1. Motion, forces and energy

1.4 Density

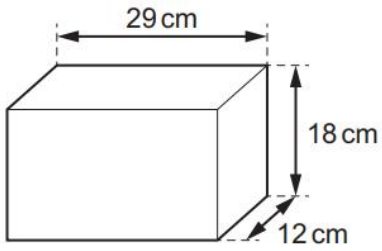
Paper 1 and 2

Question Paper

Paper 1

Questions are applicable for both core and extended candidates

1 A concrete building block has the dimensions shown.



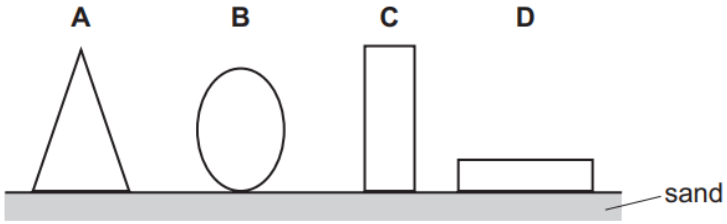
The mass of the block is 15 000 g.

What is the density of the block?

A $43\,g/cm^3$ **B** $2.4\,g/cm^3$ **C** $0.42\,g/cm^3$ **D** $0.023\,g/cm^3$

2 An artist makes four sculptures with circular bases and places them on sand. All the sculptures are of equal weight and volume.

Which sculpture is least likely to sink into the sand?



3 A quantity of water is boiled to form the same mass of steam.

Which row shows how the volume and density of the water change?

	volume	density
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

4 Which equipment is used to find the density of an irregularly shaped stone?

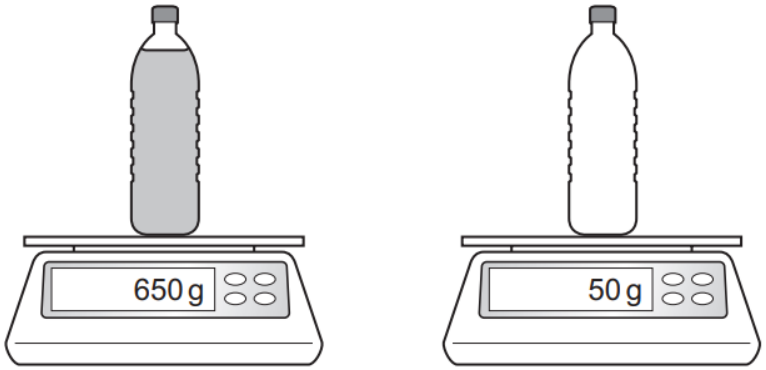
A force meter and ruler

B measuring cylinder, ruler and water

C measuring cylinder, top pan balance and water

D top pan balance and ruler

5 A plastic bottle contains 750 cm^3 of oil. The diagram shows the mass of the bottle being measured when it is full and then when it is empty.



What is the density of the oil?

A 0.80 g/cm^3 **B** 0.93 g/cm^3 **C** 1.1 g/cm^3 **D** 1.3 g/cm^3

6 A student has a bottle of cooking oil.

She determines the density of the cooking oil.

Which apparatus does she need?

	balance	measuring cylinder	ruler	thermometer
A	✓	✓	✓	✓
B	✓	✓	✓	✗
C	✓	✓	✗	✗
D	✓	✗	✗	✗

key

✓ = needed

✗ = not needed

7 Which equation is correct?

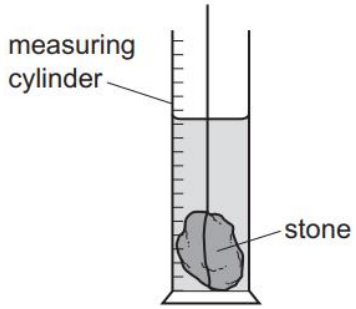
A density = mass × volume

B density = weight × volume

C mass = density × volume

D weight = density × volume

8 A student determines the density of an irregularly shaped stone. The stone is slowly lowered into a measuring cylinder partly filled with water.



Which other apparatus does the student need to calculate the density of the irregularly shaped stone?

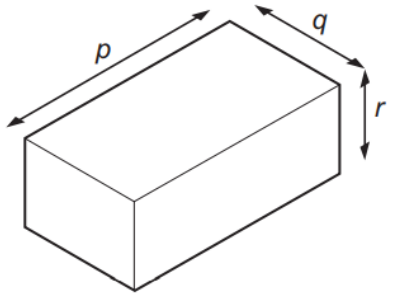
A a balance

B a thermometer

C a metre rule

D a stop-watch

9 The diagram shows the dimensions of a solid rectangular block of metal of mass *m*.



Which expression is used to calculate the density of the metal?

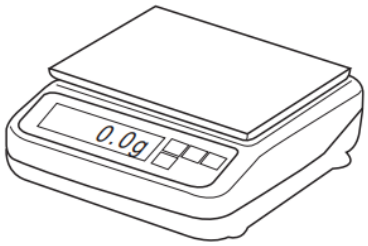
A $\frac{m}{(p \times q)}$

B $\frac{m}{(p \times q \times r)}$

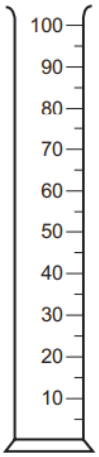
C $m \times p \times q$

D $m \times p \times q \times r$

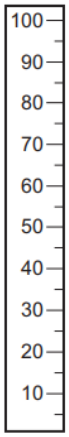
10 The diagram shows four pieces of laboratory apparatus.



balance



measuring cylinder



ruler

stop-watch

Which pieces of apparatus are used to find the density of a liquid?

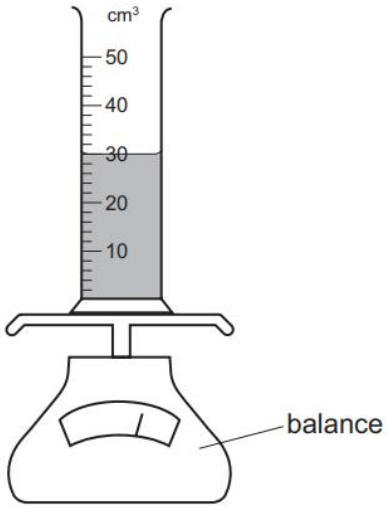
A balance and stop-watch

B balance and measuring cylinder

C measuring cylinder and ruler

D stop-watch and ruler

11 A measuring cylinder contains 30 cm^3 of a liquid.



Some more of the liquid is added until the liquid level reaches the 50 cm^3 mark.

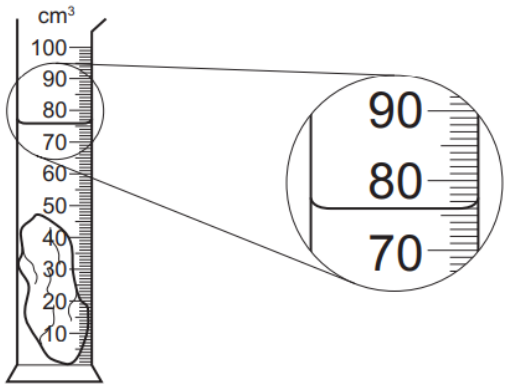
The reading on the balance increases by 30 g.

What is the density of the liquid?

A 0.60 g/cm^3 **B** 0.67 g/cm^3 **C** 1.5 g/cm^3 **D** 1.7 g/cm^3

12 A measuring cylinder contains 40 cm^3 of water.

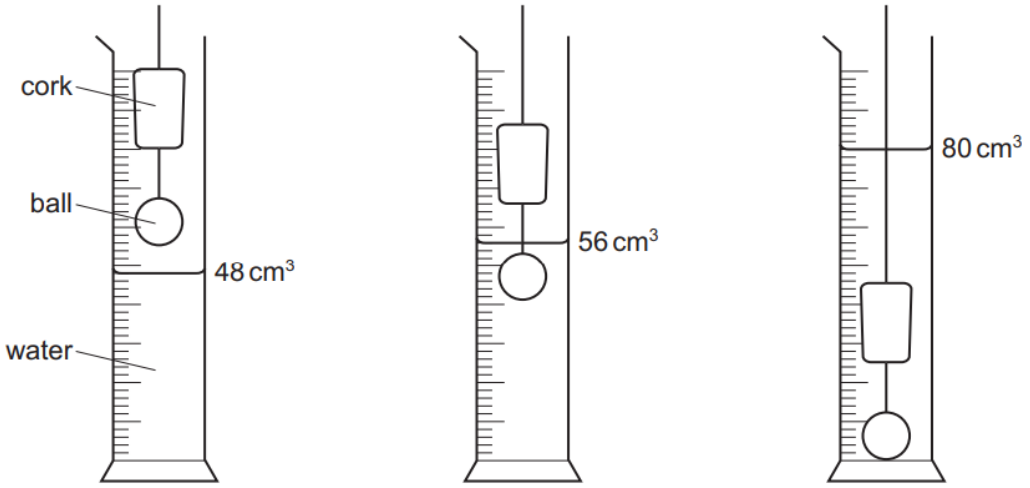
A stone of mass 94 g is lowered into the water so that it is fully submerged as shown.



What is the density of the stone?

A 1.1 g/cm^3 **B** 1.2 g/cm^3 **C** 2.1 g/cm^3 **D** 2.6 g/cm^3

13 A metal ball is attached to a cork and is lowered into a measuring cylinder, pulling the cork into the water, as shown.



ball and cork above the water

ball fully submerged but cork above the water

both ball and cork fully submerged

The mass of the cork is 4.8 g.

What is the density of the cork?

A $0.15\,g/cm^3$ **B** $0.20\,g/cm^3$ **C** $0.60\,g/cm^3$ **D** $5.0\,g/cm^3$

14 The mass of a measuring cylinder is 190 g.

400 cm^3 of liquid is put into the measuring cylinder.

The total mass of the measuring cylinder and the liquid is 560 g.

Four solid objects are lowered in turn into the liquid. The densities of the objects are shown.

1 0.40 g/cm^3

2 0.90 g/cm^3

3 1.2 g/cm^3

4 2.7 g/cm^3

Which objects will float in the liquid?

A 1 only **B** 1 and 2 only **C** 1, 2 and 3 **D** 3 and 4 only

15 Water has a density of 1000 kg/m^3.

A rectangular swimming pool has an average depth of 1.6 m.

The length of the pool is 25 m.

The width of the pool is 10 m.

What is the mass of the water in the swimming pool?

A 2.5 kg **B** 400 kg **C** 400 000 kg **D** 800 000 kg

16 The density of air is $1.2\,kg/m^3$.

A room has dimensions $5.0\,m \times 4.0\,m \times 3.0\,m$.

What is the mass of the air in the room?

A 0.02 kg **B** 0.10 kg **C** 50 kg **D** 72 kg

17 The table gives the mass and the volume of three objects P, Q and R.

object	mass / g	volume / cm^3
P	23	36
Q	170	720
R	240	340

Which objects can float in a liquid of density $0.85\,g/cm^3$?

A P and Q only

B P and R only

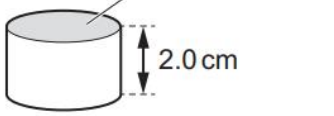
C Q and R only

D P, Q and R

18 The diagrams show four solid blocks with their dimensions and masses.

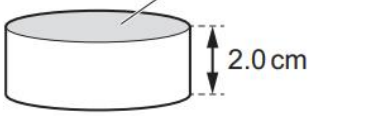
Which block has the greatest density?

A



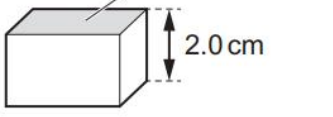
mass = 14 g

B



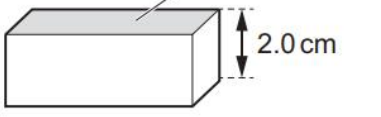
mass = 48 g

C



mass = 54 g

D



mass = 68 g

19 A metal has a density of 8.0 g / cm^3. A solid cube of mass 1.0 kg is made from this metal.

How long is each side of the cube?

A 0.50 cm **B** 2.0 cm **C** 5.0 cm **D** 42 cm

20 A liquid has a volume of 0.040 m^3 and a mass of 30 000 g.

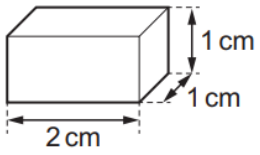
What is the density of the liquid?

A 0.075 kg / m^3 **B** 7.5 kg / m^3 **C** 750 kg / m^3 **D** 7500 kg / m^3

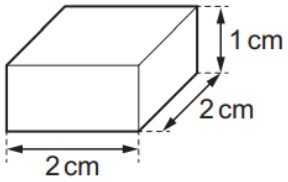
21 The diagram shows four blocks of different metals. Each block has a mass of 12 g.

Which metal has the largest density?

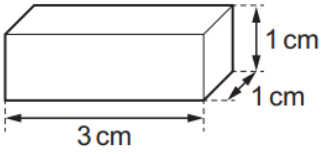
A



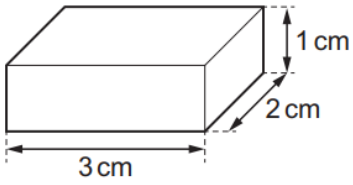
B



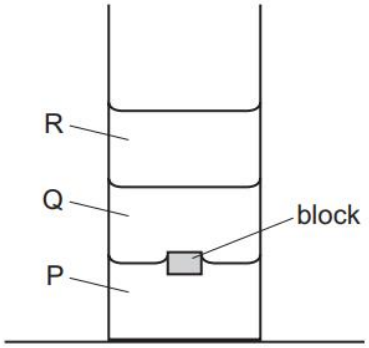
C



D



22 Three liquids P, Q and R have different densities and do not mix. The liquids are placed in a measuring cylinder and allowed to settle. A small block is then dropped into the measuring cylinder and comes to rest, as shown.



Which statement about the density of the block is correct?

A It is equal to the density of Q.

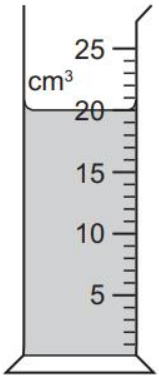
B It is greater than the density of P.

C It is greater than the density of R.

D It is less than the density of Q.

23 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 $0.80\,g/cm^3$ **B** $1.25\,g/cm^3$ **C** $36\,g/cm^3$ **D** $320\,g/cm^3$

24 Two objects P and Q are placed in a beaker containing a liquid.

Object P floats in the liquid and object Q sinks.

Which row for the densities of object P, object Q and the liquid is possible?

	density of object P / g/cm^3	density of object Q / g/cm^3	density of liquid / g/cm^3
A	1.2	0.6	0.8
B	1.2	1.4	1.0
C	11.3	8.9	13.6
D	11.3	19.3	13.6

Paper 2

Questions are applicable for both core and extended candidates unless indicated in the question

25 The mass of an object is 2.5 kg. The volume of the object is 480 cm^3.

What is the density of the object?

A $5.2 \times 10^{-3}\,g/cm^3$

B $5.2\,g/cm^3$

C $190\,g/cm^3$

D $1.2 \times 10^{3}\,g/cm^3$

26 A sealed container of volume 2000 cm^3 contains air at high pressure.

The container is placed on a top-pan balance.

The balance reads 200.00 g.

All the air is removed by a vacuum pump and the balance reading changes to 196.00 g.

What was the density of the pressurised air?

A $0.00200\,g/cm^3$

B $0.098\,g/cm^3$

C $4.00\,g/cm^3$

D $10.2\,g/cm^3$

27 The table shows the mass and volume of three different liquids, X, Y and Z. **(extended only)**

liquid	mass / g	volume / cm^3
X	120	200
Y	80	67
Z	100	120

The liquids are placed in the same container. The liquids do not mix.

Which liquid is at the top of the container and which liquid is at the bottom?

	liquid at top	liquid at bottom
A	X	Y
B	X	Z
C	Y	X
D	Y	Z

28 A plastic ball has a mass of 4.0 g and a volume of 20 cm^3.

There is a crack in the ball's surface.

The ball is placed in a bath of water. Water leaks into the ball without changing the volume of the ball and eventually the ball sinks.

The density of water = 1.0 g / cm^3.

Which mass of water has entered the ball when the top of the ball is first level with the water surface?

A 5.0 g **B** 16 g **C** 20 g **D** 24 g

29 Which two quantities must be known to determine the density of a material?

A mass and area

B mass and volume

C weight and area

D weight and volume

30 Which substance in the table has the lowest density?

	substance	mass / g	volume / cm^3
A	nylon	1.2	1.0
B	cotton	1.5	1.0
C	olive oil	1.8	2.0
D	water	2.0	2.0

31 The mass of an empty flask is 34 g.

The volume of liquid added to the flask is 20 cm^3.

The total mass of the flask and the liquid is 50 g.

What is the density of the liquid?

A 0.80 g / cm^3 **B** 1.25 g / cm^3 **C** 2.50 g / cm^3 **D** 4.20 g / cm^3

32 A rectangular metal block is 20 cm long.

The cross-sectional area of the block is 25 cm^2.

The mass of the block is 4000 g.

What is the density of the metal?

A 0.13 g / cm^3 **B** 0.32 g / cm^3 **C** 8.0 g / cm^3 **D** 2000 g / cm^3