GCSE Physics



Required Practical Answer Book

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| **Name:** | **Class:** | **Teacher:** |

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**Required Practical 1: Specific Heat Capacity**

**An investigation to determine the specific heat capacity of one or more materials.**

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| Question 1 | (a)     78 (°C)  *allow****2****marks for correct temperature change ie 22 °C*  *allow****1****mark for correct substitution*  *ie 46 200 = 0.5 × 4200 x θ*  ***or***  *https://app.doublestruck.eu/content/AG_PHS/HTML/M/M16S1H05_files/img01.png*  **3**  (b)     6.4 (W)  *allow****2****marks for an answer that rounds to 6.4*  *allow****1****mark for correct substitution*  *ie 46 200 = P × 7200*  *an answer of 23 000 or 23 100 or 385 gains 1 mark*  **2** |
| Question 2 | (a)     (i)       temperature (increase) and time switched on are directly proportional  *accept the idea of equal increases in time giving equal increases in temperature*  *answers such as:*  *•         as time increases, temperature increases*  *•         positive correlation*  *•         linear relationship*  *•         temperature and time are proportional*  *score****1****mark*  **2**  (ii)     any **one** from:  *“it” refers to the metal block*  •         energy transfer (from the block) to the surroundings  *accept lost for transfer*  *accept air for surroundings*  •         (some) energy used to warm the heater / thermometer (itself)  *accept takes time for heater to warm up*  •         (metal) block is not insulated  **1**  (iii)    15 000  *allow****1****mark for correct substitution, ie 50 × 300 provided no subsequent step shown*  **2**  (b)     lead  *reason only scores if lead is chosen*  **1**  needs least energy to raise temperature by 1°C  *accept needs less energy to heat it (by the same amount)  lowest specific heat capacity is insufficient*  **1** |
| Question 3 | (a)      conduction  **1**  (b)     (i)       there is a bigger temperature difference between the water and the surrounding air  *accept the water is hottest / hotter*  **1**  so the transfer of energy (from hot water) is faster  *accept heat for energy*  *ignore temperature falls the fastest*  **1**  (ii)     120  *allow****1****mark for converting kJ to J correctly, ie 4 032 000*  **or**  correctly calculating temperature fall as 8°C  **or**  allow **2** marks for correct substitution, ie 4 032 000 = m × 4200 × 8  answers of 0.12, 19.2 **or** 16.6 gain **2** marks  answers of 0.019 **or** 0.017 gain **1** mark  **3**  (iii)     water stays hot for longer  **1**  so heater is on for less time  *accept so less energy needed to heat water*  **1**  so cost of the jacket is soon recovered from) lower energy costs / bills  *accept short payback time*  **1** |

**Required Practical 2: Resistance**

**Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the**

**resistance of electrical circuits.**

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| Question 1 | (a)     V = 0.10 × 45  **1**  4.5 (V)  **1**  (b)     R = 12 / 0.10  **1**  total resistance = 120 (Ω)  **1**  R = 120 – 105 = 15 (Ω)  **1**  (c)     (total) resistance decreases  **1**  (so) current increases  **1** |
| Question 2 | (a)     (i)      p.d. is (directly) proportional to current **or** gradient / slope is constant ***or*** the lines show constant resistance  *accept lines are straight / diagonal*  **1**  (ii)     C  *reason only scores if C is chosen*  **1**  for the same p.d. the current is the smallest  *accept lowest gradient****and****the gradient = 1 / R*  **1**  (b)     (i)       ohm  *accept correct symbol Ω  accept an answer written in the table if not given in answer space*  **1**  (ii)     K and L  *reason only scores if both K and L are chosen*  **1**  only length varies  *accept type of metal and the diameter are the same*  **1**  (iii)    measure the resistance of more wires made from different metals  *accept test more (types of) metals measure the resistance of more wires is insufficient  they only use two metals is insufficient*  **1**  (c)     (i)       voltmeter symbol correct and drawn in parallel with the wire https://app.doublestruck.eu/content/AG_PHS/HTML/M/M15S2F07_files/img01.png  *accept voltmeter symbol correct and drawn in parallel with the battery*  **1**  (ii)     correct symbol drawn  https://app.doublestruck.eu/content/AG_PHS/HTML/M/M15S2F07_files/img02.png  *symbol must be rectangular*  **1** |

**Required Practical 3: I-V Characteristics**

**Use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements, including a filament lamp, a diode and a resistor at constant temperature.**

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| Question 1 | (a)     A = battery (of cells)/cells/cell B = thermistor/temperature dependent resistor C = transistor D = LED/light emitting diode E, F, G = resistors  *each for 1 mark*  **5**  (b)     *ideas that*(resistance) falls from 3000 to 200 units – ohms/Ω – referred to at least once  *each for 1 mark*            (*credit quickly at first then more slowly with 2 marks*) (*max 4 for part (b)*)  **4**  (c)     any figure in the range 22 – 26 (inclusive)  *gains 1 mark*  **but**24  *gains 2 marks*  **2** |
| Question 2 | (a)     (i)     correct symbol ringed  https://app.doublestruck.eu/content/AG_PHS/HTML/M/M12S2F04_files/9_img01.png  **1**  (ii)     accept any suggestion that would change light intensity, eg:  •        torch on or off  *accept power of torch*  *do****not****accept watts / wattage of torch*  •        distance between torch and LDR  •        lights in room on or off  •        shadow over the LDR  **1**  (b)     resistance decreases  **1**  from 600 kΩ to 200 kΩ  *accept by 400 kΩ*  **1**  (c)     (i)      no numbers for light intensity **or** light intensity is categoric / a description / not continuous  *not enough results is insufficient*  **1**  (ii)     YES  *mark is for the reason*  both show that resistance increases with decreasing (light) intensity / brightness  *accept they both get the same results / pattern*  **1**  (d)     A circuit that automatically switches outside lights on when it gets dark.  **1** |

**Required Practical 4: Density**

**Use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids.**

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| Question 1 | **Level 3 (5–6 marks):**  Clear and coherent description of both methods including equation needed to calculate density. Steps are logically ordered and could be followed by someone else to obtain valid results.  **Level 2 (3–4 marks):**  Clear description of one method to measure density **or** partial description of both methods. Steps may not be logically ordered.  **Level 1 (1–2 marks):**  Basic description of measurements needed with no indication of how to use them.  **0 marks:**  No relevant content.  **Indicative content**  **For both:**  •        measure mass using a balance  •        calculate density using ρ = m / V  **Metal cube:**  •        measure length of cube’s sides using a ruler  •        calculate volume  **Small statue:**  •        immerse in water  •        measure volume / mass of water displaced  •        volume of water displaced = volume of small statue |
| Question 2 | (a)     range of speeds  **1**  moving in different directions  *accept random motion*  **1**  (b)     internal energy  **1**  (c)     density = mass / volume  **1**  (d)     0.00254 / 0.0141  **1**  0.18  **1**  *accept 0.18 with no working shown for the****2****calculation marks*  kg / m3  **1** |

**Required Practical 5: Force and Extension**

**Investigate the relationship between force and extension for a spring.**

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| Question 1 | (a)     accept any value between 12 (mm) and 13 (mm) inclusive  **1**  (b)     to reduce the error in measuring the extension of the spring  *accept length for extension throughout*  **1**  as the ruler at an angle would make the measured extensions shorter  **1**  (c)     1 (N) to 6 (N)  *accept from 0 (N) to 6 (N)*  **1**  (d)     gives a straight line through the origin  **1**  (e)     any practical technique that would improve the accuracy of length measurement eg  use a set square  **1**  to line up the bottom of the spring with the ruler scale  **or**  attach a horizontal pointer to the bottom of the spring (1)  so that the pointer goes across the ruler scale (1)  **1**  (f)     the spring has been inelastically deformed  **1**  because it went past its limit of proportionality  *accept elastic limit for limit of proportionality*  **1**  *accept it does not go back to its original length when the weights are removed* |
| Question 2 | (a)     (i)     **B** **C**  *either order*  **1**  (ii)     elastic potential (energy)  *accept strain for elastic*  **1**  (b)     (i)     *mark both parts together*  **1**  measured / recorded the length of the spring (and not extension)  *accept measured****A–C****(and not****B–C****)*  *accept did not work out/measure the extension*  extension does not equal zero when force = 0  *accept line should pass through the origin*  **1**  (ii)     point marked at 5.5 (N)  *accept any point between 5.0 and 5.6 inclusive*  **1**  up to that point force and extension are (directly) proportional  *accept it’s at the end of the straight part (of the graph line)*  *accept past that point force and extension are no longer (directly) proportional*  *accept the line starts to curve*  **1**  (c)     1.8  *allow****1****mark for correct substitution, ie 25 x 0.072 provided no subsequent step shown*  *an answer 1800 gains****1****mark*  *an incorrect conversion from mm to m with a subsequent correct calculation gains****1****mark*  **2** |

**Required Practical 6: Acceleration**

**Investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration produced by a constant force.**

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| Question 1 | (a)     It will have a constant speed.  **1**  (b)     distance travelled = speed × time  **1**  (c)     a = 18 − 9   6  **1**  a = 1.5  *allow 1.5 with no working shown for****2****marks*  **1**  (d)     resultant force = mass × acceleration  **1**  (e)     F = (1120+80) × 1.5  **1**  F = 1800 (N)  *allow 1800 with no working shown for****2****marks*  **1**  *accept their 10.3 × 1200 correctly calculated for****2****marks*  (f)     182 − 92 = 2 × 1.5 × s  **1**  s = 182 − 92 / 2 × 1.5  **1**  s = 81 (m)  **1**  *allow 81 (m) with no working shown for****3****marks*  *accept answer using their 10.3 (if not 1.5) correctly calculated for****3****marks*  (g)     **Level 2 (3–4 marks):**  A detailed and coherent explanation is provided. The response makes logical links between clearly identified, relevant points that include references to the numerical factor.  **Level 1 (1–2 marks):**  Simple statements are made. The response may fail to make logical links between the points raised.  **0 marks:**  No relevant content.  **Indicative content**  •        doubling speed increase the kinetic energy  •        kinetic energy increases by a factor of 4  •        work done (by brakes) to stop the car increases  •        work done increases by a factor of 4  •        work done is force × distance and braking force is constant  •        so if work done increases by 4 then the braking distance must increase by 4  **4** |
| Question 2 | (a)     2.75  *allow****1****mark for correct substitution, ie https://app.doublestruck.eu/content/AG_PHS/HTML/M/M12SY2F07_files/image001.png*  ***or****https://app.doublestruck.eu/content/AG_PHS/HTML/M/M12SY2F07_files/image002.png*  *provided no subsequent step shown*  **2**  m/s2  **1**  (b)     driving force increases  **1**  frictional force increases  *accept air resistance / drag for frictional force*  **1**  driving force > frictional force  **1** |

**Required Practical 7: Waves**

**Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements.**

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| Question 1 | (a)     any two successive peaks labelled **W**  *accept any 2 points on same part of adjacent waves correct by eye*  **1**            half ‘height’ of wave labelled **A**  *correct by eye N.B. at least one of the answers must be labelled*  **1**  (b)     0.2  *correct answer with no working = 2 allow 1 mark for s = f x w or correct working i.e., 2 × 0.1 N.B. correct answer from incorrectly recalled relationship = 0*  **2**            m/s (unit)  *independent mark do****not****allow mps****or****mHz*  **1** |
| Question 2 | 1. K   **1**   1. use a metre rule/30 cm ruler to measure across 10 (projected) waves   **1**  and then divide by 10  **1**  accept any practical number of waves number for 10 |

**Required Practical 8: Radiation and Absorption**

**Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface.**

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| Question 1 | (i)      D, C **or**B, in either order, then A  *tick or cross on the A*  **1**  (ii)      matt absorbs energy (better than shiny)  *the converse arguments are acceptable*  **1**            black absorbs energy (better than white)  **1** |
| Question 2 | (i)     *this mark only scores if a correct pair is chosen****and****a          correct reason given*  **A** and **C**  *both required and none other*  **or** **B** and **D**  *both required and none other*  only one (independent) variable **or** different shapes but the same colour  *accept only the shape changes*  **1**  (ii)     **B** radiates heat faster  *converse answer in terms of****A****gains full marks*  **1**  **or** B is a better emitter (of heat)  but B has a smaller (surface) area **or** B has a smaller (surface) area: volume ratio  *allow****2****marks for both lose the same quantity / amount of heat in the same time*  ***or****both have same rate of heat loss*  *allow****1****mark for both lose the same quantity / amount of heat*  **1**  (iii)    any **one** from:  •    transfer a lot of heat (too rapidly)  •    water temperature drops too rapidly  *accept (significantly) more heat will be lost from the first radiator*  •    water too cold for the next radiator  *mention of absorption of heat negates mark*  **1** |
| Question 3 | (a)     dark matt  **1**  light shiny  **1**  (b)     B      A      C  **1**  biggest temperature difference (80 °C)  *dependent on first mark*  **1**  (c)     (i)       (the can that is) dark matt  **1**  best absorber (of infrared radiation)  **1**  (ii)     any **three** from:  •        same area / shape of can  •        surrounding temperature is the same for all cans  •        same surface underneath cans  •        same position in the room  **3** |

**Required Practical 9: Thermal Insulation**

**Investigate the effectiveness of different materials as thermal insulators and the factors that may affect**

**the thermal insulation properties of a material.**

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| Question 1 | (a)      (i)     radiation  **1**  (ii)     traps (small pockets of) air  *do****not****accept it’s an insulator*  *do****not****accept reduces conduction and / or convection*  *do****not****allow it doesn’t allow heat to escape*  **1**  (b)     (i)      bigger temperature difference (between the water and surroundings) at the start (than at the end)  *do****not****accept water is hotter*  **1**  (ii)     starting temperature (of the water)  *accept thickness of fleece*  *do****not****accept same amount of fleece*  *do****not****accept thermometer / can*  *do****not****accept time is the same*  **1**  (iii)    18 (°C)  *correct answer only*  **1**  (iv)     **M**  **1**  smallest temperature drop (after 20 mins)  *cannot score if****M****is not chosen*  *accept it’s the best insulator*  *accept smallest loss in heat*  *accept keeps heat / warmth in for longer*  **1** |
| Question 2 | (a)     (i)      as a source of thermal radiation  *accept heat for thermal radiation*  *accept to act as the Sun*  *do****not****accept sunlight alone*  **1**  (ii)     any **one** from:  •        volume of water  *accept amount for volume*  •        distance between lamp and boiling tube  •        initial / starting temperature of water  •        same room temperature  *do****not****accept time or same insulation material*  **1**  (iii)     any **one** from:  •        greater sensitivity / precision  *do****not****accept more reliable (negates mark)*  •        could link to a computer for (automatic) data analysis  •        could take more frequent readings  •        reduces instrument reading error  *accept more accurate*  *do****not****accept easier to use on its own*  **1**  (b)     (i)      acts as a control  *accept to be able to make a comparison*  *accept to see the difference*  *do****not****accept ‘to make it a fair test’ OWTTE on its own*  **1**  (ii)     (plastic) foam and aluminium foil  **1**  (iii)     (aluminium) foil is a poor absorber of thermal radiation  *accept heat / infra red for thermal radiation*  **1**  **or**(aluminium) foil is a (good) reflector of thermal radiation  *do****not****accept ‘reflects sunlight’ on its own*           (plastic) foam traps air which is a (good) insulator  *accept (plastic) foam is a poor conductor / (good) insulator*  *do****not****accept ‘the material’ is a good insulator / poor conductor*  **1**  (c)     particles vibrate with a bigger / stronger amplitude / faster / with more (kinetic) energy  *accept particles vibrate more*  *do****not****accept start to vibrate only*  **1**  energy transferred by collisions with other particles  *do****not****accept answers in terms of*  *free/mobile electrons*  **1** |
| Question 3 |  |

**Required Practical 10: Light**

**Investigate the reflection of light by different types of surface and the refraction of light by different substances.**

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| Question 1 | 1. **Level 3 (5–6 marks):**   A detailed and coherent plan covering all the major steps is provided. The steps in the method are logically ordered. The method would lead to the production of valid results.  A source of inaccuracy is provided.  **Level 2 (3–4 marks):**  The bulk of a method is described with mostly relevant detail. The method may not be in a completely logical sequence and may be missing some detail.  **Level 1 (1–2 marks):**  Simple statements are made. The response may lack a logical structure and would not lead to the production of valid results.  **0 marks:**  No relevant content.  **Indicative content**  place a glass block on a piece of paper  draw around the glass block and then remove from the paper  draw a line at 90° to one side of the block (the normal)  use a protractor to measure and then draw a line at an angle of 20° to the normal  replace the glass block  using a ray box and slit point the ray of light down the drawn line  mark the ray of light emerging from the block  remove the block and draw in the refracted ray  measure the angle of refraction with a protractor  repeat the procedure for a range of values of the angle of incidence  **possible source of inaccuracy**  the width of the light ray  which makes it difficult to judge where the centre of the ray is   1. velocity / speed of the light decreases   *allow velocity / speed of the light changes*  **1** |
| Question 2 | (a)     the normal  **1**  (b)     v  **1**  (c)     any **one**from:  •        light has moved from glass to air / from air to glass  *accept light has changed medium*  •        speed of light has changed  *beware of contradictions for this marking point eg light has moved from glass to air and slowed down gets zero*  •        angle of incidence is less than the critical angle  ***or****(angle) i < (angle) c****or****(angle) y is less than the critical angle*  •        change in density (of medium)  *eg glass is more (optically) dense than air*  **1**  (d)     (i)      ratio of v to y does not give the same answer (in every case)  **or**value of v doubles value of y does not double  **1**  **or**increments for v are the same but increments for y are not the same  *allow for****1****mark a calculation but no conclusion eg*    *30 → 60 19 → 35 (38)*  **1**  (ii)     as (angle) v increases, angle y increases  *accept as the angle of incidence increases, the angle of refraction increases*  ***or****there is a (strong) positive(non-linear) relationship between the variables*  ***or****ratio of sines is constant*  *do****not****accept angle y is not directly proportional to angle v*  **1** |