Logo

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**FUNCTIONAL SKILLS**

Maths Level 2



**Area: Measure, shape and space**

Criterion: 15. Use formulae to find volumes and surface areas of 3-D shapes including cylinders (formulae to be given for 3-D shapes other than cylinders)

**Underpinning knowledge**

Underpinning knowledge of the following is required before attempting this workbook:

* order of precedence: BIDMAS (or BODMAS)
* converting between metres and centimetres
* area of a circle
* area of a square
* area of a rectangle

**Calculating the volume of cubes**

Volume is the amount of space within a 3-D shape or an object.

The formula for calculating the volume of a **cube** is: V = L x W x H.

A diagram of a cube and a cube

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V = volume

L = length

W = width

H = height

The L (length) is 2cm, the W (width) is 2cm and the H (height) is 2cm.

Volume = 2cm x 2cm x 2cm = 8cm3

Therefore, the volume of the cube = 8cm3.

A cube’s volume is found when we multiply a number by itself and then itself again. The symbol for cubed is 3.

Each face of a cube is made up of a square, so each side will have the same length. This is because a square’s sides are all the same length. Therefore, you only need to be given 1 measurement to calculate the volume of a cube.

The formula for calculating a cube’s volume will be given in your exam.

**Question 1**

Calculate the volume of this cube.

*Formula = length x width x height*

***Diagram not to scale***

W = 6cm

(Show your working out.)

(2 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Question 2**

Calculate the volume of this cube.

*Formula = length x width x height*

H = 14m

***Diagram not to scale***

(Show your working out.)

(2 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_m3 |

**Question 3**

A cube has a height of 12cm. Calculate the volume of the cube.

*Formula = length x width x height*

(Show your working out.)

(2 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Calculating the volume of cuboids**

The formula for calculating the volume of a **cuboid** is the same as the formula for calculating the volume of a cube: V = L x W x H.

A diagram of a rectangular object with arrows pointing to the sides

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V = volume

**4 cm**

L = length

W = width

H = height

**3 cm**

**9 cm**

The L (length) is 9cm, the W (width) is 3cm and the H (height) is 4cm.

Volume = 9cm x 3cm x 4cm = 108cm3

Therefore, the volume of the cuboid = 108cm3.

Although cuboids use the same formula as cubes to calculate volume, their length, width and height will all be different.

The formula for calculating a cube’s volume will be given in your exam.

**Question 4**

Calculate the volume of this cuboid.

*Formula = length x width x height*

H = 7cm

***Diagram not to scale***

W = 6cm

L = 14cm

(Show your working out.)

(2 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Question 5**

Calculate the volume of this cuboid.

*Formula = length x width x height*

H = 4cm

***Diagram not to scale***

W = 4cm

L = 8cm

(Show your working out.)

(2 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Question 6**

What is the volume of a cuboid with the following measurements?

* Length = 21cm
* Width = 9cm
* Height = 10cm

*Formula = length x width x height*

(Show your working out.)

(2 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Calculating the volume of cylinders**

The formula for calculating the volume of a **cylinder** is:

v = *π* r2 h

* A picture containing cylinder, screenshot, design

  Description automatically generatedv = volume
* π = 3.14
* r = radius
* h = height

For example, the cylinder shown has:

* a height of 10cm
* a radius of 4cm

Therefore, the volume = 3.14 x (4 x 4) x 10

Volume = 3.14 x 16 x 10

Volume = 502.4cm3

The formula for calculating the volume of a cylinder will **not** be given in your exam.

**Question 7**

Calculate the volume of a cylinder with a radius of 4.5cm and height of 18cm.

π = 3.14

r = 4.5cm

***Diagram not to scale***

h = 18cm

(Show your working out.)

(4 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Question 8**

Calculate the volume of a cylinder with a radius of 12cm and height of 42cm?

π = 3.14

r = 12cm

***Diagram not to scale***

h = 42cm

(Show your working out.)

(4 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Question 9**

What is the volume of a cylinder with a radius of 7.5cm and height of 10cm?

π = 3.14

r = 7.5cm

***Diagram not to scale***

h = 10cm

(Show your working out.)

(2 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Surface area of a cube**

Surface area is the area of each side of a 3-D shape.

For example, cubes have 6 faces.

To calculate the surface area, find the surface area of 1 face and then multiply the answer by how many faces the 3-D shape has.

**Calculating the surface area of a cube**

The formula for calculating the surface area of a cube is:

A pair of dice with black dots

Description automatically generatedSA = 6a2

SA = surface area

a = length of 1 side

a2 = area of of a cube’s face

For example, the surface area of a cube is worked out as follows:

Surface area = 6a2

Surface area = 6 x (12 x 12)

12 x 12 = 144

6 x 144 = 864

Surface area = 864cm2

**Question 10**

Calculate the surface area of this cube. Each side is 20cm long.

Surface area = 6a2

a = length of 1 side

a = 20cm

***Diagram not to scale***

(Show your working out.)

(3 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm2 |

**Question 11**

Calculate the surface area of this cube. Each side measures 15cm.

Surface area = 6a2

a = length of 1 side

a = 15cm

***Diagram not to scale***

(Show your working out.)

(3 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm2 |

**Question 12**

Calculate the surface area of a cube. Each side measures 19cm.

Surface area = 6a2

a = length of 1 side

(Show your working out.)

(3 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Surface area of a cuboid**

The formula for calculating the surface area of a cuboid is:

A picture containing screenshot, line, diagram, rectangle

Description automatically generatedSA = 2wl + 2lh + 2hw

* SA = surface area
* w = width
* l = length
* h = height

The surface area of the cuboid below is worked out as follows:

* l = 5cm
* w = 3cm
* h = 2cm

SA = 2lw + 2lh + 2hw

Substitute the length, width and height into the formula.

A picture containing screenshot, square, line, text

Description automatically generatedSA = 2(5x3) + 2(5x2) + 2(2x3)

Multiply out the brackets

SA = (2 x 15) + (2 x 10) + (2 x 6)

Finally, complete the calculations in the brackets.

SA = 30cm + 20cm + 12cm = 62cm2

**Question 13**

Calculate the surface area of this cuboid.

Surface area = 2wl + 2lh + 2hw

***Diagram not to scale***

h = 7cm

w = 3.5cm

l = 14cm

(Show your working out.)

(4 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm2 |

**Question 14**

Calculate the surface area of this cuboid.

Surface area = 2wl + 2lh + 2hw

h = 18cm

***Diagram not to scale***

w = 2cm

l = 4.8cm

(Show your working out.)

(4 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm2 |

**Question 15**

Calculate the surface area of a cuboid with the following measurements:

* Length = 36cm
* Width = 15cm
* Height = 9cm

Surface area = 2wl + 2lh + 2hw

(Show your working out.)

(4 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Calculating the surface area of open cylinders**

An open cylinder is a cylinder that does not have any ends.

A brown paper tube with a hole

Description automatically generated

The formula for calculating the surface area of an open cylinder is:

Surface area = 2πrh

A picture containing text, screenshot, diagram, circle

Description automatically generated

* SA = surface area
* π = 3.14
* r (radius)
* h (height)

A black and white drawing of a cylinder

Description automatically generated with medium confidenceCalculate the surface area of this open cylinder.

Surface area = 2πrh

π = 3.14

Radius = 2ft

Height = 6ft

Surface area = 2 x 3.14 x 2 x 6

= 75.36ft2

**Question 16**

Calculate the surface area of an open cylinder with a radius (r) of 7cm and a height (h) of 20cm?

π = 3.14

(Show your working out.)

(3 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm2 |

**Question 17**

Calculate the surface area of an open cylinder with a radius (r) of 12cm and a height (h) of 36cm? Round your answer to the nearest whole number.

π = 3.14

(Show your working out.)

(4 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm2 |

**Question 18**

Calculate the surface area of an open cylinder with a diameter (d) of 6cm and a height (h) of 10cm?

π = 3.14

r = d ÷ 2

(Show your working out.)

(4 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Calculating the surface area of closed cylinders**

A closed cylinder is a cylinder that has ends on both sides.

**A cylindrical container with a lid

Description automatically generated**

**Calculate the surface area of a closed cylinder**

The formula for calculating the surface area of a closed cylinder is:

Surface area = 2πrh + 2πr2

π = 3.14

r = radius

h = height

A black and white drawing of a cylinder

Description automatically generated with medium confidenceCalculate the surface area of this open cylinder.

Surface area = 2πrh + 2πr2

π = 3.14

Radius = 2ft

Height = 6ft

Surface area = (2 x 3.14 x 2 x 6) + (2 x 3.14 x (2 x 2))

= 75.36ft + 25.12ft

= 100.48ft2

**Question 19**

Calculate the surface area of this closed cylinder with a radius (r) of 9cm and a height (h) of 15cm.

π = 3.14

(Show your working out.)

(4 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm2 |

**Question 20**

Calculate the surface area of this closed cylinder with a radius (r) of 3cm and a height (h) of 22cm.

π = 3.14

(Show your working out.)

(4 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm2 |

**Question 21**

Calculate the surface area of this closed cylinder with a radius (r) of 5cm and a height (h) of 8.5cm. Round your answer to the nearest whole number.

π = 3.14

(Show your working out.)

(3 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm2 |

**Exam practice 1**

A yellow calculator with a grey sticker

Description automatically generated

Food packaging supplies are delivered in the following boxes.

**A box with measurements

Description automatically generated**

*Formula = length x width x height*

Estimate the volume of the box by rounding each measurement to the nearest 10cm.

(Show your working out.)

(4 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_cm3 |

**Exam practice 2**

Calculate the surface area of the following cuboid.

0.9m

***Diagram not to scale***

2.2m

5.7m

Surface area (SA) = 2wl + 2lh + 2hw

(Show your working out.)

(3 marks)

|  |
| --- |
| Answer: \_\_\_\_\_\_\_\_m2 |

**Answers**

**Calculating the volume of cubes**

**Question 1**

6 x 6 x 6 = 216cm3

**Question 2**

14 x 14 x 14 = 2,744m3

**Question 3**

12 x 12 x 12 = 1,728cm3

**Calculating the volume of cuboids**

**Question 4**

14 x 7 x 6 = 588cm3

**Question 5**

8 x 4 x 4 = 128cm3

**Question 6**

21 x 9 x 10 = 1,890 cm3

**Calculating the volume of cylinders**

**Question 7**

First, calculate r2

4.5 x 4.5 = 20.25

Multiply by the height.

20.25 x 18 = 364.5

Multiply by π

π = 3.14

364.5 x 3.14 = 1,144.53cm3

**Question 8**

First, calculate r2

12 x 12 = 144

Multiply by the height.

144 x 42 = 6,048

Multiply by π

π = 3.14

6,048 x 3.14 = 18,910.72cm3

**Question 9**

First, calculate r2

7.5 x 7.5 = 56.25

Multiply by the height.

56.25 x 10 = 562.5

Multiply by π

π = 3.14

562.5 x 3.14 = 1,766.25cm3

**Surface area of a cube**

**Question 10**

SA = 6a2

a = 20cm

20 x 20 = 400

6 x 400 = 2,400cm2

**Question 11**

SA = 6a2

a = 15cm

15 x 15 = 225

6 x 225 = 1,350cm2

**Question 12**

SA = 6a2

a = 19cm

19 x 19 = 361

6 x 361 = 2,166cm2

**Surface area of a cuboid**

**Question 13**

SA = 2wl + 2lh + 2hw

= 2(3.5 x 14) + 2(14 x 7) + 2(7 x 3.5)

= (2 x 49) + (2 x 98) + (2 x 24.5)

= 98 + 196 + 49

= 343cm2

**Question 14**

SA = 2wl + 2lh + 2hw

= 2(2 x 4.8) + 2(4.8 x 18) + 2(18 x 2)

= (2 x 9.6) + (2 x 86.4) + (2 x 36)

= 19.2 + 172.8 + 72

= 264cm2

**Question 15**

SA = 2wl + 2lh + 2hw

= 2(15 x 36) + 2(36 x 9) + 2(9 x 15)

= (2 x 540) + (2 x 324) + (2 x 135)

= 1,080 + 648 + 270

= 1,998cm2

**Surface area of an open cylinder**

**Question 16**

Surface area = 2πrh

π = 3.14

2 x 3.14 x 7 x 20

= 879.2cm2

**Question 17**

Surface area = 2πrh

π = 3.14

2 x 3.14 x 12 x 36

= 2,712.96cm2

= 2,713cm2

**Question 18**

Surface area = 2πrh

π = 3.14

Radius is half of diameter.

6 ÷ 2 = 3cm

2 x 3.14 x 3 x 10

= 188.4 cm2

**Surface area of a closed cylinder**

**Question 16**

Surface area = 2πrh + 2πr2

= (2 x 3.14 x 9 x 15) + (2 x 3.14 x (9 x 9))

= 847.8 + 508.68

= 1,356.48cm2

**Question 17**

Surface area = 2πrh + 2πr2

= (2 x 3.14 x 3 x 22) + (2 x 3.14 x (3 x 3))

= 414.48 + 56.52

= 471cm2

**Question 18**

Surface area = 2πrh + 2πr2

= (2 x 3.14 x 5 x 8.5) + (2 x 3.14 x (5 x 5))

= 266.9 + 157

= 423.9cm2

Rounded to the nearest whole number = 424cm2

**Exam practice**

**Exam practice 1**

Round each number to the nearest 10cm.

7.4cm ≈ 10cm

21.5cm ≈ 20cm

14.8cm ≈ 10cm

Use the formula v = l x w x h

= 20 x 10 x 10

= 2,000cm3

**Exam practice 2**

Substitute the numbers into the formula.

Surface area (SA) = 2wl + 2lh + 2hw

= 2(0.9 x 5.7) + 2(5.7 x 2.2) + 2(2.2 x 0.9)

= 10.26 + 25.08 + 3.96

= 39.3cm3

**Your functional skills exam**

Your functional skills exams will consist of 2 papers.   
These papers will take place over the following time periods:

* Non-calculator paper – 40 minutes
* Calculator – 1 hour 50 minutes

Further information on the format that your test will take can be obtained from your training provider.

**Hints and tips**

* Find out what format your exam will be in. It may be paper-based   
  or on-screen.
* Plan what you are going to revise in advance. Don’t leave it until the last minute.
* Do as many past papers as you can so you are prepared for the day. If possible, try to complete the past papers following the same format as the actual exam.
* Find a quiet place to study and revise. It helps to sit at a table or a desk, don’t revise in bed.
* Don’t stay up all night revising the night before your exam. It’s important to have a good rest so you feel refreshed and ready to go.
* Read the question 3 times. The first time to ensure you understand what is being asked, the second time to get an understanding of what you need to do, and a third time to figure out exactly what maths techniques you should be applying.
* If you are struggling with a question, skip it and come back to it later. Try not to sit getting worked up about a difficult question, it will only waste exam time. Move on and come back to it after you have answered the other questions.
* Take note of the number of marks available. This will give you an indication of how much working out you must show. For example, 1 mark will need an answer only and more marks will need you to show your working out.
* When you’ve finished the exam, go back and check your answers. If you still have time remaining, use it to check your answers and when you have checked your answers check them again.