# 5.5 Speed and Density: 1-hour Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

**1** A small bag of rice has mass 1.2 kg and volume 0.0015 m³. Calculate the density of the rice in kg/m$^3$. Give your answer correct to 3 significant figures.

**(Total for Question 1 is 2 marks)**

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**2** A jogger runs 18 km in 1.5 hours at a constant speed. Work out her average speed, in km/h.

**(Total for Question 2 is 2 marks)**

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**3** A block of cheese has a mass of 480 g and a volume of 320 cm³. Work out the density of the cheese, in g/cm$^3$.

**(Total for Question 3 is 2 marks)**

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**4** A cyclist travels at a constant speed of 20 m/s. Work out this speed in km/h.

**(Total for Question 4 is 2 marks)**


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**5** A block of wood has mass 0.9 kg and density 600 kg/m$^3$.

**(a)** Calculate the volume of the block in cubic metres (m$^3$). **(2)**

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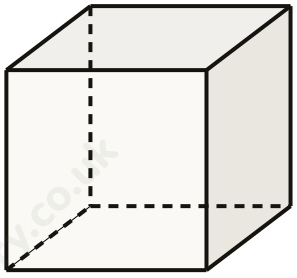
**(b)** Give the volume in cm$^3$. **(1)**

**(Total for Question 5 is 3 marks)**

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**6** A metal cube has side length 10 cm. The density of the metal is 7800 kg/m$^3$. Calculate the mass of the cube in kilograms. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn




**(Total for Question 6 is 3 marks)**


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**7** A driver covers 90 km in 1 hour 30 minutes.

**(a)** Work out the average speed in km/h. **(2)**

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**(b)** How long to travel 150 km at this speed? Give your answer in hours and minutes. **(2)**

.....

**(c)** How far would the driver travel in 20 minutes at this average speed? **(1)**

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**(Total for Question 7 is 5 marks)**

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**8** Priya drives 90 km in 1 hour 12 minutes. She then drives a further 60 km in 48 minutes. Work out her average speed for the whole journey. Give your answer in km/h.

**(Total for Question 8 is 4 marks)**

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**9** Sara walks 3.6 km in 45 minutes, at a constant speed.
Calculate her average speed in m/s. Give your answer to 3 significant figures.

**(Total for Question 9 is 4 marks)**


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**10** A brick exerts a pressure of 15 000 Pa on the ground. The brick has a mass of 6 kg. Take the gravitational field strength as g = 10 N/kg. Given that force = mass x g and pressure = force / area, work out the area of the brick in contact with the ground. Give your answer in $cm^2$.

**(Total for Question 10 is 4 marks)**

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**11** A boat travels upstream against the river current for 2 hours and covers 30 km. It returns downstream along the same route in 1.2 hours.

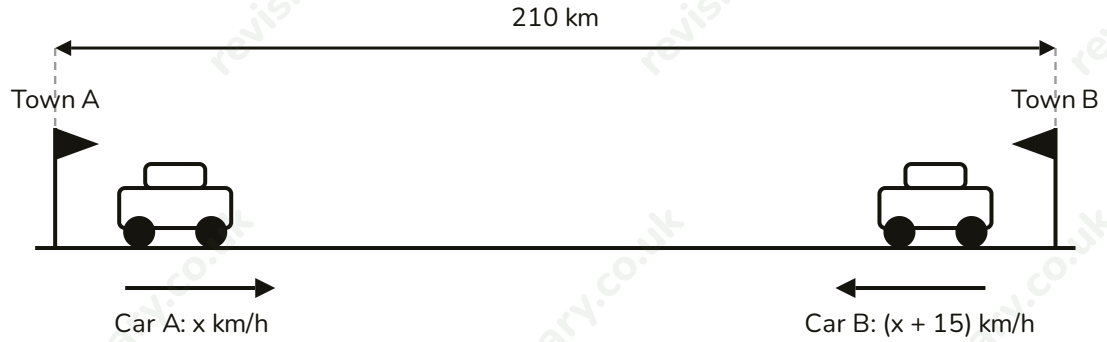
**(a)** Find the speed of the boat in still water and the speed of the current in km/h. **(4)**

**(b)** Explain briefly why the downstream time is less than the upstream time. **(1)**

**(Total for Question 11 is 5 marks)**


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**12** Two cars start at the same time and travel towards each other from two towns 210 km apart. Car A travels at a constant speed of x km/h. Car B travels at a constant speed of (x + 15) km/h. The cars meet after 1 hour 24 minutes. Form and solve an equation to find the value of x.




**(Total for Question 12 is 5 marks)**

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**13** A material has density ρ g/cm$^3$ and is formed into a hollow spherical shell with outer radius R cm and inner radius r cm.

**(a)** Write an expression in terms of ρ, R and r for the mass of the shell in grams. **(3)**

**(b)** Given ρ = 2.7, R = 8 and r = 7, calculate the mass of the shell to the nearest gram. **(3)**

**(Total for Question 13 is 6 marks)**


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# Mark scheme · 5.5 Speed and Density: 1-hour Pack

## Question 1

use density = mass/volume, 1.2 / 0.0015 **M1**

800 kg/m$^3$ cao **A1**

**Answer: 800 kg/m$^3$**

## Question 2

18 / 1.5 oe **M1**

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

**Answer: 12 km/h**

## Question 3

480 / 320 oe **M1**

1.5 (g/cm$^3$) cao **A1**

**Answer: 1.5 g/cm$^3$**

## Question 4

20 x 3.6 oe, e.g. 20 x 3600 / 1000 **M1**

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

**Answer: 72 km/h**

## Question 5

(a) use volume = mass/density, 0.9 / 600 **M1**

(a) 0.0015 m³ cao **A1**

**(a) Answer: 0.0015 m$^3$**

(b) 1500 cm³ cao **B1**

**(b) Answer: 1500 cm$^3$**

## Question 6

convert 10 cm to 0.10 m and find volume = 0.10$^3$ = 0.001 m³ or equivalent **M1**

use mass = density x volume, 7800 x 0.001 **M1**

7.80 kg cao **A1**

**Answer: 7.80 kg**

## Question 7

(a) convert 1 h 30 min to 1.5 h and use speed = distance/time, 90/1.5 **M1**

(a) 60 km/h cao **A1**

**(a) Answer: 60 km/h**

(b) use time = distance/speed, 150/60 = 2.5 hours **M1**

(b) 2 hours 30 minutes cao **A1**

**(b) Answer: 2 hours 30 minutes**

(c) distance = 60 x (20/60) = 20 km cao **B1**

**(c) Answer: 20 km**

## Question 8

total distance = 90 + 60 = 150 (km) **M1**

total time = 72 + 48 = 120 minutes = 2 hours oe **M1**

150 / 2 (dep on both previous method marks) **dM1**

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

**Answer: 75 km/h**

## Question 9

3.6 km = 3600 m oe **M1**

45 minutes = 2700 seconds oe **M1**

3600 / 2700 oe (ft their distance in m and time in s) **M1**

1.33 (m/s) awrt **A1**

**Answer: 1.33 m/s (3 s.f.)**

## Question 10

6 x 10 (= 60) oe, finding the force **M1**

60 / 15000 (= 0.004) (dep), finding the area in m$^2$ **dM1**

0.004 x 10000 oe, converting m$^2$ to cm$^2$ **M1**

40 (cm$^2$) cao **A1**

**Answer: 40 cm$^2$**

## Question 11

(a) Set up equations: upstream speed = v - c with (v - c) * 2 = 30 and downstream speed = v + c with (v + c) * 1.2 = 30 **M1**

(a) Solve the two equations: v - c = 15 and v + c = 25 **M1**

(a) v = 20 km/h cao **A1**

(a) c = 5 km/h cao **A1**

**(a) Answer: Boat speed in still water = 20 km/h; current speed = 5 km/h**

(b) The current adds to the boat speed downstream and subtracts upstream, so downstream speed is greater hence time is less oe **B1**

**(b) Answer: Because the current increases the effective speed downstream and reduces it upstream, so the downstream trip takes less time.**

## Question 12

1 hour 24 minutes = 1.4 hours oe **M1**

1.4x + 1.4(x + 15) = 210 oe, forming a correct equation **M1**

2.8x + 21 = 210 oe, correct expansion/simplification **M1**

2.8x = 189 (dep) **dM1**

x = 67.5 cao **A1**

**Answer: x = 67.5 (Car A's speed is 67.5 km/h)**

## Question 13

(a) Volume of shell = (4/3)π(R$^3$ - r$^3$) stated **M1**

(a) Mass = density * volume, substitute ρ: mass = ρ * (4/3)π(R$^3$ - r$^3$) **M1**

(a) mass = (4/3)π ρ (R$^3$ - r$^3$) (algebraic expression cao) **A1**

**(a) Answer: mass = (4/3) π ρ (R$^3$ - r$^3$) grams**

(b) Substitute values: volume = (4/3)π(8$^3$ - 7$^3$) = (4/3)π(512 - 343) = (4/3)π*169 **M1**

(b) Multiply by ρ: mass = 2.7 * (4/3)π*169 and evaluate numerically **M1**

(b) 1911 g cao (to nearest gram) **A1**

**(b) Answer: 1911 g**


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