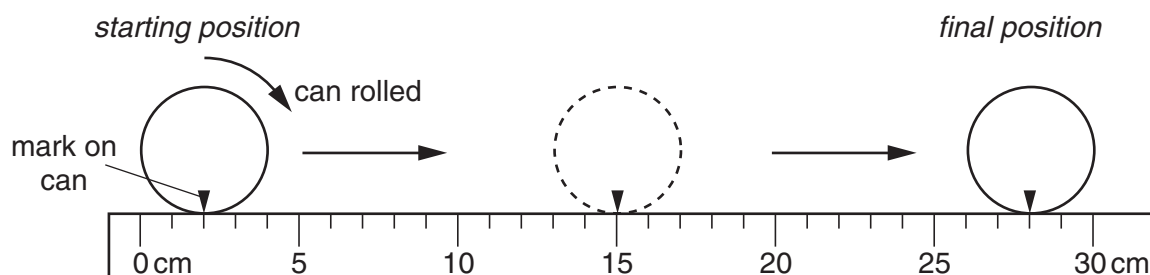# Chapter 1.   Making measurements
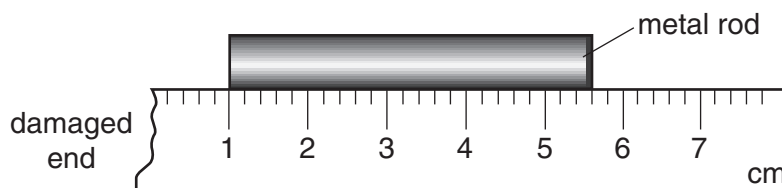
1.1   Measuring length

1   A cylindrical can is rolled along the ruler shown in the diagram.

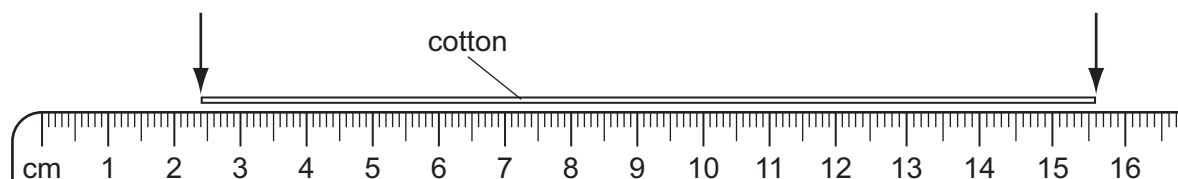The can rolls over twice.

What is the circumference (distance all round) of the can?

A   13 cm   **B**   14 cm   **C**   26 cm   **D**   28 cm

2   A girl uses a ruler to measure the length of a metal rod. Because the end of the rule is damaged, she places one end of the rod at the 1 cm mark as shown.
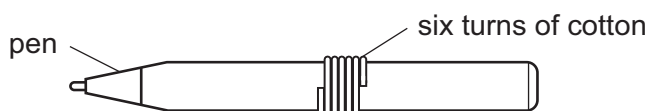

How long is the metal rod?

A   43 mm   **B**   46 mm   **C**   53 mm   **D**   56 mm

3   A piece of cotton is measured between two points on a ruler.
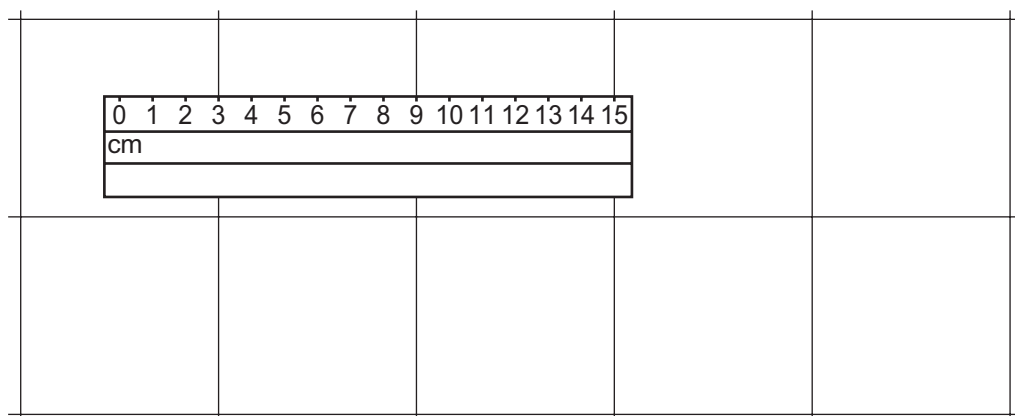

When the length of cotton is wound closely around a pen, it goes round six times.
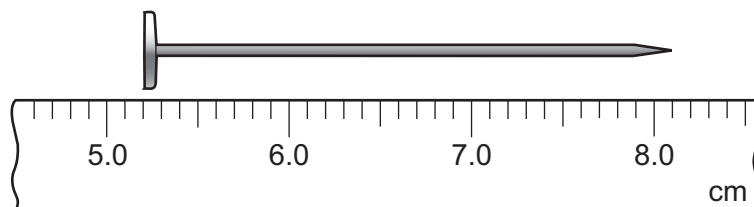

What is the distance once round the pen?

A   2.2 cm   **B**   2.6 cm   **C**   13.2 cm   **D**   15.6 cm

4 A floor is covered with square tiles. The diagram shows a ruler on the tiles.

How long is one tile?

A 3 cm   **B** 6 cm   **C** 9 cm   **D** 12 cm

5 A ruler is used to measure the length of a nail.

What is the length of the nail?

A 1.3 cm   **B** 2.9 cm   **C** 5.2 cm   **D** 8.1 cm

6 The diagram shows a thick-walled tube. The thickness of the wall is 3 mm.
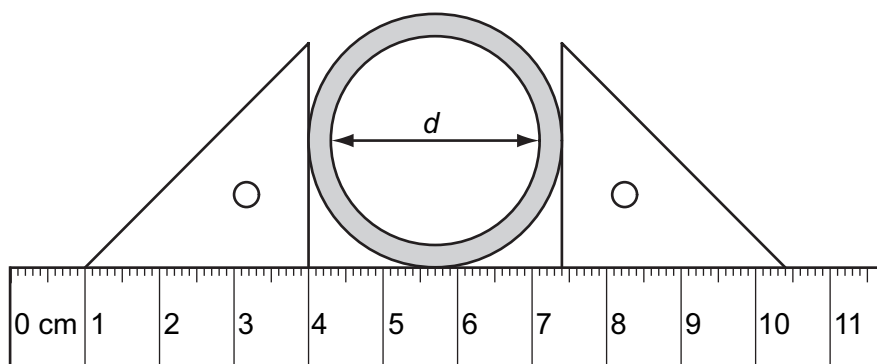
What is the internal diameter *d* of the tube?

A 2.8 cm   **B** 3.1 cm   **C** 3.4 cm   **D** 7.4 cm

7   Some liquid is heated in a flask.

The diagrams show the height of the liquid in the tube when the liquid is cold and when it is hot.

What is the difference in the heights?

A   1.7 cm   **B**   2.8 cm   **C**   3.2 cm   **D**   4.5 cm

8   A metre rule is used to measure a length.

Which reading is shown to the nearest millimetre?

A   0.7 m   **B**   0.76 m   **C**   0.761 m   **D**   0.7614 m

9   The diagram shows an enlarged drawing of the end of a metre rule. It is being used to measure the length of a small feather.

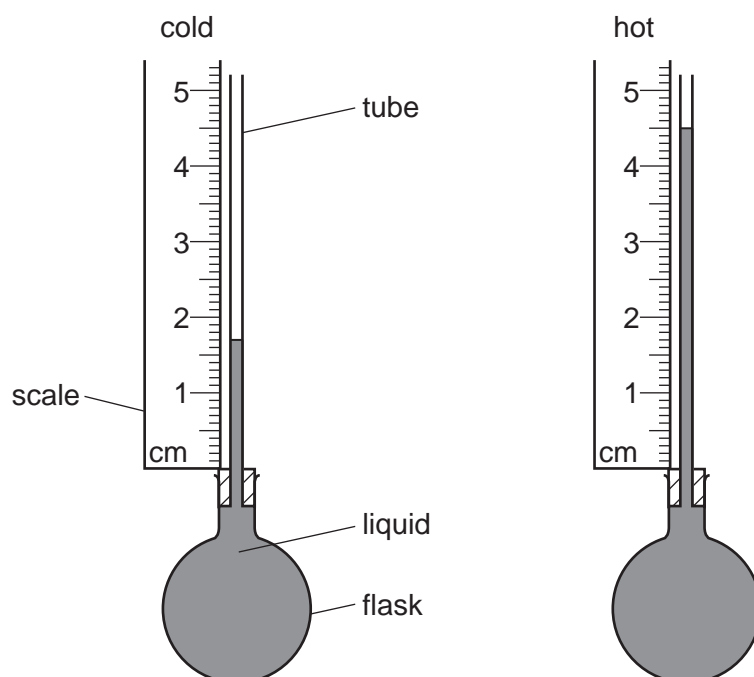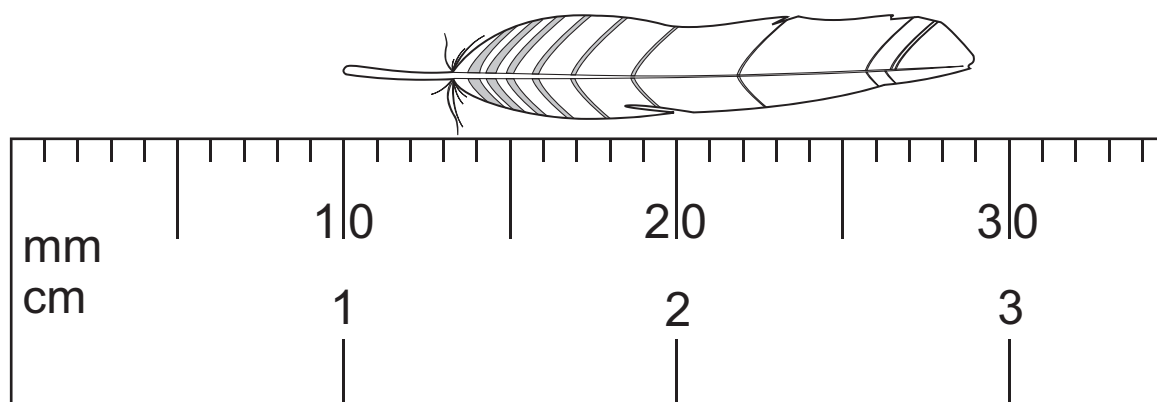What is the length of the feather?

A   19 mm   **B**   29 mm   **C**   19 cm   **D**   29 cm

10   A ruler is used to measure the length of an object.
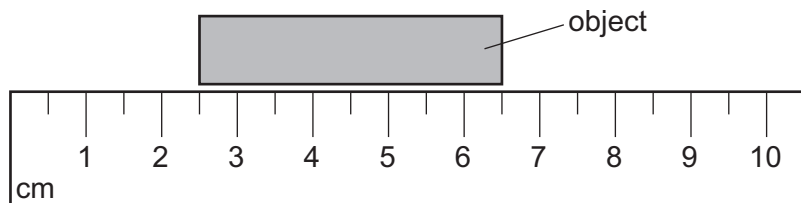
What is the length of the object?

A   3.0 cm   **B**   4.0 cm   **C**   5.0 cm   **D**   6.5 cm

11   A cylindrical can is rolled along the ruler shown in the diagram.
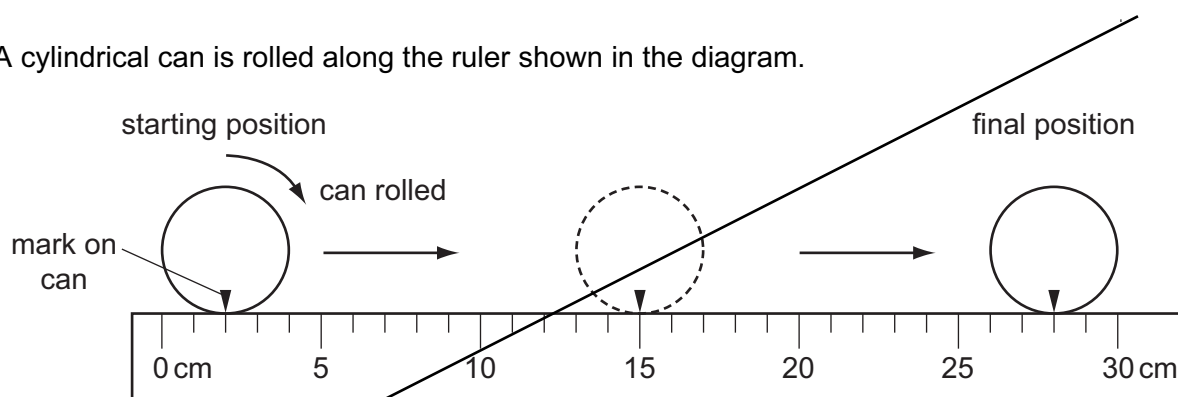
The can rolls over twice.

What is the circumference (distance all round) of the can?

A   13 cm   **B**   14 cm   **C**   26 cm   **D**   28 cm

1.2   Measuring volume

1   The diagram shows the level of liquid in a measuring cylinder.

What is the volume of the liquid?

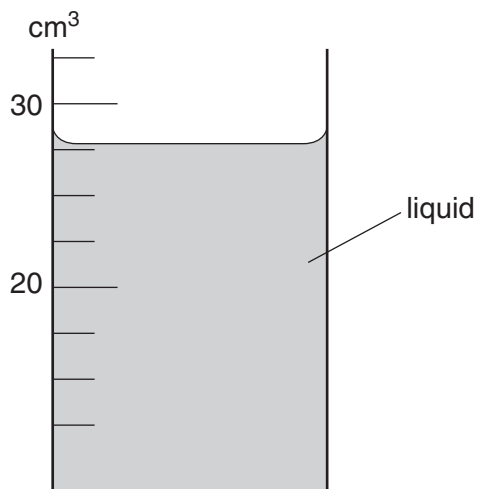**A**   24 cm^3 **B**   28 cm^3 **C**   29 cm^3 **D**   32 cm^3

2   A glass tank contains some water.
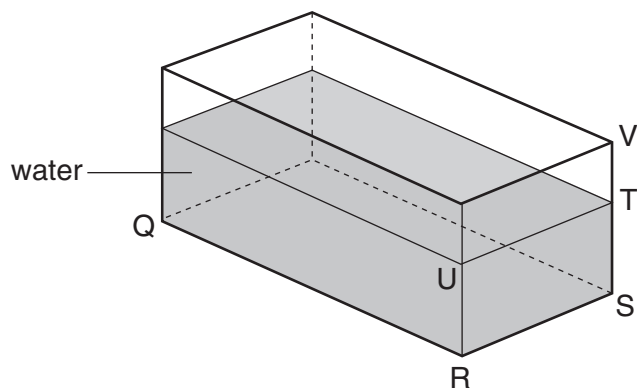
The length QR and the width RS of the tank are known.

What other distance needs to be measured in order to be able to calculate the volume of the water?

A   ST   **B**   SV   **C**   TU   **D**   TV

3 Which of the following is **not** necessary when using a measuring cylinder to measure the volume of a quantity of water?

    A   making sure that the measuring cylinder is vertical

    B   making sure that your eye is level with the liquid surface

    C   reading the bottom of the meniscus

    D   using the largest measuring cylinder possible

4 The diagram shows a measuring cylinder.

Which unit would be most suitable for its scale?

    A mm^2 **B** mm^3 **C** cm^2 **D** cm^3

5 A decorator wishes to calculate the area of a bathroom tile so that he can estimate the amount of adhesive that he needs to buy.

What must he use?

    A   a measuring cylinder only

    B   a ruler only

    C   a measuring cylinder and a clock only

    D   a measuring cylinder and a ruler only

6 A measuring cylinder is used to measure the volume of a liquid.
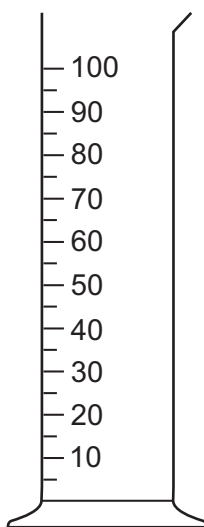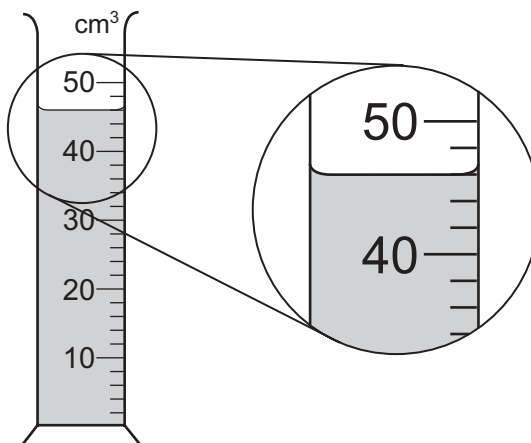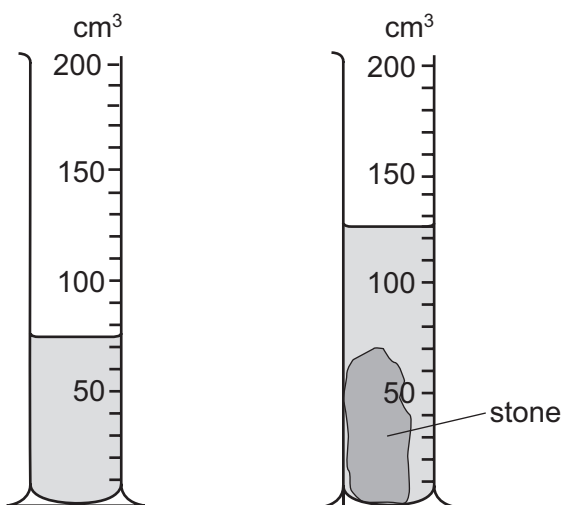

What is the volume of the liquid?

A 43 cm^3 **B** 46 cm^3 **C** 48 cm^3 **D** 54 cm^3

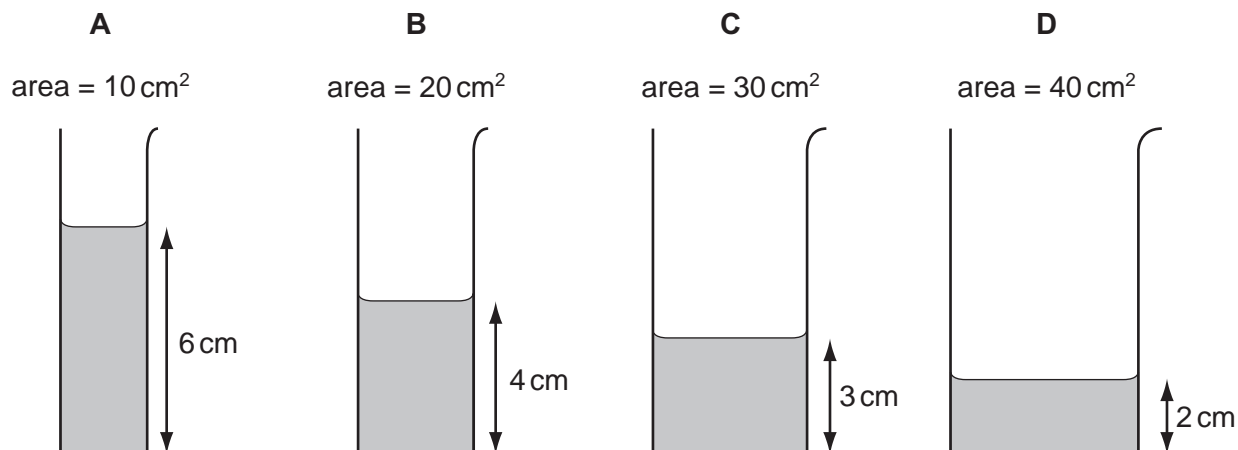**7** A measuring cylinder contains some water. When a stone is put in the water, the level rises.

What is the volume of the stone?

A 50 cm^3 **B** 70 cm^3 **C** 75 cm^3 **D** 125 cm^3

8   Some water is poured into four tubes of different cross-sectional areas.

Which tube contains the largest volume of water?

A	B	C	D
area = 10 cm²	area = 20 cm²	area = 30 cm²	area = 40 cm²

6 cm   4 cm   3 cm   2 cm

9   A scientist needs to determine the volume of a small, irregularly shaped rock sample. Only a ruler and a measuring cylinder, partially filled with water, are available.

cm³

rock sample   ruler

measuring
cylinder
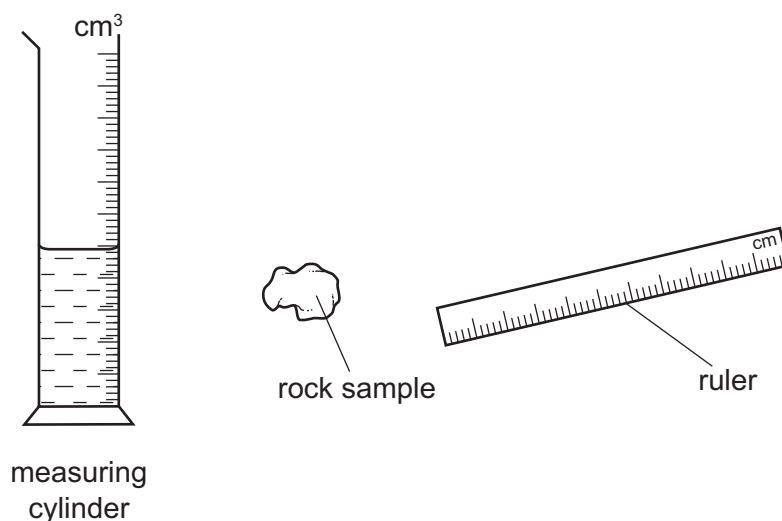
To determine the volume, which apparatus should the scientist use?

A   both the measuring cylinder and the ruler

B   neither the measuring cylinder nor the ruler

C   the measuring cylinder only

D   the ruler only

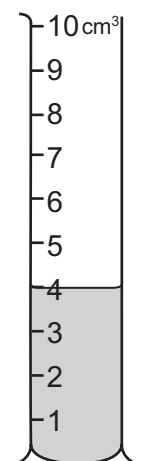**10** The diagrams show an experiment to determine the volume of a stone.

without stone   with stone
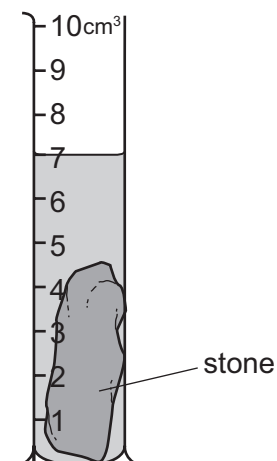
What is the volume of the stone?

A 3 cm^3 **B** 4 cm^3 **C** 7 cm^3 **D** 11 cm^3

11 Drops of water are dripping steadily from a tap (faucet). The diagram shows a measuring cylinder which has collected 120 drops of water.
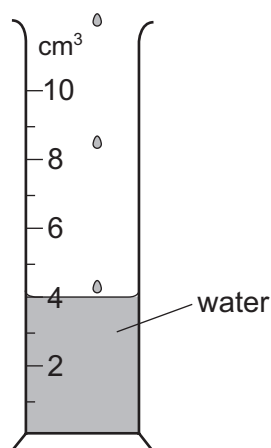
How many drops in total will have been collected when the measuring cylinder reads 10 cm^3?

A 48   **B** 60   **C** 180   **D** 300

1.3   Measuring density

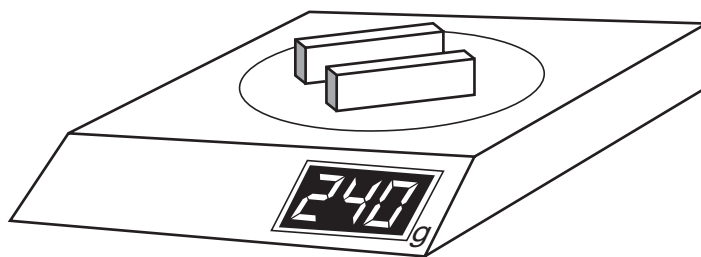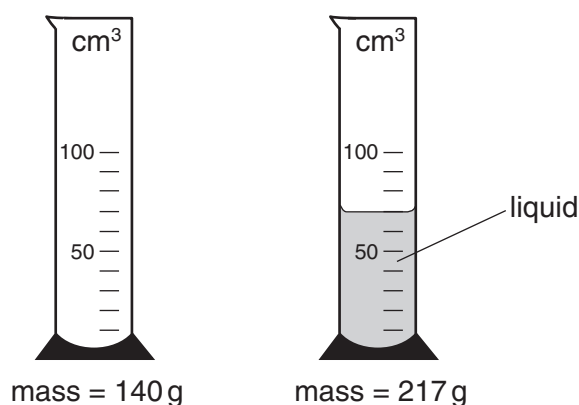**1**   A shop-keeper places two identical blocks of cheese on a set of scales and notices that their combined mass is 240 g. Each block measures 2.0 cm x 5.0 cm x 10.0 cm.

What is the density of the cheese?

A $0.42 \, \text{g}/\text{cm}^3$ **B** $0.83 \, \text{g}/\text{cm}^3$ **C** $1.2 \, \text{g}/\text{cm}^3$ **D** $2.4 \, \text{g}/\text{cm}^3$

2   The masses of a measuring cylinder before and after pouring some liquid are shown in the diagram.

mass = 140 g   mass = 217 g

What is the density of the liquid?

A $\dfrac{217}{52} \, \text{g}/\text{cm}^3$ **B** $\dfrac{217}{70} \, \text{g}/\text{cm}^3$ **C** $\dfrac{77}{52} \, \text{g}/\text{cm}^3$ **D** $\dfrac{77}{70} \, \text{g}/\text{cm}^3$

3   What apparatus is needed to determine the density of a regularly-shaped block?

A   a balance and a ruler

B   a balance and a forcemeter (spring balance)

C   a measuring cylinder and a ruler

D   a measuring cylinder and a beaker

4   The mass of a full bottle of cooking oil is 1.30 kg.

When exactly half of the oil has been used, the mass of the bottle plus the remaining oil is 0.90 kg.

What is the mass of the bottle?

A   0.40 kg   **B**   0.50 kg   **C**   0.65 kg   **D**   0.80 kg

5   A student tries to find the density of a metal block. First he measures the weight with a forcemeter (spring balance). Next he measures the sides of the block using a rule, in order to calculate the volume of the block. Finally he divides the weight by the volume to find the density.

The student has made a mistake.

Why does his method **not** give the density?

A   Density is volume divided by weight.

B   He should have measured the surface area, not the volume.

C   He should have used the mass in his calculation, not the weight.

D   Weight is not measured with a forcemeter (spring balance).

6   Which of the following is a unit of density?

A cm^3/g

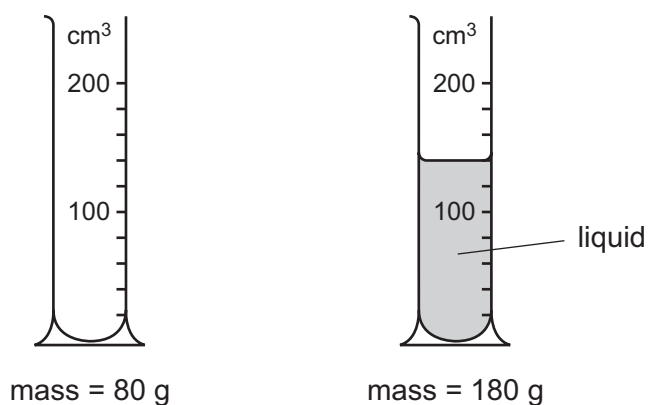**B** g/cm^2

C g/cm^3

D kg/m^2

7   The diagram shows some liquid in a measuring cylinder. The mass of the liquid is 16 g.
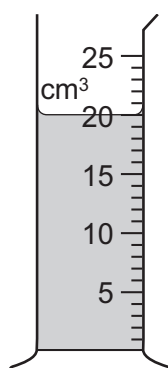

What is the density of the liquid?

A $320 g/cm^3$ **B** $36 g/cm^3$ **C** $1.25 g/cm^3$ **D** $0.8 g/cm^3$

8 The masses of a measuring cylinder before and after pouring some liquid into it are shown in the diagram.

mass = 80 g   mass = 180 g

What is the density of the liquid?

A $\dfrac{100}{120}$ g/cm^3 **B** $\dfrac{100}{140}$ g/cm^3 **C** $\dfrac{180}{120}$ g/cm^3 **D** $\dfrac{180}{140}$ g/cm^3

9 The same mass of four different liquids is placed in some measuring cylinders.

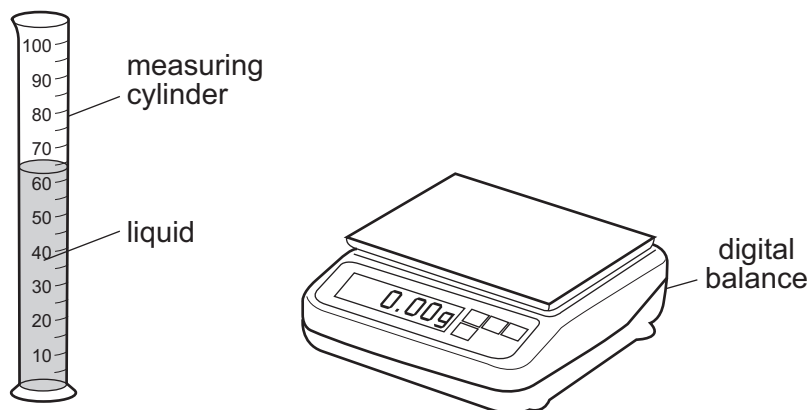Which measuring cylinder contains the liquid with the greatest density?
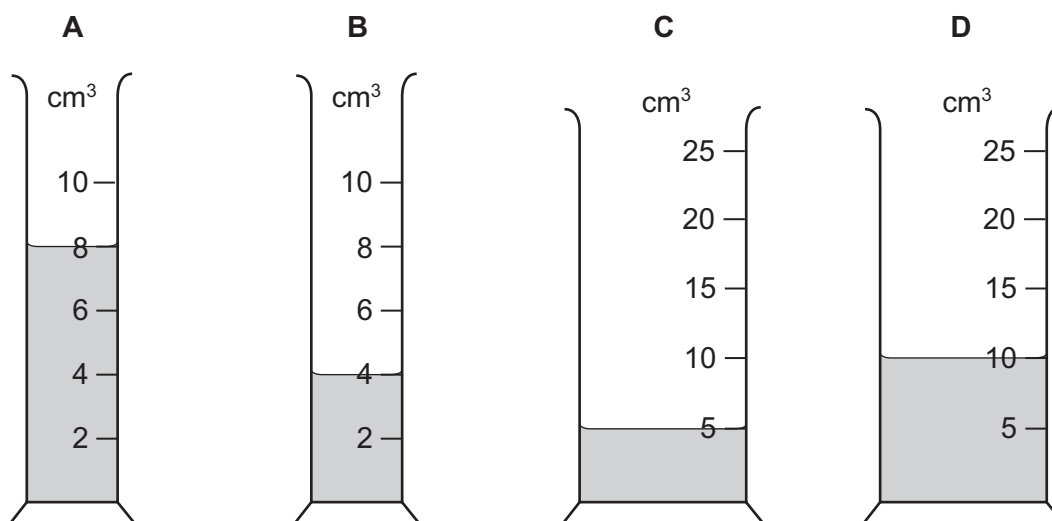
10 A person measures the length, width, height and mass of a rectangular metal block.

Which of these measurements are needed in order to calculate the density of the metal?

A mass only

B height and mass only

C length, width and height only

D length, width, height and mass

11 A student pours liquid into a measuring cylinder.

The student records the volume of the liquid from the scale on the measuring cylinder. He then puts the measuring cylinder containing the liquid on a balance and records the mass.

What else needs to be measured before the density of the liquid can be calculated?

A the depth of the liquid in the measuring cylinder

B the mass of the empty measuring cylinder

C the temperature of the liquid in the measuring cylinder

D the volume of the empty measuring cylinder

12 The diagram shows four blocks, each made of glass of density $2.6\,\text{g}/\text{cm}^3$.
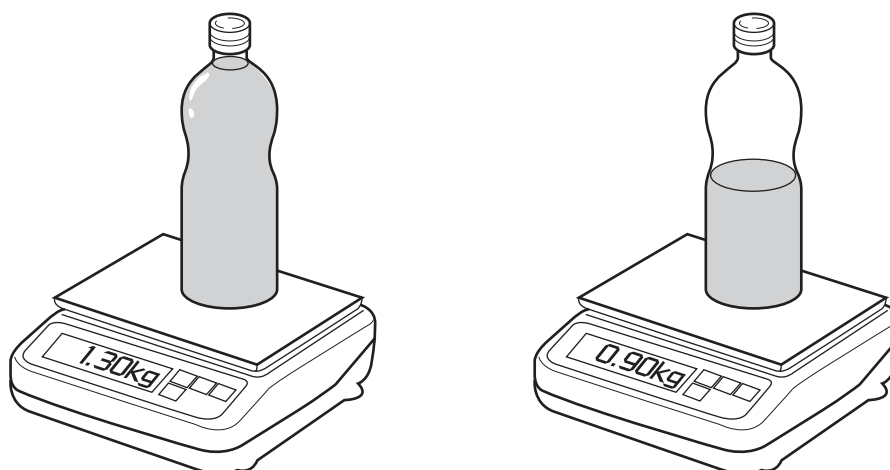
The top of each block has an area of $1\,\text{cm}^2$.

Which block has a mass of 13 g?
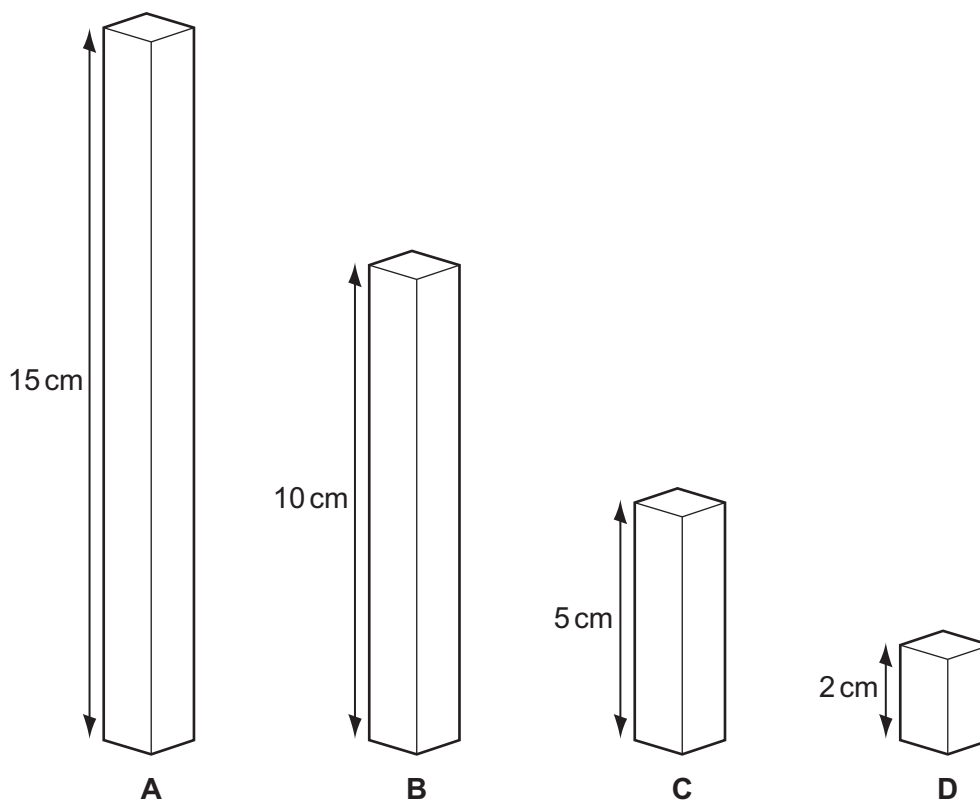
13 The mass of a full bottle of cooking oil is 1.30 kg.

When exactly half of the oil has been used, the mass of the bottle plus the remaining oil is 0.90 kg.
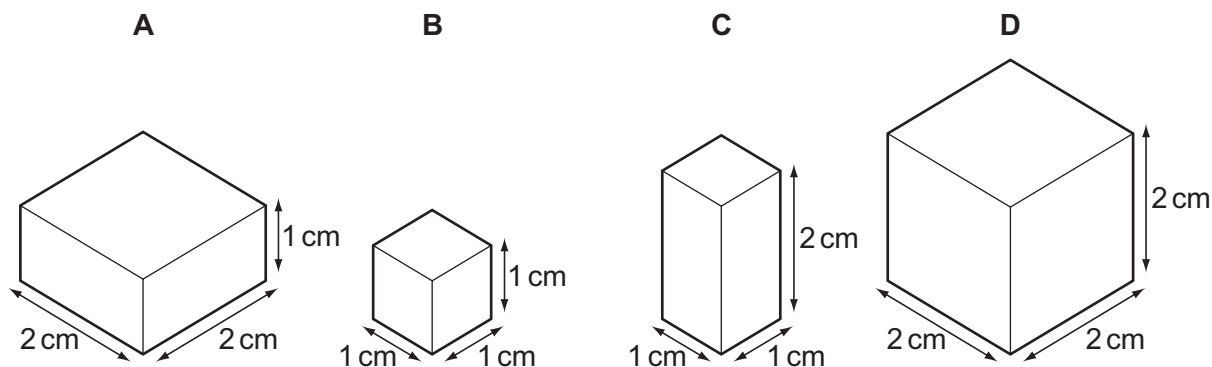

What is the mass of the empty bottle?

A 0.40 kg   **B** 0.50 kg   **C** 0.65 kg   **D** 0.80 kg

14 Which of the following is a unit of density?

   A cm^3/g **B** g/cm^2 **C** g/cm^3 **D** kg/m^2

15 Each of the solids shown in the diagram has the same mass.

   Which solid has the greatest density?

16 A student is trying to find the density of water and of a large, regularly-shaped solid.

   Which apparatus is needed to find the density of **both**?

   A   balance, clock, ruler
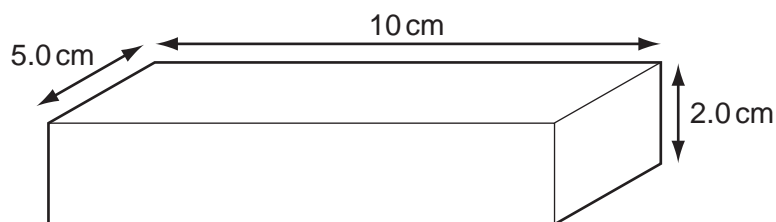
   B   balance, measuring cylinder, ruler

   C   balance, measuring cylinder, string

   D   clock, ruler, string

17 A metal drum has a mass of 200 kg when empty and 1000 kg when filled with 1.0 m^3 of methylated spirit.

   What is the density of methylated spirit?

   A $0.0050\,kg/m^3$

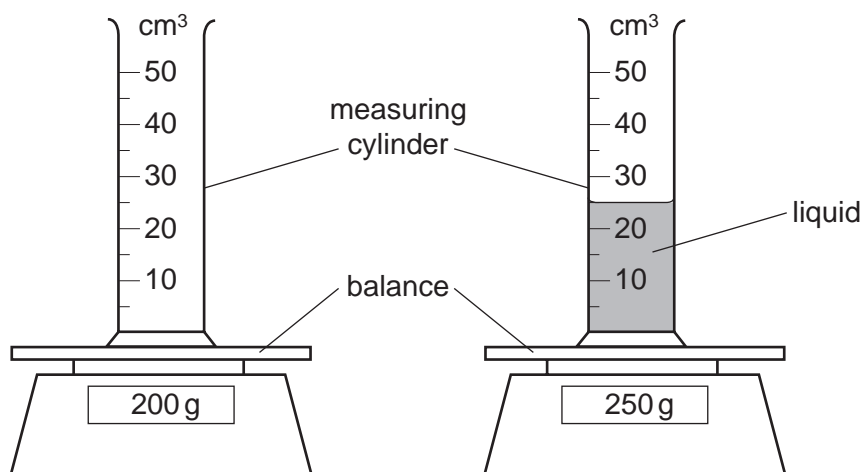   **B** $0.11\,kg/m^3$

   C $800\,kg/m^3$

   D $1000\,kg/m^3$

18   The diagram shows a rectangular metal block measuring $10\,cm \times 5.0\,cm \times 2.0\,cm$.

Its mass is 250 g.

What is the density of the metal?

A $0.20\,g/cm^3$ **B** $0.40\,g/cm^3$ **C** $2.5\,g/cm^3$ **D** $5.0\,g/cm^3$

19   The diagram shows an experiment to find the density of a liquid.

What is the density of the liquid?

A $0.5\,g/cm^3$ **B** $2.0\,g/cm^3$ **C** $8.0\,g/cm^3$ **D** $10.0\,g/cm^3$

20   A student needs to find the density of a cubic block of wood.

Which two pieces of apparatus should she use?

A   balance and metre rule

B   balance and thermometer

C   measuring cylinder and metre rule

D   measuring cylinder and thermometer

21   Two identical measuring cylinders containing different liquids are placed on a simple balance.

They balance as shown.

liquid X
volume = 200 cm^3

liquid Y
volume = 100 cm^3
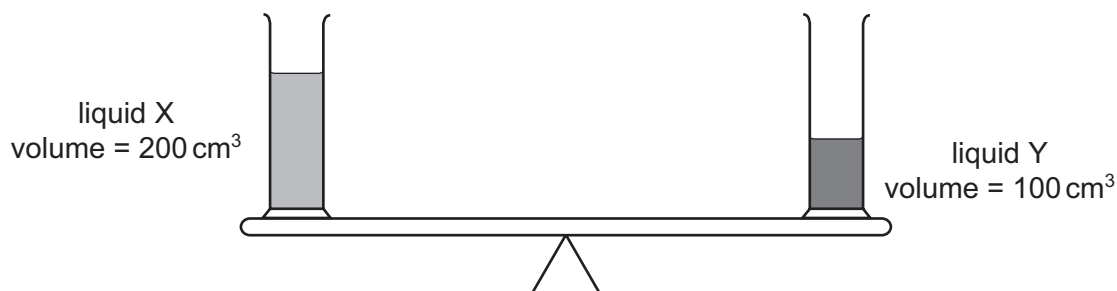
How does the density of X compare with the density of Y?

A   density of X = $\frac{1}{2}$ × density of Y

B   density of X = density of Y

C   density of X = 2 × density of Y

D   density of X = 4 × density of Y

22   Which items of apparatus are required to determine the density of a liquid?

A   balance and measuring cylinder

B   balance and thermometer

C   metre rule and measuring cylinder

D   metre rule and thermometer

23 The diagrams show a rectangular box with inside measurements of $5\,cm \times 6\,cm \times 4\,cm$.

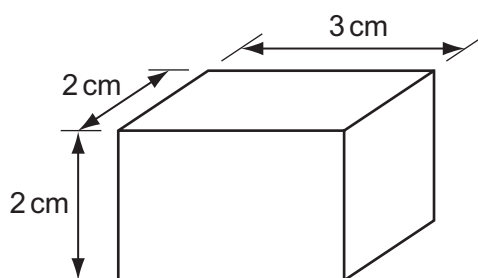mass = 40 g   total mass = 220 g
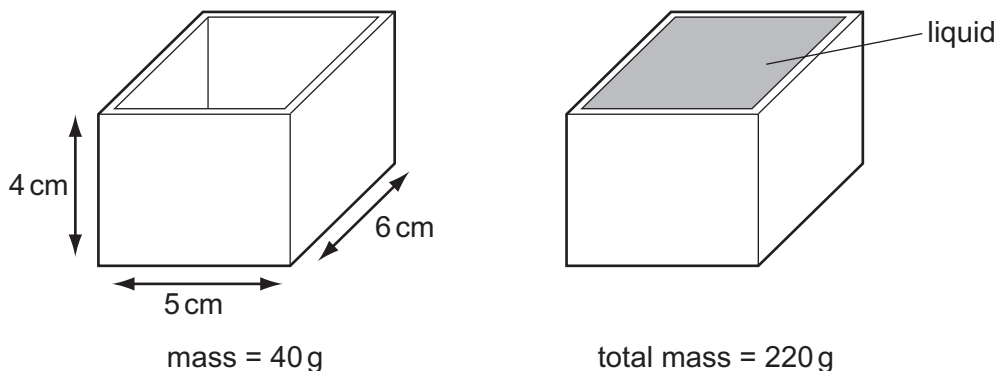
The box has a mass of 40 g when empty. When filled with a liquid, it has a total mass of 220 g.

What is the density of the liquid?

A $\dfrac{220}{(5 \times 6 \times 4)}\,g/cm^3$

B $\dfrac{(220 - 40)}{(5 \times 6 \times 4)}\,g/cm^3$

C $\dfrac{(5 \times 6 \times 4)}{220}\,g/cm^3$

D $\dfrac{(5 \times 6 \times 4)}{(220 - 40)}\,g/cm^3$

24 The diagram shows a rectangular block of density $2\,g/cm^3$.
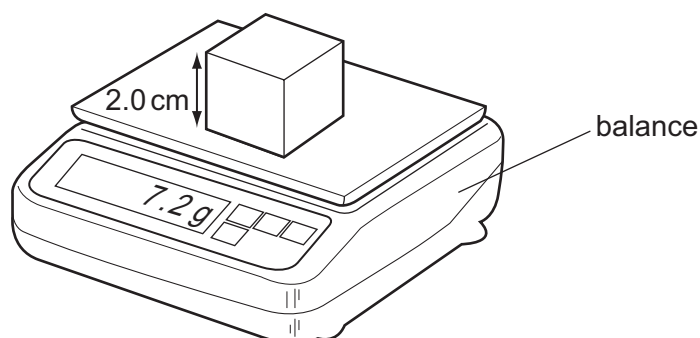

What is the mass of the block?

A 2 g   **B** 6 g   **C** 14 g   **D** 24 g

25 A student is trying to find the density of water and of a large, regularly shaped concrete block.

Which apparatus is needed to find the density of **both** the water and the concrete block?

A   balance, clock, measuring cylinder

B   balance, clock, ruler

C   balance, measuring cylinder, ruler

D   clock, measuring cylinder, ruler
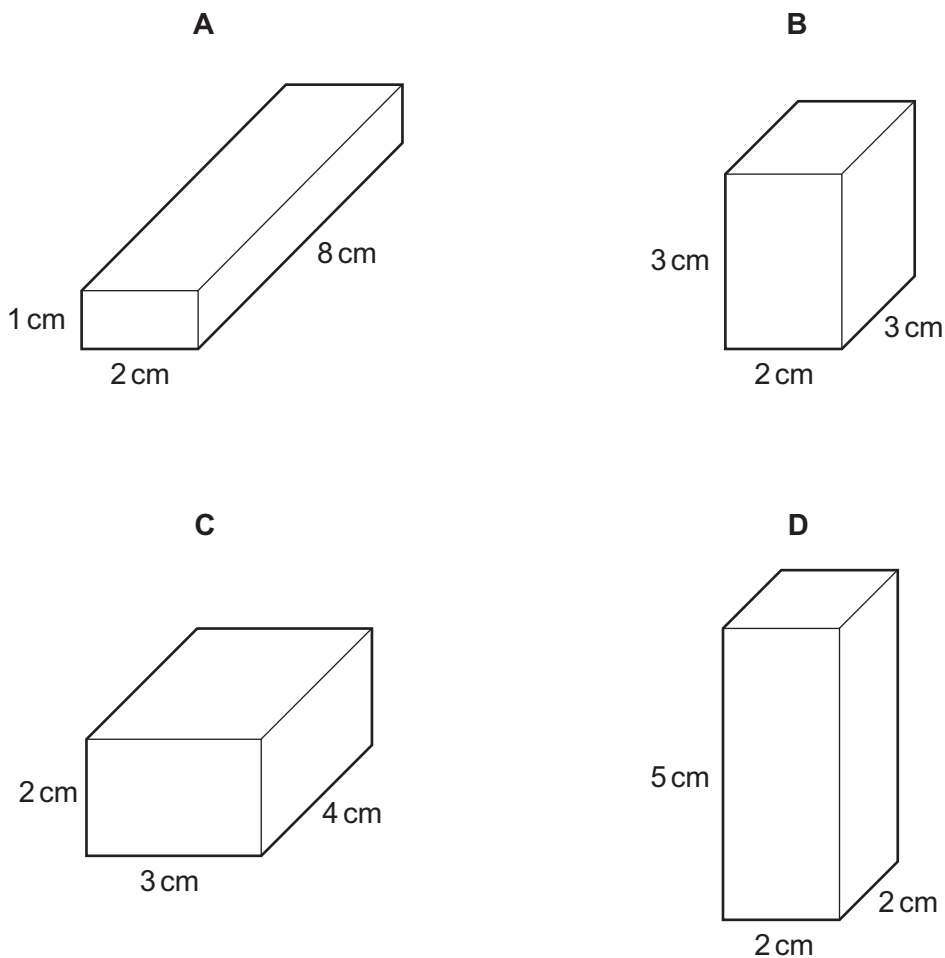
26 A cube of side 2.0 cm is placed on a balance.

What is the density of the cube?

A $0.90 \, \text{g/cm}^3$ B $1.2 \, \text{g/cm}^3$ C $1.8 \, \text{g/cm}^3$ D $3.6 \, \text{g/cm}^3$

27 The diagrams show four blocks with the same mass.

Which block is made from the least dense material?

28 A student is told to measure the density of a liquid and also of a large cube of metal.

Which pieces of equipment are sufficient to be able to take the measurements needed?

A   balance, measuring cylinder and ruler

B   balance and thermometer

C   measuring cylinder and ruler

D   measuring cylinder, ruler and thermometer

29 A stone has a volume of $0.50\,cm^3$ and a mass of $2.0\,g$.

What is the density of the stone?

A $0.25\,g/cm^3$

B $1.5\,g/cm^3$

C $2.5\,g/cm^3$

D $4.0\,g/cm^3$

30 A liquid has a density of $0.80\,g/cm^3$.

Which could be the volume and mass of this liquid?

	volume/cm^3	mass/g
A	2.0	16
B	8.0	10
C	10	8.0
D	16	2.0

31 Two identical glasses are filled to the same level with water. One of the two glasses has ice cubes floating in it. When the ice cubes melt, in which glass is the level of the water higher?

A the glass without ice cubes

B the glass with ice cubes

C the same in both

D insufficient information

32 Fresh water ice cubes are put into a glass of saltwater. Once the ice cubes have melted, how will the water level in the glass compare to what is was before the ice melted?

A level increases

B level decreases

**C** level stays the same

D insufficient information

1.4 Measuring time

1 A stopwatch is used to time a race. The diagrams show the watch at the start and at the end of the race.
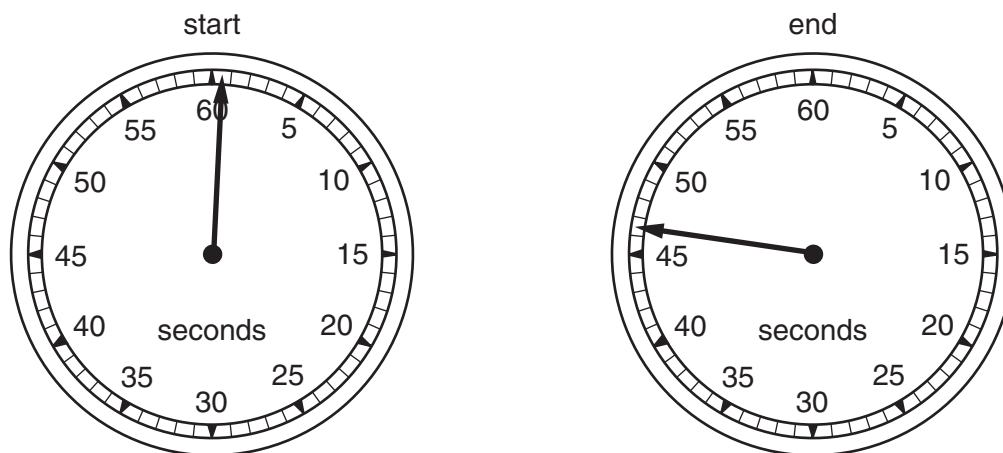
How long did the race take?

A 45.7 s   B 46.0 s   C 46.5 s   D 47.0 s

2 A pendulum is set in motion and 20 complete swings are timed. The time measured is 30 s.

What is the time for one complete swing of the pendulum?

A 0.67 s   B 0.75 s   C 1.5 s   D 3.0 s

3 The diagrams show the times on a stopclock at the beginning and at the end of an experiment.
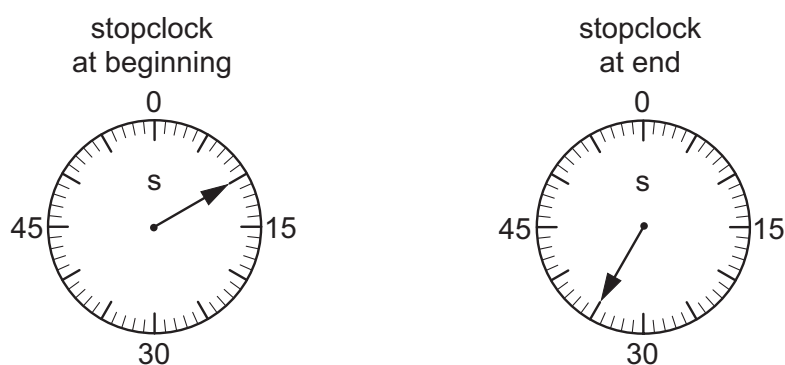
How long did the experiment take?

A 10 s   B 25 s   C 35 s   D 45 s

4   Two digital stopwatches X and Y, which record in minutes and seconds, are used to time a race.

The readings of the two stopwatches, at the start and at the end of the race, are shown.

	start	end
stopwatch X	00:00	00:40

|	start	end
stopwatch Y	01:30	02:20

Which statement about the time of the race is correct?

A   Both stopwatches record the same time interval.

B   Stopwatch X recorded 10 s longer than stopwatch Y.

C   Stopwatch Y recorded 10 s longer than stopwatch X.

D   Stopwatch Y recorded 50 s longer than stopwatch X.

5   A stopwatch is used to time an athlete running 100 m. The timekeeper forgets to reset the watch to zero before using it to time another athlete running 100 m.
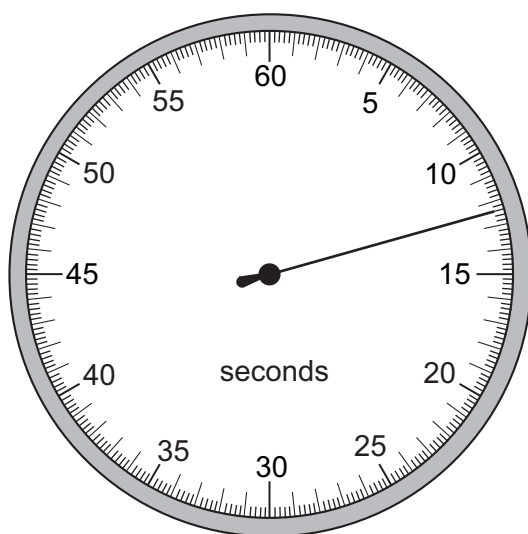
stopwatch at
end of first
athlete's run
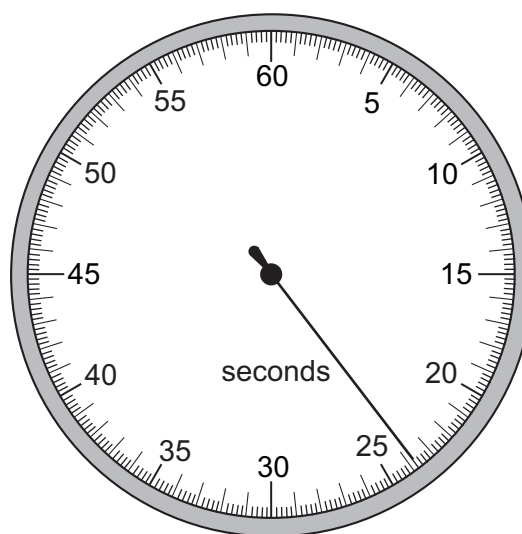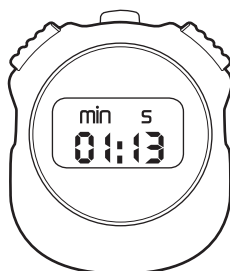
stopwatch at
end of second
athlete's run

How long does the second athlete take to run 100 m?

A   11.2 s   **B**   11.4 s   **C**   12.4 s   **D**   23.8 s

6 A student uses a stopwatch to time a runner running around a circular track. The runner runs two laps (twice around the track). The diagrams show the reading on the stopwatch when the runner starts running, at the end of the first lap, and at the end of the second lap.

reading when runner starts	reading at end of first lap	reading at end of second lap
min s 00:00	min s 01:13	min s 02:03

What is the time taken for the runner to run the second lap?

A 0 min 50 s   **B** 1 min 10 s   **C** 1 min 13 s   **D** 2 min 03 s

7 Four athletes run twice around a track. The table shows their times at the end of each lap.

Which athlete runs the second lap the fastest?

athlete	time at end of first lap / s	time at end of second lap / s
A	22.99	47.04
B	23.04	47.00
C	23.16	47.18
D	23.39	47.24

8 A pendulum is set in motion and timed. The time measured for 20 complete swings is 30 s.

What is the time for one complete swing of the pendulum?

A 0.67 s   **B** 0.75 s   **C** 1.5 s   **D** 3.0 s

9 A pendulum is set in motion and timed. The time measured for 20 complete swings is 30 s.

What is the time for one complete swing of the pendulum?

A 0.67 s   **B** 0.75 s   **C** 1.5 s   **D** 3.0 s