

GCSE MATHS

Units, rates and compound measures

Worked Solutions

Q1

**

$$72 \times 1000 / 3600 = 20 \text{ m/s}$$

Convert kilometres to metres and hours to seconds.

Q2

**

$$15 \times 3600 / 1000 = 54 \text{ km/h}$$

Convert the distance travelled in one hour to kilometres.

Q3

**

$$350 / 100^2 = 0.035 \text{ m}^2$$

There are 10,000 square centimetres in a square metre.

Q4

**

$$0.004 \times 100^3 = 4000 \text{ cm}^3$$

Cube the length conversion factor.

Q5

**

$$2.7 \times 10^6 / 1000 = 2700 \text{ kg/m}^3$$

One cubic metre contains a million cubic centimetres; convert grams to kilograms.

Q6

**

$$18 \times 60 / 45 = 24 \text{ litres/min}$$

Scale the amount to 60 seconds.

Q7

**

$$t = 2 + 24 / 60 = 2.4$$

Convert minutes to a fraction of an hour.

$$v = 156 / 2.4 = 65 \text{ km/h}$$

Divide distance by time.

Q8

**

$$d = 18 \times 35/60 = 10.5 \text{ km}$$

Convert 35 minutes to hours before multiplying.

Q9

**

$$t = 168/96 = 1.75 \text{ hours}$$

Divide distance by speed.

$$1.75 \text{ hours} = 1 \text{ h } 45 \text{ min}$$

Convert the decimal part to minutes.

$$09:42 + 1:45 = 11:27$$

Add the journey time.

Q10

$$t = 40/50 + 12/60 + 60/75 = 1.8$$

Add both driving times and the stop.

$$v = 100/1.8 \approx 55.6 \text{ km/h}$$

Divide total distance by elapsed time and round to 1 d.p.

Q11

$$(4 + 6)t = 600$$

Their combined distance closes the gap.

$$t = 600/10 = 60 \text{ s}$$

Divide by the combined speed.

Q12

$$\text{head start} = 6(20) = 120 \text{ m}$$

Find the gap when the second cyclist passes.

$$(8 - 6)t = 120$$

Use the rate at which the gap closes.

$$t = 60 \text{ s}$$

Solve.

Q13

**

$$\text{density} = 540/200 = 2.7 \text{ g/cm}^3$$

Divide mass by volume.

Q14

**

$$m = 0.8(350) = 280 \text{ g}$$

Multiply density by volume.

Q15

**

$$V = 1800/7.5 = 240 \text{ cm}^3$$

Convert the mass to grams, then divide by density.

Q16

**

$$P = 600/0.025 = 24000 \text{ Pa}$$

Divide force by area.

Q17

$$F = 180000(0.04) = 7200 \text{ N}$$

Convert kilopascals to pascals, then multiply by area.

Q18

$$A = 240/30000 = 0.008 \text{ m}^2 = 80 \text{ cm}^2$$

Divide to find area, then multiply by 10,000.

Q19

$$m = 200(0.8) + 300(1.2) = 520 \text{ g}$$

Add the two masses.

$$V = 200 + 300 = 500 \text{ cm}^3$$

Add the volumes.

$$\text{density} = 520/500 = 1.04 \text{ g/cm}^3$$

Divide total mass by total volume.

Q20

$$t = 60/40 + 60/60 = 2.5 \text{ hours}$$

The slower leg takes longer.

$$v = 120/2.5 = 48 \text{ km/h}$$

Divide the whole distance by the whole time.

Q21

$$t_{\text{total}} = 90/60 = 1.5 \text{ h}$$

Find the allowed time.

$$t_{\text{left}} = 1.5 - 30/40 = 0.75 \text{ h}$$

Subtract time already used.

$$v = 60/0.75 = 80 \text{ km/h}$$

Use the remaining distance.

Q22

$$\text{combined rate} = \frac{1}{6} + \frac{1}{4} = \frac{5}{12}$$

Add fractions of a tank filled per hour.

$$t = 1 \div \frac{5}{12} = \frac{12}{5} \text{ h}$$

Divide one tank by the filling rate.

$$\frac{12}{5} \text{ h} = 2 \text{ h } 24 \text{ min}$$

Convert the fraction of an hour.

Q23

$$\frac{200 + 5x}{100 + x} = 3.2$$

Express total mass divided by total volume.

$$200 + 5x = 320 + 3.2x$$

Multiply by the total volume.

$$1.8x = 120 \Rightarrow x = \frac{200}{3} \text{ cm}^3$$

Solve.

Q24

$$P_{\text{new}} = F/(0.8A) = 1.25(F/A)$$

The new area is 0.8 times the old area.

$$(1.25 - 1) \times 100\% = 25\%$$

Convert the pressure multiplier to a percentage increase.