5.5 Speed and Density: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 70 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A cyclist travels 12 kilometres in 30 minutes. Work out the cyclist's speed in kilometres per hour (km/h).

(Total for Question 1 is 1 mark)

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2 Which of these is the correct formula for calculating average speed?

- ☐ A) speed = distance x time
- ☐ B) speed = distance / time
- ☐ C) speed = time / distance
- ☐ D) speed = distance / time^2

(Total for Question 2 is 1 mark)

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3 A block of wood has a mass of 45 g and a volume of 60 cm³.
Calculate the density of the wood, in g/cm^3.

(Total for Question 3 is 2 marks)

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4 A toy car is 0.5 metres long. Its density is 2000 kg/m^3 and its mass is 0.3 kg. State whether these values are consistent, showing a short calculation.

(Total for Question 4 is 1 mark)

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5 Use the relationship 1 m/s = 3.6 km/h.

(a) Convert 7 m/s to km/h. Give your answer to 1 decimal place. **(2)**

(b) Convert 90 km/h to m/s. Give your answer to 2 significant figures. **(2)**

(c) State the rule to convert from m/s to km/h. **(1)**

(Total for Question 5 is 5 marks)

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6 A rock has a mass of 350 g and a volume of 140 cm^3. The density of water is 1 g/cm^3.
Determine, showing your working, whether the rock will float or sink in water.

(Total for Question 6 is 3 marks)

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7 A train travels 234 km in 2 hours 30 minutes, at a constant average speed.
Work out the average speed of the train in km/h.

(Total for Question 7 is 3 marks)

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8 Two small metal blocks are compared.
Block A has mass 0.6 kg and volume 0.0008 m^3.
Block B has mass 0.9 kg and volume 0.0009 m^3.

(a) Find the density of each block in kg/m^3. **(3)**

(b) Which block is denser and by how many kg/m^3? **(2)**

(Total for Question 8 is 5 marks)

9 An alloy is made by combining 60 cm^3 of copper, density 8.9 g/cm^3, with 40 cm^3 of tin, density 7.3 g/cm^3. Work out the density of the alloy. Give your answer correct to 3 significant figures.

(Total for Question 9 is 4 marks)

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10 A cylindrical metal rod has length 1.2 m and cross-sectional area 3.5 cm^2. The density of the metal is 7.8 g/cm^3. Calculate the mass of the rod in kilograms. Give your answer to 3 significant figures.

(Total for Question 10 is 4 marks)

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11 A small sculpture is made from a mixture of two metals, bronze and silver, fused together with no gaps.
The whole sculpture has a total mass of 940 g and a total volume of 110 cm^3.
The bronze part has a volume of 60 cm^3 and a density of 8.9 g/cm^3.
The rest of the sculpture is silver.
Calculate the density of the silver part, giving your answer to 3 significant figures.

(Total for Question 11 is 5 marks)

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12 A lorry carries 12.0 tonnes of a granular material with density 1600 kg/m^3 in a rectangular container 4.00 m long and 1.50 m wide.

(a) Calculate the height of the material in the container in metres. Give your answer to 3 significant figures. **(6)**

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(b) The lorry travels a 180 km route. For the first 60 km the lorry averages 36 km/h because of roadworks. For the remaining distance it averages 72 km/h. Calculate the overall average speed for the whole journey in km/h. Give your answer to 3 significant figures. **(8)**

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(c) State one practical reason why average speed for a loaded lorry might be lower than for an unloaded lorry on the same road. **(2)**

(Total for Question 12 is 16 marks)

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Mark scheme · 5.5 Speed and Density: Test Pack

Question 1

24 km/h cao **B1**

Answer: 24 km/h

Question 2

B **B1**

Answer: B

Question 3

density = mass / volume i.e. 45 / 60 oe **M1**

0.75 (g/cm^3) cao **A1**

Answer: 0.75 g/cm^3

Question 4

clear statement with supporting calculation: volume = 0.3 / 2000 = 0.00015 m^3 and statement that values do not contradict each other cao **B1**

Answer: Volume = mass/density = 0.3 / 2000 = 0.00015 m^3. Values are consistent (no contradiction).

Question 5

(a) use 7 x 3.6 **M1**

(a) 25.2 km/h cao **A1**

(a) Answer: 25.2 km/h

(b) use 90 / 3.6 **M1**

(b) 25 m/s cao **A1**

(b) Answer: 25 m/s

(c) multiply by 3.6 oe **B1**

(c) Answer: Multiply by 3.6

Question 6

350 / 140 oe **M1**

2.5 (g/cm^3) oe **A1**

correct conclusion with reason, e.g. 'sinks, since 2.5 > 1' ft from their density **C1**

Answer: Sinks, since its density (2.5 g/cm^3) is greater than the density of water (1 g/cm^3).

Question 7

2 hours 30 minutes = 2.5 hours oe, e.g. 5/2 hours **M1**

234 / 2.5 oe (ft their time in hours) **M1**

93.6 (km/h) cao **A1**

Answer: 93.6 km/h

Question 8

(a) use density = mass/volume for block A, 0.6 / 0.0008 **M1**

(a) use density = mass/volume for block B, 0.9 / 0.0009 **M1**

(a) give both densities: A = 750 kg/m^3, B = 1000 kg/m^3 cao **A1**

(a) Answer: Block A: 750 kg/m^3; Block B: 1000 kg/m^3

(b) calculate difference 1000 - 750 **M1**

(b) Block B is denser by 250 kg/m^3 cao **A1**

(b) Answer: Block B is denser by 250 kg/m^3

Question 9

mass of copper = 60 x 8.9 (= 534) oe **M1**

mass of tin = 40 x 7.3 (= 292) oe **M1**

(534 + 292) / (60 + 40) (dep on both previous method marks) **dM1**

8.26 (g/cm^3) cao **A1**

Answer: 8.26 g/cm^3

Question 10

Convert length to cm or area to m^2 consistently, e.g. length 1.2 m = 120 cm then volume = area * length = 3.5 * 120 cm^3 **M1**

Use mass = density * volume: 7.8 * (3.5*120) **M1**

3276 g (or equivalent) cao **A1**

3.28 kg awrt (3 s.f.) **A1**

Answer: 3.28 kg

Question 11

mass of bronze = 8.9 x 60 oe **M1**

534 (g) cao **A1**

mass of silver = 940 - their 534 (ft) **M1**

volume of silver = 110 - 60 = 50 oe; density of silver = their mass of silver / 50 (ft) **M1**

8.12 (g/cm^3) awrt **A1**

Answer: 8.12 g/cm^3

Question 12

(a) Convert mass to kg: 12.0 tonnes = 12000 kg **M1**

(a) Use volume = mass / density: volume = 12000 / 1600 = 7.5 m^3 **M1**

(a) Compute base area: 4.00 * 1.50 = 6.00 m^2 **M1**

(a) Height = volume / area = 7.5 / 6.00 **M1**

(a) Height = 1.25 m cao **A1**

(a) Height to 3 s.f. = 1.25 m cao **A1**

(a) Answer: 1.25 m

(b) Calculate times for each section: t1 = 60/36 hours, t2 = 120/72 hours **M1**

(b) Evaluate times: t1 = 1.666666... h, t2 = 1.666666... h **M1**

(b) Total time = t1 + t2 = 3.333333... h **M1**

(b) Total distance = 180 km stated **M1**

(b) Average speed = total distance / total time = 180 / 3.333333... **M1**

(b) Carry out division to get 54 km/h **M1**

(b) 54.0 km/h awrt to 3 s.f. **A1**

(b) Method explanation or check: times equal so average speed is harmonic mean leading to 54 km/h or equivalent check **B1**

(b) Answer: 54.0 km/h

(c) Practical reason given, e.g. heavier load increases braking distance and reduces acceleration so driver travels slower oe **B1**

(c) Alternate acceptable reason: speed limits for heavy vehicles, stability/safety concerns, or longer stopping distances leading to lower speeds **B1**

(c) Answer: Possible answer: A loaded lorry accelerates and brakes more slowly and has a longer stopping distance, so drivers travel more slowly for safety.

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