3.6 Further Mechanics and Thermal Physics: 10-minute Pack

Total Marks

AQA 7408 · Calculator allowed · about 10 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 An ice cube of mass 25 g (0.025 kg) at 0°C is dropped into a drink. The specific latent heat of fusion of ice is 3.34×10^5 J/kg.

(a) State what is meant by the specific latent heat of fusion of a substance. **(1)**

(b) Calculate the energy needed to completely melt the ice cube, and hence calculate the minimum power of a heater that would melt this mass of ice in 2.0 minutes, assuming all of the heater's output goes into melting the ice. **(4)**

(c) Explain, in terms of the behaviour of molecules, why the temperature of the ice-water mixture remains constant while the ice is melting, even though energy is continuously being supplied. **(2)**

(Total for Question 1 is 7 marks)

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Mark scheme · 3.6 Further Mechanics and Thermal Physics: 10-minute Pack

Question 1

(a) the energy required to change the state of 1 kg of a substance from solid to liquid, without any change in temperature, oe **B1**

(a) Answer: The energy needed to melt 1 kg of a substance (solid to liquid) at constant temperature.

(b) correct substitution into Q = mL, using mass in kg **M1**

(b) Q = 8350 J, cao **A1**

(b) P = Q/t, using t = 2.0 x 60 = 120 s, ft **M1**

(b) P = 69.6 W (awrt), cao **A1**

(b) Answer: Q = 8350 J; P = 69.6 W (3 s.f.)

(c) the energy supplied does work against the intermolecular forces holding molecules in the fixed lattice structure, increasing their potential energy, rather than increasing their kinetic energy, oe **B1**

(c) since temperature is a measure of the average kinetic energy of the molecules, and this does not change during melting, the temperature remains constant until all the ice has melted, oe **B1**

(c) Answer: Energy supplied breaks intermolecular bonds (increasing potential energy) rather than increasing molecular kinetic energy, so since temperature depends on average kinetic energy, it stays constant until melting is complete.

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