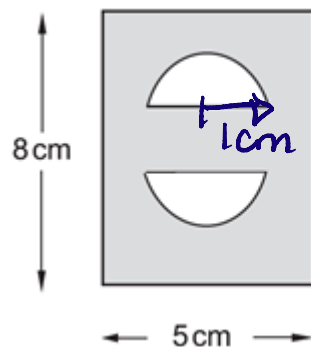


# Volume of Prisms, Cones, Pyramids & Spheres (F)

A collection of 9-1 Maths GCSE Sample and Specimen questions from AQA, OCR, Pearson-Edexcel and WJEC Eduqas.

|              |               |
|--------------|---------------|
| Name:        | Mel@JustMaths |
| Total Marks: |               |

1. Jo makes a pendant by cutting two semicircles of radius 1 cm from the rectangle, as shown below.



Not to scale

$$C = \pi D$$

$$A = \pi r^2 \quad \leftarrow$$

Show that the shaded area is  $36.9 \text{ cm}^2$  correct to three significant figures.

$$\text{Area of rectangle} = 8 \times 5 = 40 \text{ cm}^2$$

$$\text{area of circle} = \pi \times r^2 = \pi \times 1^2 = 3.14 \text{ cm}^2$$

$$\text{Shaded area} = \begin{array}{r} 40.00 \\ - 3.14 \\ \hline 36.86 \end{array} \approx 36.9 \text{ cm}^2 \quad (3 \text{ s.f.}) \quad [4]$$

The silver Jo uses is 2 mm thick.

Find the volume of silver in the pendant.

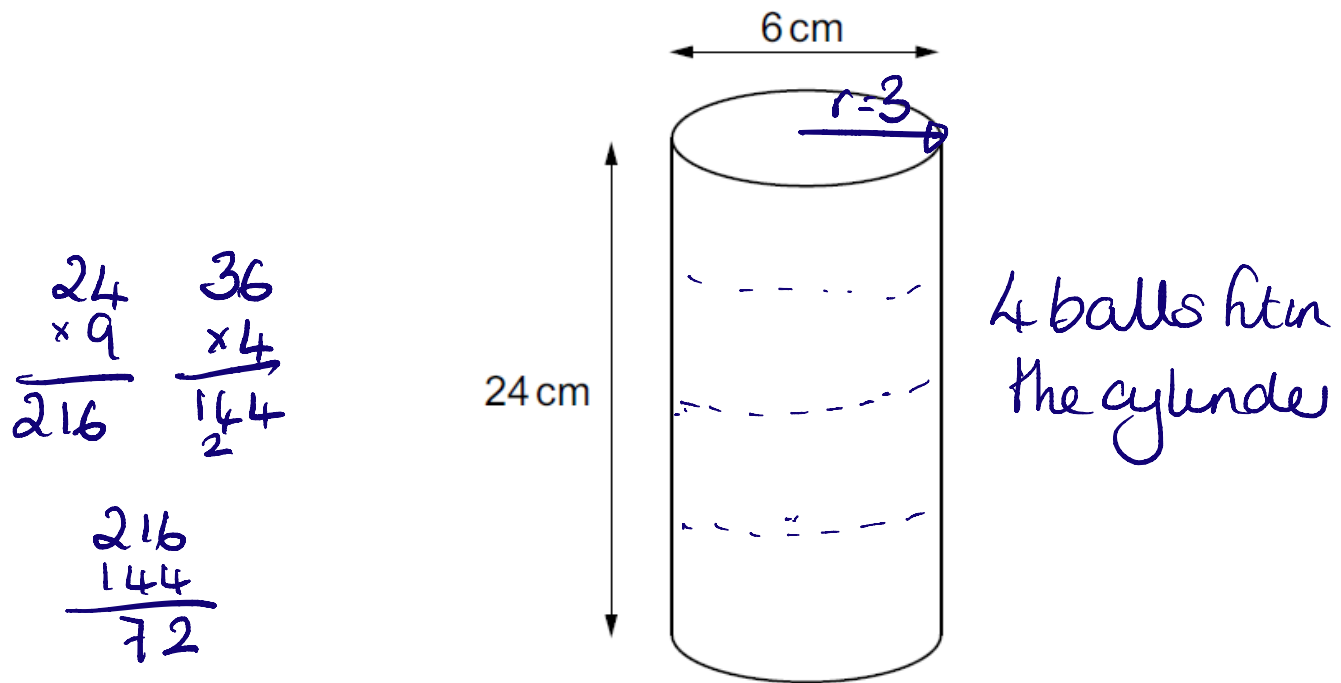
Give your answer in  $\text{cm}^3$ .

$$2 \text{ mm} = 0.2 \text{ cm}$$

$$\begin{aligned} \text{Volume} &= 36.9 \times 0.2 \\ &= 7.38 \text{ cm}^3 \end{aligned}$$

$$\dots\dots\dots 7.38 \dots\dots\dots \text{ cm}^3 \quad [3]$$

2. Four solid balls are packed in a cylindrical container.



The diameter of each ball is 6 cm.

The cylinder has diameter 6 cm and height 24 cm.

Calculate the volume of unused space in the cylinder.

(The volume  $V$  of a sphere is  $V = \frac{4}{3}\pi r^3$ )

$$\text{Volume of cylinder} = \pi r^2 h = \pi \times 3^2 \times 24 = 216\pi \text{ cm}^3$$

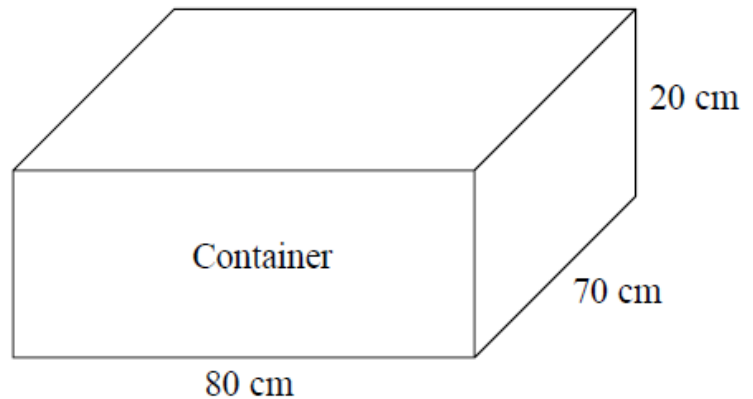
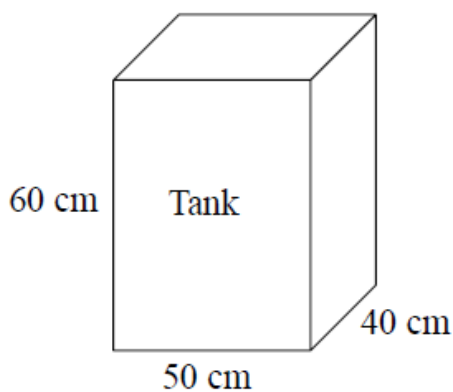
$$\begin{aligned} \text{Volume of 1 sphere} &= \frac{4}{3} \pi \times 3^3 = \frac{4}{\cancel{3}} \pi \times 3 \times 3 \times \cancel{3} \\ &= 36\pi \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{so 4 spheres} &= 4 \times 36\pi \\ &= 144\pi \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Unused space} &= 216\pi - 144\pi \\ &= 72\pi \end{aligned}$$

$$\dots\dots\dots 72\pi \dots\dots\dots \text{ cm}^3 [6]$$

3. The diagram shows a tank in the shape of a cuboid.



It also shows a container in the shape of a cuboid.

The tank is full of oil.  $\text{Volume} = 50 \times 60 \times 40 = 120000 \text{ cm}^3$

The container is empty.

35% of the oil from the tank is spilled.  $10\% = 12000$   $30\% = 36000$

The rest of the oil from the tank is put into the container.

Work out the height of the oil in the container.

Give your answer to an appropriate degree of accuracy.

$$\begin{array}{r} \text{The rest} = \\ 120000 \\ - 36000 \\ \hline 84000 \text{ cm}^3 \end{array}$$

$$\begin{aligned} 80 \times 70 \times h &= 84000 \\ h &= \frac{84000}{5600} = 15 \text{ cm} \end{aligned}$$

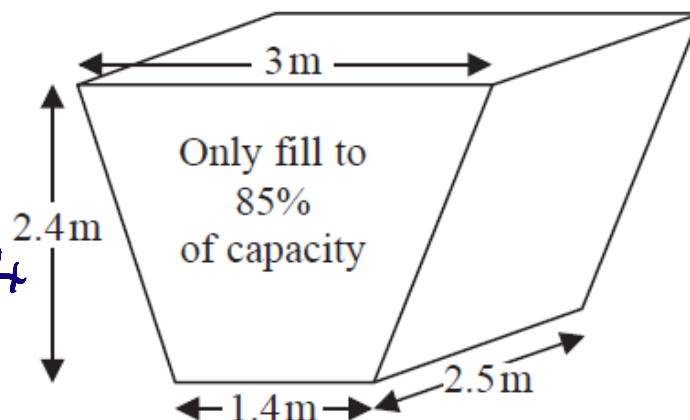
..... 15 ..... cm [5]

4. The diagram shows an oil tank in the shape of a prism.

The cross section of the prism is a trapezium.

Cross sectional area

$$\begin{aligned} &= \frac{1}{2}(3 + 1.4) \times 2.4 \\ &= 2.2 \times 2.4 \\ &= 5.28 \text{ m}^2 \end{aligned}$$



$$\begin{aligned} \text{Volume} &= 5.28 \times 2.5 \\ &= 13.2 \text{ m}^3 \end{aligned}$$

The tank is empty.

Oil flows into the tank.

After one minute there are 300 litres of oil in the tank. *300 litres/minute*

Assume that oil continues to flow into the tank at this rate.

(a) Work out how many more minutes it takes for the tank to be 85% full of oil.

(1 m<sup>3</sup> = 1000 litres)

$$13.2 \text{ m}^3 = 13.2 \times 1000 \text{ litres} = 13,200 \text{ litres}$$

$$85\% = 13200 \times 0.85 = 11,220 \text{ litres}$$

$$\text{less } 300 \text{ litres} = 10920$$

$$\text{at a rate of } 300 \text{ l/min} = 10920 \div 300 = 36.4$$

..... *36.4* ..... minutes [5]

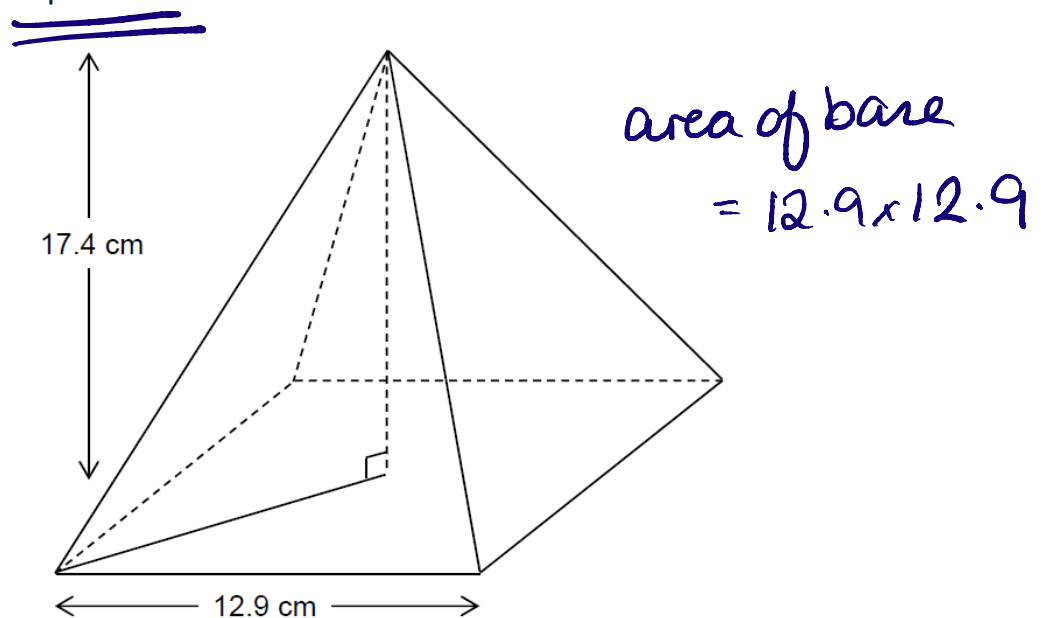
The assumption about the rate of flow of the oil could be wrong.

(b) Explain how this could affect your answer to part (a).

*if it is a faster rate it will take less time. If it flows slower it will take more time*

[1]

5. This pyramid has a square base.



Volume of a pyramid =  $\frac{1}{3} \times \text{area of base} \times \text{perpendicular height}$

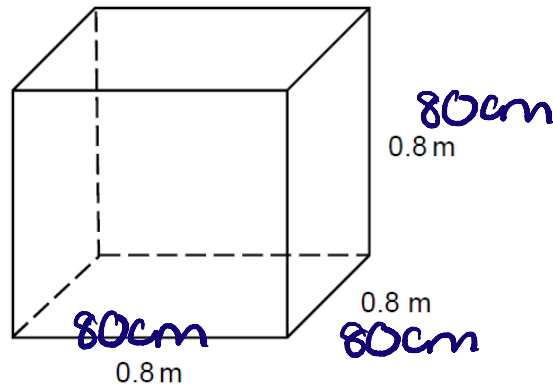
Work out the volume of the pyramid.

$$= \frac{1}{3} \times (12.9 \times 12.9) \times 17.4$$

$$= 965.178 \text{ cm}^3$$

[3]

6. A cube has edges of length 0.8 metres.

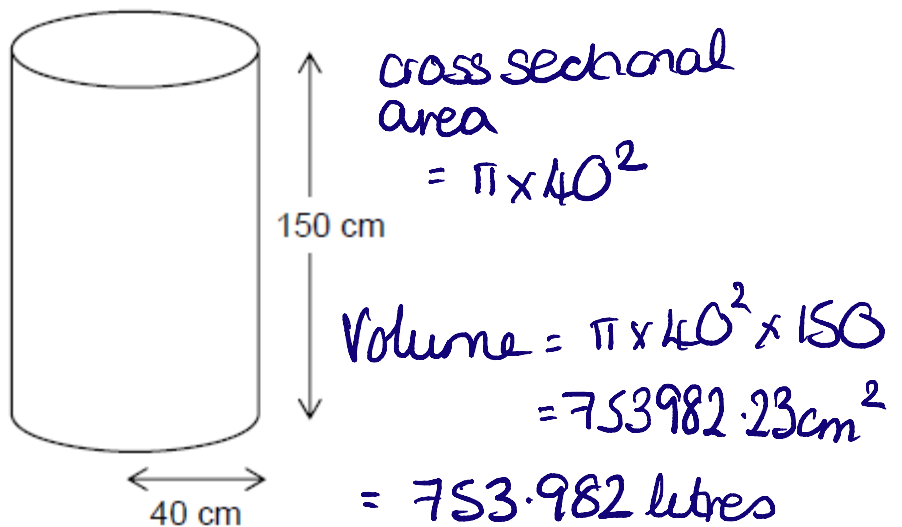


Work out its volume in cubic centimetres.

$$80 \times 80 \times 80 =$$

$$512,000 \text{ cm}^3 \text{ [2]}$$

7. A water tank is a cylinder with radius 40 cm and depth 150 cm



It is filled at the rate of 0.2 litres per second.

$$\Rightarrow 753.982 \div 0.2$$

1 litre = 1000 cm<sup>3</sup>

$$= 3769.9 \text{ seconds}$$

Does it take longer than 1 hour to fill the tank?

You must show your working.  $\Rightarrow 60 \times 60 \text{ s} = 3600 \text{ seconds}$

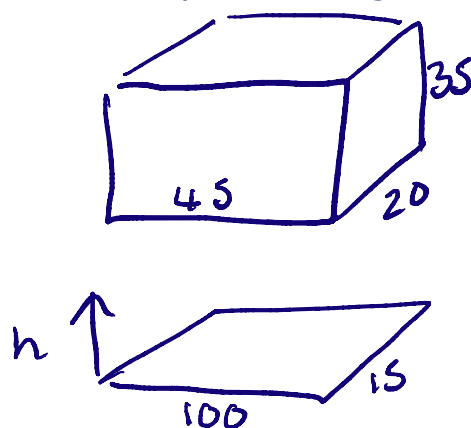
yes it takes longer than 1 hour to fill

[4]

8. A cuboid with length 45 cm, width 20 cm and height 35 cm is completely filled with water.

The water is then poured into a larger cuboid with length 100 cm and width 15 cm. Calculate the height of the water in the larger cuboid.

Show all your working.



$$\text{Volume} = 45 \times 35 \times 20 = 31,500 \text{ cm}^3$$

$$31,500 = 100 \times 15 \times h$$

$$h = \frac{31,500}{1500}$$

$$= \underline{21 \text{ cm}}$$

[4]

9. The diagram shows a sand pit.

The sand pit is in the shape of a cuboid.

Sally wants to fill the sand pit with sand.

A bag of sand costs £2.50

There are 8 litres of sand in each bag.

$$\hookrightarrow 8000 \text{ cm}^3$$

Sally says,

"The sand will cost less than £70"

Show that Sally is wrong.

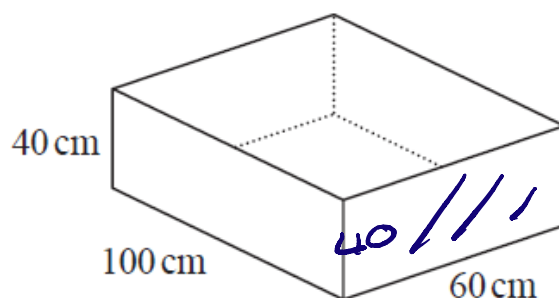
$$1000 \text{ cm}^3 = 1 \text{ litre.}$$

$$240,000 \div 8000 = 30 \text{ bags}$$

$$30 \times £2.50 = £75$$

$$£75 > £70$$

Sally is wrong [5]

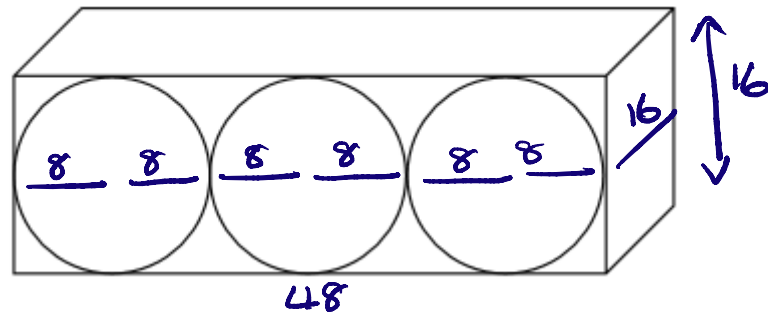


$$60 \times 40 \times 100 = 240,000 \text{ cm}^3$$

10. Volume of a sphere =  $\frac{4}{3} \pi r^3$  where  $r$  is the radius.

a) Work out the volume of a sphere of radius 8 cm  $\frac{4}{3} \times \pi \times 8^3 = 536.165 \text{ cm}^3$  [2]

b) Three spheres of radius 8 cm are packed tightly into a cuboid as shown.



Work out the volume of the cuboid.

[4]

$$\begin{aligned} \text{Volume} &= 16 \times 16 \times 48 \\ &= \underline{19,968 \text{ cm}^3} \end{aligned}$$

## CREDITS AND NOTES

| Question | Awarding Body   |
|----------|-----------------|
| 1        | OCR             |
| 2        | OCR             |
| 3        | Pearson Edexcel |
| 4        | Pearson Edexcel |
| 5        | AQA             |
| 6        | AQA             |
| 7        | AQA             |
| 8        | WJEC Eduqas     |
| 9        |                 |
| 10       | AQA             |

### Notes:

These questions have been retyped from the original sample/specimen assessment materials and whilst every effort has been made to ensure there are no errors, any that do appear are mine and not the exam board's (similarly any errors I have corrected from the originals are also my corrections and not theirs!).

Please also note that the layout in terms of fonts, answer lines and space given to each question does not reflect the actual papers to save space.

These questions have been collated by me as the basis for a GCSE working party set up by the GLOW maths hub - if you want to get involved please get in touch. The objective is to provide support to fellow teachers and to give you a flavour of how different topics "could" be examined. They should not be used to form a decision as to which board to use. There is no guarantee that a topic will or won't appear in the "live" papers from a specific exam board or that examination of a topic will be as shown in these questions.



### Links:

AQA <http://www.aqa.org.uk/subjects/mathematics/gcse/mathematics-8300>

OCR <http://ocr.org.uk/gcsemaths>

Pearson Edexcel <http://qualifications.pearson.com/en/qualifications/edexcel-gcses/mathematics-2015.html>

WJEC Eduqas <http://www.eduqas.co.uk/qualifications/mathematics/gcse/>

### Contents:

This version contains questions from:

AQA – Sample Assessment Material, Practice set 1 and Practice set 2

OCR – Sample Assessment Material and Practice set 1

Pearson Edexcel – Sample Assessment Material, Specimen set 1 and Specimen set 2

WJEC Eduqas – Sample Assessment Material