3.9 Physics Required Practicals and Uncertainties: 10-minute Pack

AQA 8464 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Zara investigates how the type of surface affects the rate of emission of infrared radiation, using a Leslie cube filled with boiling water. The cube has four vertical faces of equal area: matt black, matt white, shiny black and shiny silver. An infrared detector, connected to a data logger, is held at the same fixed distance from each face in turn, and the reading (in arbitrary detector units) is recorded after one minute.

Surface: matt black	matt white	shiny black	shiny silver
Detector reading (units): 85	65	45	20

(a) Identify the independent variable in this investigation. **(1)**

(b) Identify two variables that must be controlled for this to be a valid comparison between surfaces. **(2)**

(c) Using the data, identify which surface emits infrared radiation at the greatest rate, and explain this in terms of the surface's properties. **(2)**

(d) Explain why the detector must be kept at the same fixed distance from each face of the cube. **(2)**

(Total for Question 1 is 7 marks)

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2 State one safety precaution a student should take in each of the required practicals below, and the hazard it addresses.

(a) Heating a metal block with an electrical immersion heater in the specific heat capacity practical. **(1)**

(b) Directing a ray box or laser at a mirror or glass block in the light practical. **(1)**

(Total for Question 2 is 2 marks)

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Mark scheme · 3.9 Physics Required Practicals and Uncertainties: 10-minute Pack

Question 1

(a) the type/finish of the surface (which face of the Leslie cube the detector faces), oe **B1**

(a) Answer: The type of surface (which face of the cube is used).

(b) any one of: volume/mass of water in the cube; starting temperature of the water; time before each reading is taken, oe **B1**

(b) a second, different variable from the list above, oe; also allow the distance between the detector and each face, or the surface area of each face **B1**

(b) Answer: For example: the volume and starting temperature of the water in the cube, and the time before each reading is taken.

(c) matt black (highest reading, 85 units) **B1**

(c) matt, dull surfaces are better emitters (and absorbers) of infrared radiation than shiny surfaces, oe **B1**

(c) Answer: Matt black, with the highest reading (85 units); dull, matt surfaces are better emitters of infrared radiation than shiny, polished surfaces.

(d) the intensity of infrared radiation detected decreases with distance from the source, oe **B1**

(d) if the distance varied between readings, this would be an uncontrolled variable, so differences in the reading could not be attributed only to the surface type, oe **B1**

(d) Answer: Detected intensity falls with distance from the source. If distance varied, it would be an uncontrolled variable, making it impossible to say any difference was caused only by the surface type.

Question 2

(a) do not touch the heater or block during or immediately after use, as they can cause burns/scalds, oe; allow using a heatproof mat **B1**

(a) Answer: Do not touch the heater or block during or shortly after use, as they get hot enough to cause burns.

(b) do not look directly into the beam / do not shine it towards anyone's eyes, as it can damage the retina, oe **B1**

(b) Answer: Do not look directly into the light beam, or shine it at anyone's eyes, as it can damage the retina.

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