GCSE Physics Trilogy (F)



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)     0.1 (°C)  **1**  (b)     power = energy transferred / time  *allow P = E / t*  **1**  *allow E = P × t*  (c)     1050 / 300  **1**  3.5 (W)  **1**  *accept 3.5 (W) with no working shown for****2****marks*  (d)     1050 = m × 4200 × 0.6  **1**  m = 1050 / (4200 × 0.6)  **1**  m = 0.417 (kg)  **1**  *accept 0.417 (kg) with no working shown for****3****marks*  (e)     any **one** from:  •        energy used to heat metal pan (as well as the water)  •        energy transfer to the surroundings (through the insulation)  •        angle of solar radiation will have changed during investigation  •        intensity of solar radiation may have varied during investigation  **1** |
| Question 2 | (a)     (i)      any **two** from:  •        mass (of block)  *accept weight for mass*  •        starting temperature  •        final / increase in temperature  *temperature is insufficient*  •        voltage / p.d.  *same power supply insufficient*  •        power (supplied to each block)  •        type / thickness of insulation  *same insulation insufficient*  **2**  (ii)     one of variables is categoric **or** (type of) material is categoric  *accept the data is categoric*  *accept a description of categoric*  *do****not****accept temp rise is categoric*  **1**  (iii)    concrete  *reason only scores if concrete chosen*  **1**  (heater on for) longest / longer time  *a long time or quoting a time is insufficient*  *do****not****accept it is the highest bar*  **1**  (iv)    4500 (J)  *allow****1****mark for correct substitution ie*  *2  ×  450  ×  5 provided no subsequent step shown*  **2**  (b)     (i)      point at 10 minutes identified  **1**  (ii)     line through all points except anomalous  *line must go from at least first to last point*  **1**  (iii)    20 (°C)  *if 20°C is given, award the mark.*  *If an answer other than 20°C is given, look at the graph. If the graph shows a correct extrapolation of the candidate’s best-fit line and the intercept value has been correctly stated, allow 1 mark.*  **1**  (iv)    2 (minutes)  **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)     battery, lamp and ammeter connected in series with variable resistor  **1**  voltmeter in parallel with (filament) lamp  **1**  (b)     **Level 2 (3–4 marks):**  A detailed and coherent description of a plan covering all the major steps is provided. The steps are set out in a logical manner that could be followed by another person to obtain valid results.  **Level 1 (1–2 marks):**  Simple statements relating to relevant apparatus or steps are made but they may not be in a logical order. The plan would not allow another person to obtain valid results.  **0 marks:**  No relevant content  **Indicative content**  •        ammeter used to measure current  •        voltmeter used to measure potential difference  •        resistance of variable resistor altered to change current in circuit **or** change potential difference (across filament lamp)  •        resistance (of filament lamp) calculated **or** R=V / I statement  •        resistance calculated for a large enough range of different currents that would allow a valid conclusion about the relationship to be made  **4**  (c)     (as current increases) resistance increases (at an increasing rate)  **1**  (d)     any value between 6.3 and 6.9 (Ω)  **1**  (e)     **A**: Filament lamp  **1**  **B**: Resistor at constant temperature  **1**  **C**: Diode  **1** |
| Question 2 | (a)     (i)      any **six** from:  •        switch on  •        read both ammeter and voltmeter  *allow read the meters*  •        adjust variable resistor to change the current  •        take further readings  •        draw graph  •        (of) V against I  *allow take mean*  •        R = V / I  *allow take the gradient of the graph*  **6** |

**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)     from K to L  **1**  (b)     the same as  **1**  smaller than  **1**  *correct order only*  (c)     4 N  **1**  (d)     the limit of proportionality is reached when a weight of 7N is added to the spring  *accept any number from 6.8 to 7.2 inclusive*  **1**  (e)     the extension is directly proportional to the weight.  **1**  (f)     C  **1** |
| 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)      (i)     12  **1**  (ii)     0.2  *allow****1****mark for their (a)(i) ÷ 60 and correctly calculated*  **1**  m/s2  *accept correct unit circled in list*  *accept ms−2*  *do****not****accept mps2*  **1**  (b)     **B**  **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 | absorber  **1**  reflector  **1**  emitter  **1** |
| Question 2 | (a)      (i)     convection  **1**  (ii)     conduction  **1**  (b)     (i)      2  **1**  black is the best absorber (of thermal energy / heat)  *accept black is the best emitter (of thermal energy / heat)*  *note that a comparative is needed (eg better or best)*  **1**  (ii)     the colour of the metal plates  **1**  (iii)    any **one** from:  •    more precise / accurate / reliable  *do****not****accept better reading*  *do****not****accept thermometer is unreliable*  •    can measure continuously  •    take many readings in a small time  •    removes (human) reading error  *accept easier to read*  •    can compare / draw graphs automatically  •    records data automatically  **1**  (c)     (i)      radiation  *accept radiates*  *accept infra red (IR) waves*  *do****not****accept heat waves*  **1**  (ii)     to reflect (heat away from the fire fighter)  *accept it reflects*  *accept it is a poor absorber (of thermal radiation / heat)*  *do****not****accept deflect / bounce for reflect*  **1**  (d)     **N**  *the mark is for the reason which does not score if****M****is chosen*  transfers / absorbs less heat **or** gives smallest increase in temperature  *accept will keep fire fighters cooler*  *accept****N****is cooler (after 15 minutes)*  *an answer****N****goes up to 52°C and****M****goes up to 100°C is insufficient*  **1** |