mistake in this sentence | the correct word(s) is |
|---|---|
| They all travel at $3 \times 10^2$ m/s in a vacuum. | $10^8$<br>GIVEN |
| Sound waves are electromagnetic. | any of<br>radio, micro(wave), infrared (IR), visible, ultraviolet (UV), X-ray or gamma |
| Infra-red waves are the most harmful to people. | gamma |
| Gamma waves are used for heating up food. | micro(waves)/ Infrared (IR) |
| *Radio* waves have the highest frequency. | Gamma (γ) |
| *Gamma* waves have a very long wavelength. | radio (waves) |

each line for 1 mark;;;;;

5

(Total for Question 1 = 9 marks)

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 2 a i | 96 000 000;<br>matching unit e.g. Hz; | allow 96 x$10^6$<br>Allow for 2 marks<br>96 MHz<br>96 000 kHz | 1<br>1 |
| ii | Idea that plaque vibrates also; | Allow<br>shakes plaque free<br>breaks plaque up<br><br>Ignore ideas of physical contact, e.g.:<br>hits plaque<br>knocks plaque off | 1 |
| iii | One of<br>to clean out the **debris** / eq;<br>to cool the tip / eq ;<br>to reduce damage to the tooth/eq; | allow<br>wash away<br>ignore unqualified 'to clean' | 1 |

GradeMax

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|---|---|---|---|---|
| b | i | B reflected ; | | 1 |
| | ii | wave speed = frequency x wavelength; | Allow rearrangements and standard abbreviations and symbols<br>e.g. frequency = speed /wavelength<br>v = f x λ etc | 1 |
| | iii | rearranged equation ;<br>substitution;<br>evaluation;<br>e.g.<br>f= v/λ<br>(f =) 1540 / 0.00044<br>3.5 (MHz) | rearrange and sub in either order<br><br>allow a power of ten (POT) error for 2 marks<br><br>allow matching unit<br>e.g.<br>3500 kHz | 3 |

| | | | |
|---|---|---|---|
| (c) | Any TWO from<br>MP1 US is longitudinal wave<br>OR<br>MP1 UV is transverse wave;<br><br>MP2 US needs a medium;<br>MP3 UV an electromagnetic wave;<br><br>MP4 UV has (much) higher frequency than US/ RA;<br><br>MP5 US has a lower speed than UV;<br>MP6 UV has same speed as light; | Care- avoid giving two marks for MP1<br><br>allow equivalent statement about λ<br>speed of ~300 m/s (in air)<br>speed of $3x10^8$ m/s<br><br>Ignore statements about harmful effects | 2 |

(Total for Question 2 = 11 marks)

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 3 (a) (i) | sub into E = I x V x t;<br>evaluation;<br>rounding to 2SF;<br>e.g.<br>(E=) 2.1 x 1.5 x 12<br>37.8 (J)<br>38 (J) | <br><br><br><br><br>Correct answer without working gains 3 marks | 3 |
| (ii) | GPE = m x g x h ; | accept:<br>• word equations and rearrangements<br>do not accept:<br>• gravity for g<br>• 10 for g<br>• a 'units' only eqn | 1 |
| (iii) | sub into eqn;<br>evaluation;<br><br>e.g. (GPE=) 0.13 x10 x 0.63<br>0.82 (J) | no POT error as eqn has 'g'<br><br><br>0.819 (J)<br>allow 0.802 (J) ( g as 9.81) | 2 |
| (iv) | any TWO from:<br>MP1 energy 'lost' as heat and/or sound;<br>MP2 mass has gained KE;<br>MP3 mass of string has been ignored / eq;<br>MP4 motor not 100% efficient; | <br><br><br>allow eqn | 2 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 3 (b) | Any FOUR from:<br><br>MP1. Current in <u>coil</u> ;<br><br>MP2. (Creates) magnetic field (around the wires of the coil);<br><br>MP3. Interaction of (this) field with that of (permanent) magnets;<br><br>MP4. There is a force on the wire(of coil);<br><br>MP5. Reference to left hand rule;<br><br>MP6. force up on one side and down on other side;<br><br>MP7. Idea that commutator reverses current (every half turn); | allow credit for points shown labelled diagram<br><br>current in circuit is not enough<br>coil becomes an electromagnet<br><br>can be shown on diagram<br>idea of catapult field<br><br>reference to moment/turning effect on the coil | 4 |

(Total for Question 3 = 12 marks)

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 4. (a) (i) | change of direction of a wave (as it changes from 1 medium to another); | allow definition in terms of change of speed<br>condone 'bending of light' | 1 |
| (ii) | MP1. right angle by eye;<br>MP2. incident angle marked;<br>MP3. incident angle value in range 31º to 34º; | allow normal labelled with right angle (90º or symbol)<br>Give 2 marks (MP2 and MP3) for answer in range without a marked incident angle | 3 |

GradeMax

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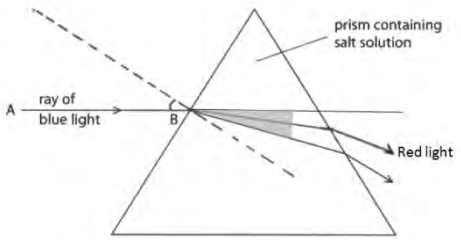
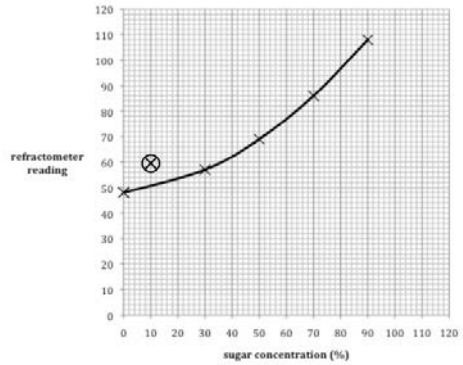
|---|---|---|---|
| iii |  <br>MP1. $r_r > r_b$ ;<br><br>MP2. $r_r < i$ ;<br><br>MP3. less refraction than for blue light on emergence; | red line above blue line inside prism<br>refraction at first surface (inside grey area)<br><br>exit rays diverge downwards | 3 |

| | | | |
|---|---|---|---|
| iv | what happens inside the prism<br>ONE mark from:-<br>MP1. (blue light will) refract more (at the first surface);<br>MP2. it will be nearer the normal;<br>MP3. 'r' will be smaller;<br><br>what happens on emergence:-<br>ONE mark from:-<br>MP4. it will bend even more;<br>MP5. so larger deviation than previously; | allow for MP1<br><br>it will go slower; | 2 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 4 b i |  <br>**Sugar concentration (%)** / **Refractometer reading**<br>0 / 48<br>10 / 60<br>30 / 57<br>50 / 69<br>70 / 86<br>90 / 108<br>axes labelled with units;<br>scales correct and linear to cover at least half the grid on one of the axes;<br>points;;<br>(-1 for each incorrect point to a maximum of 2)<br>curve of best fit drawn; | | 5 |

| | | | |
|---|---|---|---|
| (ii) | point 10, 60 circled;<br>(10,)50; | <br>allow 49-52 | 1<br>1 |
| (iii) | 63 / ans from candidates graph; | <br>ans in range 62-66 | 1 |
| (iv) | Any two from<br>• pattern sentence / positive correlation / positive slope;<br>• gradient changes/nonlinearity discussed;<br>• not through the origin; | <br>as one increases the other increases<br>allow<br>• refractometer readings increase faster than % sugar concentration<br>• attempted mathematical description e.g. exponential or similar | 2 |

(Total for Question 4 = 19 marks)

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 5 (a) | any two from :<br>a balance/scales;<br>metre rule or measuring tape;<br>stopwatch or stop-clock; | <br>allow newtonmeter | 2 |
| (b) | dependent = time (taken for fall); | accept speed (of cupcake cases) | 2 |
| | independent = mass (of cupcake cases); | accept number/weight (of cupcake cases) | |
| (c) | Any ONE of<br>• (constant) height;<br>• still air/no (cross) wind;<br>• from rest/zero force at launch;<br>• identical (cupcake) cases; | | 1 |
| (d) | time in s;<br>mass in g; | accept in either order<br>accept<br>mass in kg<br>weight in N<br>number of cupcake cases in numbers/no units | 2 |

| | | | |
|---|---|---|---|
| (e) | Any one of<br>• detail of any sensible and valid procedure;<br>e.g. repeat readings for time and then average readings<br>• detail of more suitable conditions<br>e.g. measure over a larger fall<br>work indoors/reduce draughts ; | allow<br>more accurate timing methods; | 1 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 5(f) | down arrow labelled weight; | allow<br>gravitational force/pull<br>ignore 'gravity' | 2 |
| (i) | up arrow labelled drag; | allow<br>air resistance<br>accept friction, upthrust<br>ignore lift | |
| (ii) | any three from<br><br>MP1. idea of **unbalanced** force;<br>e.g. at the start, the only force is weight<br>part way down, the weight is greater than the drag<br>MP2. (this unbalanced) force causes acceleration;<br>MP3. idea of balanced forces near the bottom;<br>e.g. near the bottom the forces are equal<br>MP4. therefore no acceleration;<br>e.g. it reaches terminal velocity | do not credit repeat of the diagram above<br><br>there is no upward force at the start<br><br>weight equals drag | 3 |

(Total for Question 5 = 13 marks)

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 6 (a) | D americium-238; | | 1 |
| (b) (i) | either order:<br>uranium -234, uranium-235; | accept symbols but not just the numbers | 1 |
| (ii) | either order:<br>plutonium-238, americium-238 | accept symbols | 1 |
| (iii) | either order:<br>uranium-235, americium-238 | accept symbols | 1 |
| (c) (i) | will decay/ emit radioactive particles (or gamma); | allow<br>named particles<br>'they are radioactive'<br>'they emit radioactivity' | 3 |

| | | | |
|---|---|---|---|
| (ii) | time taken;<br><br>and either<br>• For **half** of (radioactive) nuclei / atoms /isotope to decay;<br>OR<br>• For (radio)activity to halve; | allow<br>how long it takes<br><br>Ignore<br>particles /molecules<br>'break down'<br>'reactivity'<br><br>**Reject** for ONE mark ideas of<br>• half of a time<br>• half a nucleus/ an atom<br>• complete decay | |

GradeMax

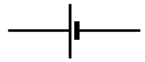
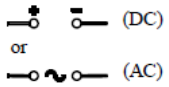
| Question number | Answer | Notes | Marks |
|---|---|---|---|
| (d) (i) | $^{238}_{94}Pu \rightarrow {}^{4}_{2}\alpha + {}^{234}_{92}X + {}^{0}_{0}\gamma$<br><br>one mark for alpha correct;<br>one mark for gamma correct;<br>one line for **balancing** the top line; NB ECF from alpha and or gamma<br>one mark for **balancing** the bottom line; NB ECF from alpha and or gamma | | 4 |
| (ii) | Uranium; | | 1 |
| (e) (i) | proton number / atomic number decreases by 1;<br><br>nucleon number /mass number remains unchanged (as p and n have same mass); | | 2 |
| (ii) | plutonium -238; | condone plutonium without nucleon number | 1 |

(Total for Question 6 = 15 marks)

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 7 (a) (i) | can all be switched separately ;<br>others stay alight when 1 bulb blows/eq; | | 2 |
| (ii) | One of -<br>to prevent overheating in the circuit / appliance/ wiring/ lamps;<br>to switch off the circuit;<br>to prevent current exceeding a certain value; | IGNORE live wire/plug | 1 |
| (iii) | (if or when) current exceeds stated value/current too high;<br>the fuse (over heats and) melts;<br><br>this breaks the circuit/stops the current/ turns the circuit off; | <br><br>allow "fuse blows"<br>ignore burns<br>ignore<br>'stops the electricity' | 3 |

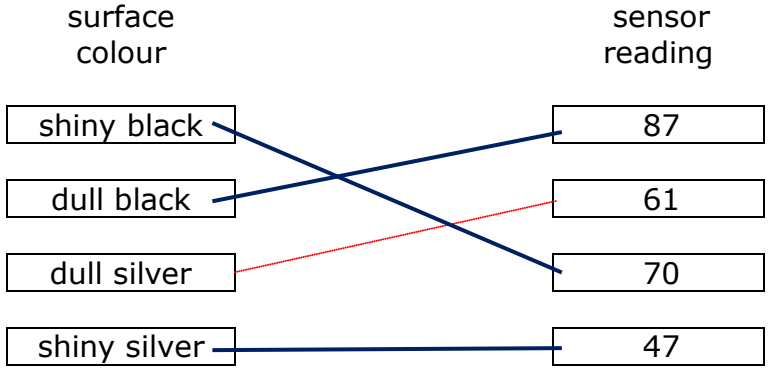
| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 7 (b) (i) | P= I x V ; | Allow<br>• rearrangements<br>• standard abbreviations<br>• equation in words | 1 |
| (ii) | rearrangement;<br>sub into equation;<br>evaluation;<br>e.g.<br>I= P/V<br>=250 /230<br>=1.1 (A) | rearrange and sub in either order<br>allow a power of ten (POT) error for -1<br><br>1.09 (A) | 3 |
| (iii) | value 3 (A);<br>fuse (value should only be) a little bigger than the current; | Allow ecf from bii | 2 |
| (iv) | In ANY order<br>Any two from:-<br>MP1. circuit breakers are resettable/eq;<br>MP2. circuit breakers work instantly/ fuses do not work instantly;<br>MP3. doesn't require earth wire;<br>MP4. Circuit breakers are more sensitive; | | 2 |
| (c) | D | | 1 |

(Total for Question 7 = 15 marks)

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 8 (a) (i) | symbols for circuit components;<br>• cell, battery, 'box' labelled power supply, a.c. symbol, component ends for battery<br>• ammeter or milliammeter<br>• thermistor<br> <br>a series circuit; | Acceptable power supply symbols<br>  <br> <br>  <br><br>ignore all other symbols | 2 |
| (ii) | voltmeter in parallel with thermistor; | ecf from 'thermistor' in ai | 1 |

| | | | |
|---|---|---|---|
| (iii) | any FIVE from:<br>MP1. measure current at any known/fixed temperature;<br>MP2. measure voltage at any known/fixed temperature;<br>MP3. measure temperature;<br>MP4. vary temp and take new readings ;<br>MP5. idea of allowing temp to equalise between readings;<br>MP6. either change temp by heating water OR start at 100ºC and allow to cool;<br>MP7. either start from ice OR use ice cubes to take temp down below room temp;<br>MP8. calculate V/I;<br>MP9. repetition/averaging (at any stage);<br>MP10. use of stirrer/digital thermometer; | | 5 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 8 (b) (i) | no mark for the choice<br>any valid explanation (dependant on choice of line or curve);<br>e.g.<br>A/curve<br>it fits more points/all the points are closer to the line / eq;<br><br>OR<br>B /straight line<br>it has 4 points above the line, 4 points below the line/eq; | <br><br><br><br>accept<br>theory says it should be a curve<br>the resistance will not be zero at 100 ºC | 1 |
| (ii) | One of the following ideas:-<br>• the new point could be nearer to one line than the other;<br>• the lines are furthest apart at 10ºC; | <br>accept<br>this measurement would give more data | 1 |
| (c) | Any one correct ;<br>All three correct;;<br>L metal wire at constant temperature<br>K diode<br>J filament lamp | | 1 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 9 (a) (i) |  <br>any one correct;<br>all 3 correct;; | | 2 |
| (ii) | (different surfaces) emit heat at different rates/eq; | allow<br>emit different amounts of heat / radiation | 1 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 9 (b) (i) | P = ρ x g x h ; | do not accept:<br>• gravity for g<br>• 10 for g<br>• d for density<br>accept:<br>• word equations and rearrangements<br>• for h allow height<br>depth<br>height difference | 1 |
| (ii) | sub into eqn for P;<br><br>evaluation;<br>unit;<br>e.g.<br>(P=) 1260x10x0.25<br>3150<br>Pa | no POT error as 'g' used<br>allow 9.8(1) for g<br><br><br>1260x9.8x0.25<br>3090<br>allow<br>• $N/m^2$<br>• matching unit e.g. 3.15 kPa | 3 |

| | | | |
|---|---|---|---|
| (iii) | any THREE from:<br>MP1. black absorbs IR/heat;<br>MP2. black heats up more than shiny;<br>MP3. gas particles on black side move faster/get hotter/have more KE/move apart;<br>MP4. pressure on left/black side increases; | Allow RA where appropriate<br><br>allow gas expands<br><br>allow force(/area) for pressure<br><br>ignore: ideas of collisions | 3 |
| (iv) | difference in liquid height is less;<br><br>more difficult/harder to move ; | height goes down less /decrease in h is less<br>allow: argument in terms force /pressure | 2 |

| | | | |
|---|---|---|---|
| (v) | MP1 it will give a bigger temperature (range)/eq;<br>AND<br>DOP a suitable comment<br>e.g.<br>MP2 a larger difference in water level;<br><br>MP3 a larger difference in air volume;<br><br>MP4 a larger difference in (kinetic) energy of air/gas molecules/particles;<br><br>MP5 idea of upper limit to range; | Allow<br>the girl is right<br><br><br>amount of water for water level<br>amount of air for air volume<br>speed of molecules /particles<br><br>water would reach the bulb<br><br>if the second statement is chosen, no marks | 2 |

(Total for Question 9 = 14 marks)

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