3.3 Particle Model of Matter: 30-minute Pack

AQA 8463 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The table shows the density of four materials. Water has a density of 1.0 g/cm^3.

Material	Density (g/cm^3)
Cork	0.24
Ice	0.92
Glass	2.5
Oak wood	0.75

(a) List the four materials in order of density, starting with the least dense. **(1)**

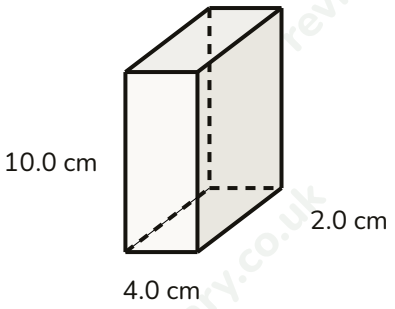
(b) State which of the four materials would float when placed in water, and give a reason for your answer. **(2)**

(Total for Question 1 is 3 marks)

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2 A metal block is a cuboid. It has a mass of 316 g. Its dimensions are: length 4.0 cm, width 2.0 cm, height 10.0 cm.

(a) Calculate the volume of the block. **(2)**



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(b) Calculate the density of the block. Use your answer to part (a). **(2)**

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(Total for Question 2 is 4 marks)

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3 A 50 g ice cube is left in a sealed, airtight container until it has completely melted into water.

(a) State the mass of the water in the container once the ice has completely melted. **(1)**

(b) Explain why the mass does not change when the ice melts. **(2)**

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(c) State whether melting is a physical change or a chemical change. **(1)**

(Total for Question 3 is 4 marks)

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4 A sealed container shows a pressure reading of 2.50×10^5 Pa. A laboratory assistant records this value and also reports it in kilopascals and in atmospheres. Convert 2.50×10^5 Pa into kilopascals and into atmospheres (1 atm = 1.013×10^5 Pa).

(a) Convert the pressure into kilopascals. **(1)**

(b) Convert the pressure into atmospheres using 1 atm = 1.013×10^5 Pa. Give your answer to 3 significant figures. **(2)**

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(Total for Question 4 is 3 marks)

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5 On a warm, dry day, puddles of water disappear even though the air temperature is well below 100°C.

(a) State the name of the process by which liquid water turns into water vapour below its boiling point. **(1)**

(b) Explain, in terms of the particle model, why evaporation causes the temperature of the remaining water to decrease. **(3)**

(Total for Question 5 is 4 marks)

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6 A 2.0 kg block of aluminium is heated from 20°C to 70°C. The specific heat capacity of aluminium is 900 J/(kg °C). Use: change in thermal energy = mass x specific heat capacity x change in temperature

(a) Calculate the change in temperature of the block. **(1)**

(b) Calculate the change in thermal energy of the block. **(3)**

(c) State the type of energy transfer occurring as the aluminium block is heated. **(1)**

(d) State what is meant by the specific heat capacity of a substance. **(2)**

(Total for Question 6 is 7 marks)

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Mark scheme · 3.3 Particle Model of Matter: 30-minute Pack

Question 1

(a) cork, oak wood, ice, glass cao **B1**

(a) Answer: Cork, oak wood, ice, glass.

(b) cork, ice and oak wood would float **B1**

(b) because they are all less dense than water (their density is less than 1.0 g/cm^3), oe **B1**

(b) Answer: Cork, ice and oak wood would all float, because their density is less than the density of water (1.0 g/cm^3).

Question 2

(a) 4.0 x 2.0 x 10.0 **M1**

(a) 80 cm^3 cao **A1**

(a) Answer: 80 cm^3

(b) 316 / 80, ft from (a) **M1**

(b) 3.95 g/cm^3 cao **A1**

(b) Answer: 3.95 g/cm^3

Question 3

(a) 50 g cao **B1**

(a) Answer: 50 g.

(b) no particles enter or leave the sealed container, oe **B1**

(b) melting only changes the arrangement and movement of the particles, it does not change the number or type of particles present (no new substance is made), oe **B1**

(b) Answer: No particles enter or leave the sealed container, and melting only changes how the particles are arranged and how they move; it does not change the number or type of particles present.

(c) physical change **B1**

(c) Answer: A physical change.

Question 4

(a) 2.50 x 10^2 kPa (conversion by dividing by 1000) **B1**

(a) Answer: 250 kPa

(b) substitutes into atm = 2.50e5 / 1.013e5 **M1**

(b) 2.47 atm cao to 3 s.f. **A1**

(b) Answer: 2.47 atm

Question 5

(a) evaporation **B1**

(a) Answer: Evaporation

(b) particles in the water have a range (distribution) of kinetic energies (speeds) **B1**

(b) the particles with the most kinetic energy (fastest-moving) are most likely to escape from the surface as vapour **B1**

(b) this leaves particles with a lower average kinetic energy in the liquid, so the average kinetic energy (and temperature) of the remaining water decreases **B1**

(b) Answer: Fastest particles escape, lowering the average kinetic energy (and temperature) of the remaining liquid.

Question 6

(a) 50°C cao **A1**

(a) Answer: 50°C

(b) 2.0 x 900 x 50 substituted **M1**

(b) evaluated correctly **M1**

(b) 90000 J (9.0 x 10^4 J) cao **A1**

(b) Answer: 90000 J

(c) thermal energy is transferred to the block by heating, increasing its internal energy oe **B1**

(c) Answer: Heating (thermal energy transfer)

(d) the energy required to raise the temperature of **B1**

(d) 1 kg of the substance by 1°C (or 1 K) **B1**

(d) Answer: The energy needed to raise the temperature of 1 kg of a substance by 1°C.

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