1.

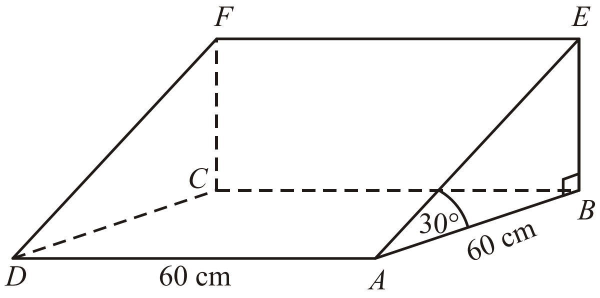


Diagram **NOT** accurately drawn

The diagram represents a prism.
AEFD is a rectangle.
ABCD is a square.

EB and *FC* are perpendicular to plane *ABCD.*

AB = 60 cm.
AD = 60 cm.
Angle *ABE* = 90°.
Angle *BAE* = 30°.

Calculate the size of the angle that the line *DE* makes with the plane *ABCD.*
Give your answer correct to 1 decimal place.

..........................°

(Total 4 marks)

2.

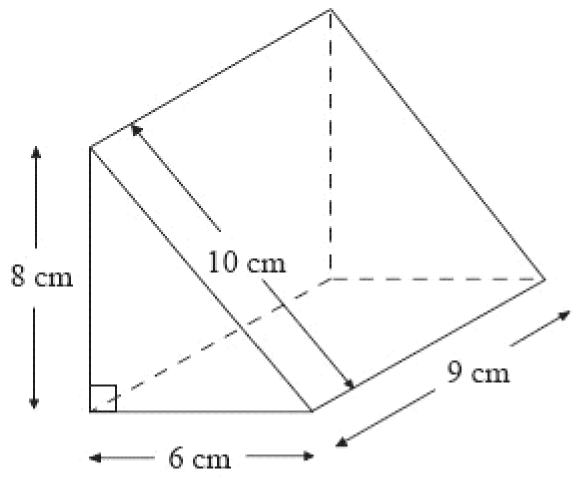


Diagram **NOT** accurately drawn

Work out the surface area of the triangular prism.
State the units with your answer.

……………………

(Total 4 marks)

3. The diagram shows a pyramid. The apex of the pyramid is V.

Each of the sloping edges is of length 6 cm.

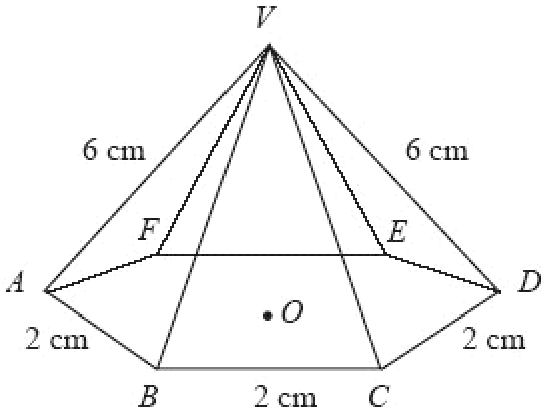


Diagram **NOT** accurately drawn

The base of the pyramid is a regular hexagon with sides of length 2 cm.

O is the centre of the base.

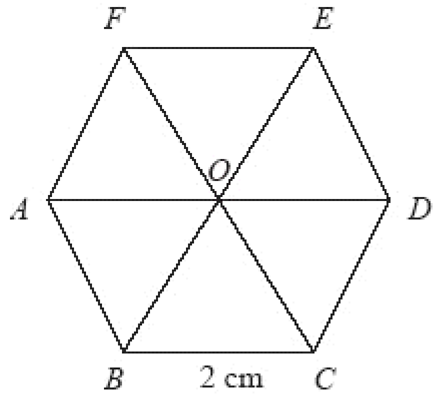


Diagram **NOT** accurately drawn

(a) Calculate the height of V above the base of the pyramid.
Give your answer correct to 3 significant figures.

………………..cm

(2)

(b) Calculate the size of angle DVA.
Give your answer correct to 3 significant figures.

………………..°

(3)

(c) Calculate the size of angle *AVC*.
Give your answer correct to 3 significant figures.

………………….. °

(4)
(Total 9 marks)

4.

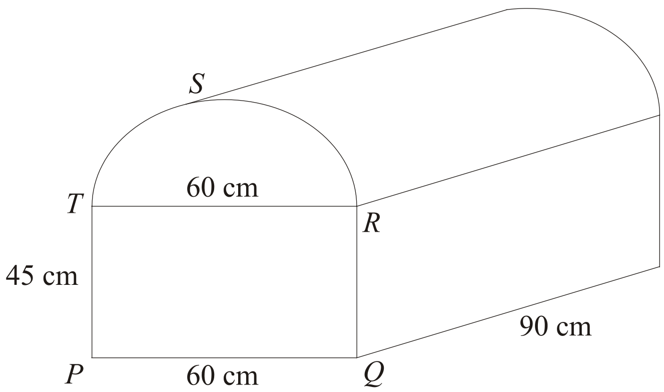


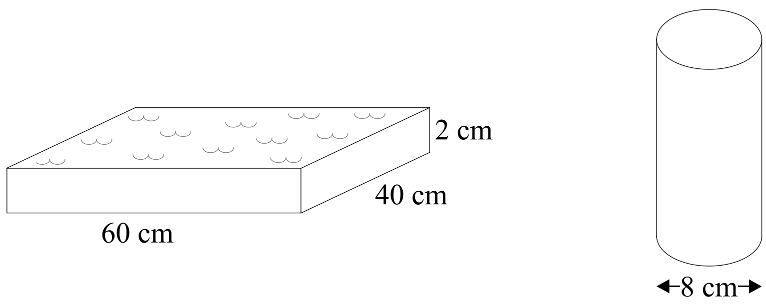
Diagram **NOT** accurately drawn

The diagram shows a prism of length 90 cm.
The cross section, *PQRST*, of the prism is a semi-circle above a rectangle.
PQRT is a rectangle.
RST is a semi-circle with diameter *RT*.
PQ = *RT* = 60 cm.
PT = *QR* = 45 cm.

Calculate the volume of the prism.
Give your answer correct to 3 significant figures.

.... cm^3
(Total 4 marks)

5.



Diagrams **NOT** accurately drawn

A rectangular tray has length 60 cm, width 40 cm and depth 2 cm.
It is full of water.
The water is poured into an empty cylinder of diameter 8 cm.

Calculate the depth, in cm, of water in the cylinder.
Give your answer correct to 3 significant figures.

.... cm
(Total 5 marks)

6.

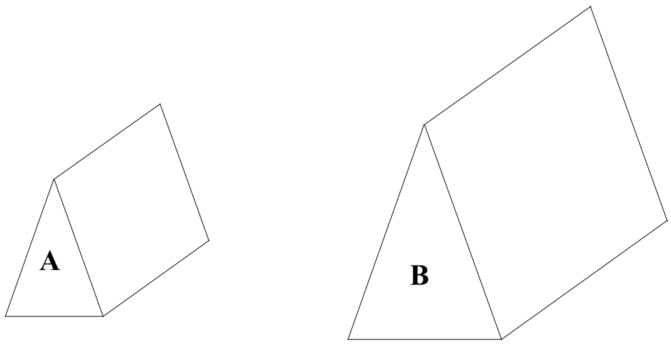


Diagram **NOT** accurately drawn

Two prisms, **A** and **B**, are mathematically similar.
The volume of prism **A** is 12 000 cm^3.
The volume of prism **B** is 49 152 cm^3.
The total surface area of prism **B** is 9728 cm^2.

Calculate the total surface area of prism **A**.

.... cm^2
(Total 4 marks)

7.

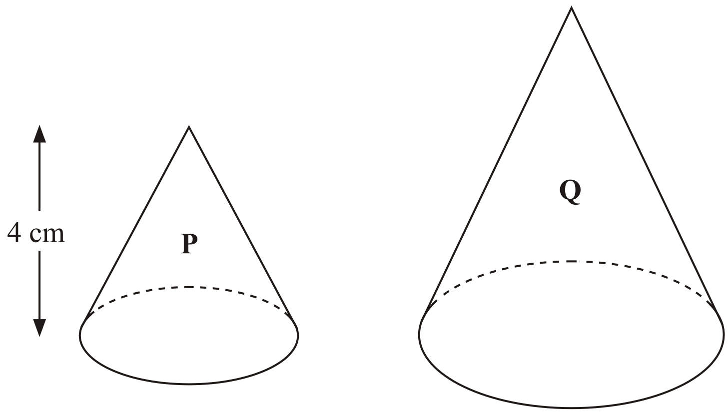


Diagram **NOT**
accurately drawn

Two cones, **P** and **Q**, are mathematically similar.
The total surface area of cone **P** is 24 cm^2.
The total surface area of cone **Q** is 96 cm^2.
The height of cone **P** is 4 cm.

(a) Work out the height of cone **Q**.

.... cm

(3)

The volume of cone **P** is 12 cm^3.

(b) Work out the volume of cone **Q**.

.... cm^3

(2)

(Total 5 marks)

8. The diagram shows a cylinder and a sphere.

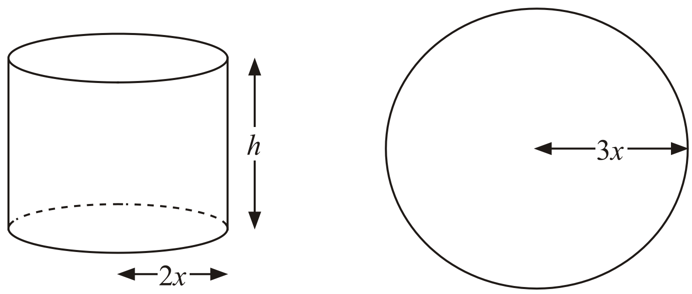


Diagram **NOT** accurately drawn

The radius of the base of the cylinder is $2x$ cm and the height of the cylinder is h cm.
The radius of the sphere is $3x$ cm.
The volume of the cylinder is equal to the volume of the sphere.

Express h in terms of x.
Give your answer in its simplest form.

h = ...
(Total 3 marks)

9.

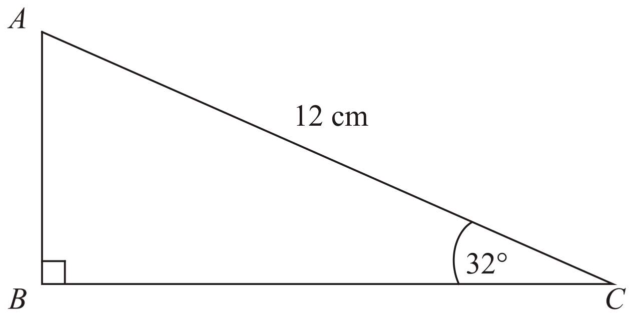


Diagram **NOT** accurately drawn

AC = 12 cm.
Angle ABC = 90°.
Angle ACB = 32°.

Calculate the length of AB.
Give your answer correct to 3 significant figures.

.... cm
(Total 3 marks)

10.

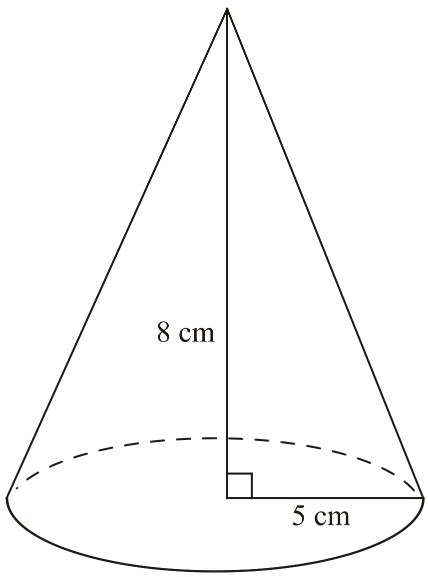


Diagram **NOT** accurately drawn

A cone has a base radius of 5 cm and a vertical height of 8 cm.

(a) Calculate the volume of the cone.
Give your answer correct to 3 significant figures.

.... cm^3

(2)

Here is the net of a different cone.

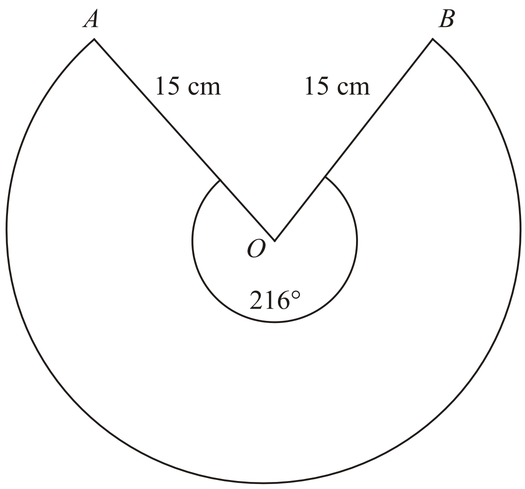


Diagram **NOT** accurately drawn

The net is a sector of a circle, centre O, and radius 15 cm.
Reflex angle $AOB = 216°$
The net makes a cone of slant height 15 cm.

(b) Work out the vertical height of the cone.

.... cm

(4)
(Total 6 marks)

11. A cuboid has length 3 cm, width 4 cm and height 12 cm.

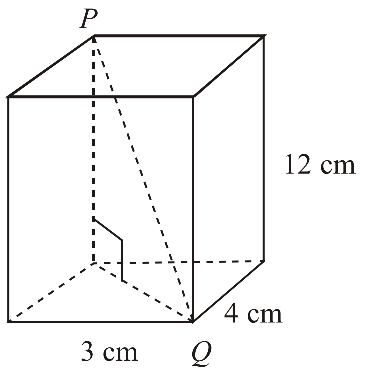


Diagram **NOT** accurately drawn

Work out the length of PQ.

.... cm
(Total 3 marks)

12. The volumes of two mathematically similar solids are in the ratio 27 : 125

The surface area of the smaller solid is 36 cm^2.

Work out the surface area of the larger solid.

.... cm^2
(Total 3 marks)

13.

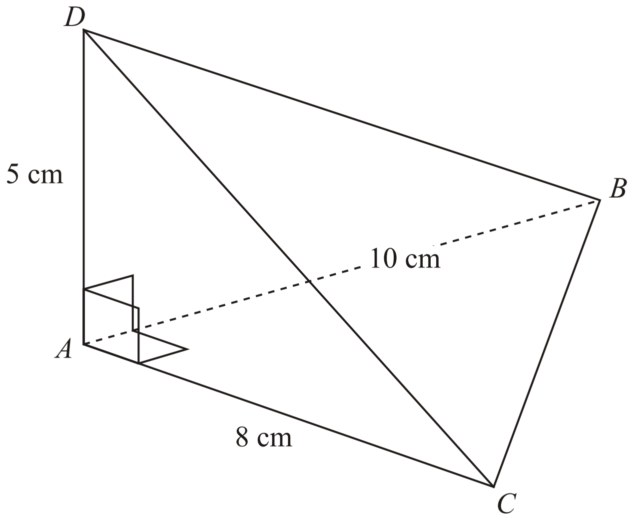


Diagram **NOT** accurately drawn

The diagram shows a tetrahedron.
AD is perpendicular to both *AB* and *AC*.
AB = 10 cm.
AC = 8 cm.
AD = 5 cm.
Angle *BAC* = 90°.

Calculate the size of angle *BDC*.
Give your answer correct to 1 decimal place.

....
(Total 6 marks)

14.

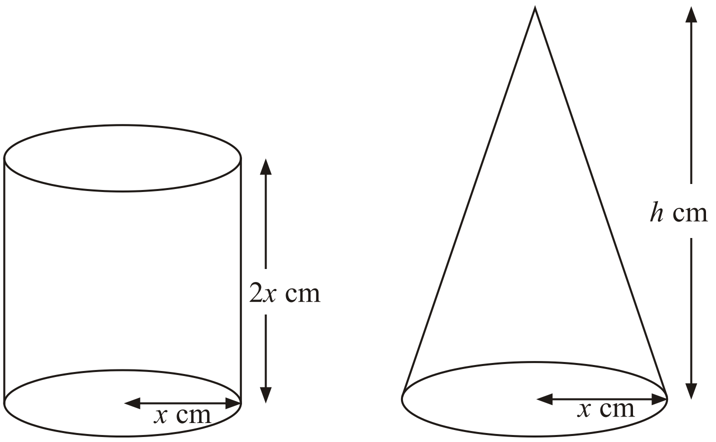


Diagram **NOT** accurately drawn

A cylinder has base radius x cm and height $2x$ cm.

A cone has base radius x cm and height h cm.

The volume of the cylinder and the volume of the cone are equal.

Find h in terms of x.
Give your answer in its simplest form.

h = ...

(Total 3 marks)

15.

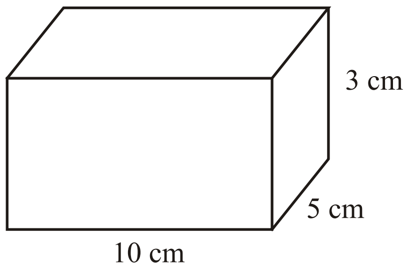


Diagram **NOT** accurately drawn

The diagram shows a solid cuboid.
The cuboid has length 10 cm, width 8 cm and height 5 cm.

The cuboid is made of wood.
The wood has a density of 0.6 grams per cm^3.

Work out the mass of the cuboid.

.... grams
(Total 4 marks)

16.

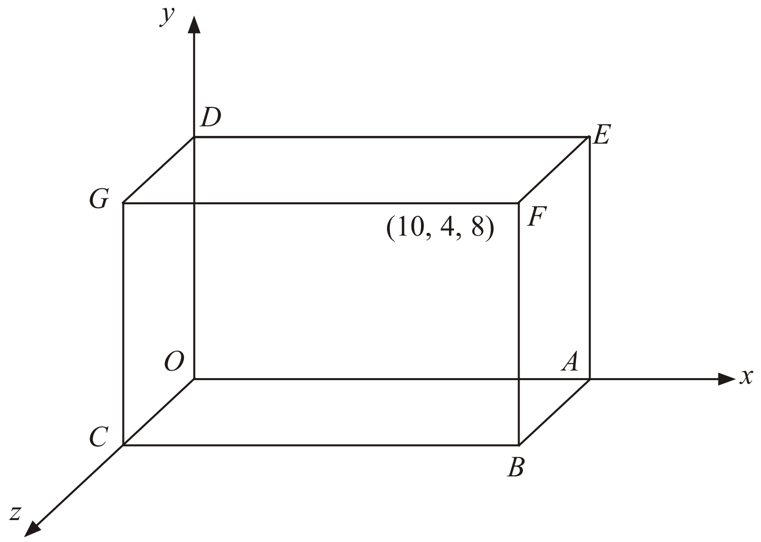


Diagram **NOT** accurately drawn

The diagram shows a cuboid.
The coordinates of the vertex F are (10, 4, 8).

(a) Write down the coordinates of the vertex E.

(.......... , ... , ...)

(1)

(b) Find the coordinates of the midpoint of OE.

(.......... , ... , ...)

(2)
(Total 3 marks)

17. *F* and *G* are two points on a 3-D coordinate grid.
Point *F* is (2, 3, 3).
Point *G* is (6, –1, –4).

Which are the coordinates of the midpoint of the line segment *FG*?

A	B	C	D	E
(4, 2, 3½)	(2, 1, ½)	(4, 1, –½)	(4, 2, ½)	(4, 1, ½)

(Total 1 mark)

18. The diagram shows a cuboid on a 3-D grid.

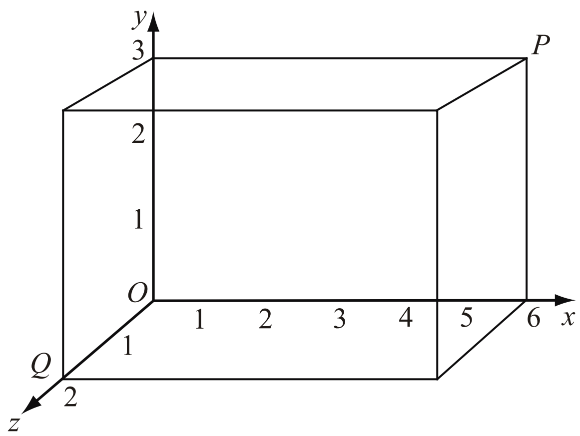


Diagram **NOT** accurately drawn

P and *Q* are two vertices of the cuboid.

Which are the coordinates of the midpoint of the line segment *PQ*?

A	B	C	D	E
(6,3,2)	(6,1½,1)	(3,3,2)	(3,3,1)	(3,1½,1)

(Total 1 mark)

19.

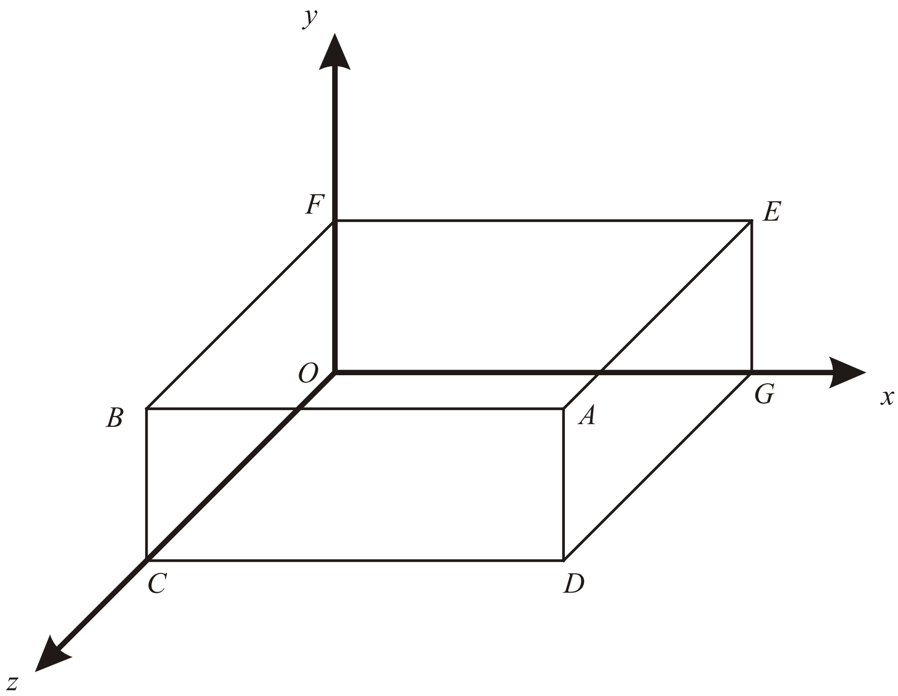


Diagram **NOT** accurately drawn

The diagram shows a cuboid drawn on a 3-D grid.

Vertex *A* has coordinates (5, 2, 3).

(a) Write down the coordinates of vertex *E*.

(.......... , ... , ...)

(1)

B and *D* are vertices of the cuboid.

(b) Work out the coordinates of the midpoint of *BD*.

(........... , ... , ...)

(3)

(Total 4 marks)

20. A cuboid is shown on a 3-D grid.

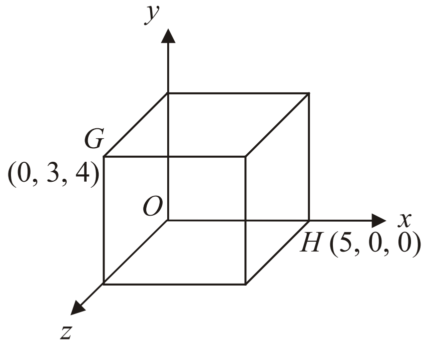


Diagram **NOT** accurately drawn

The point *G* has coordinates (0, 3, 4)
The point *H* has coordinates (5, 0, 0)

Which are the coordinates of the midpoint of the line segment *GH*?

A	B	C	D	E
(5, 3, 4)	$(2\frac{1}{2}, 3, 4)$	$(2\frac{1}{2}, 1\frac{1}{2}, 2)$	(10, 6, 8)	$(5, 1\frac{1}{2}, 2)$

(Total 1 mark)

21.

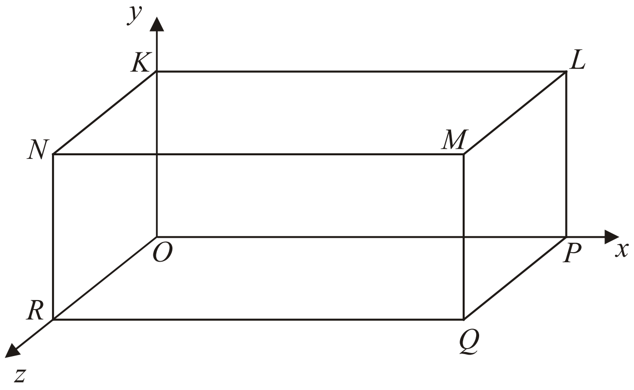


Diagram **NOT** accurately drawn

The diagram shows a cuboid on a 3-D grid.
The coordinates of the vertex *M* are (6, 2, 3).

What are the coordinates of the midpoint of *LN*?

A	B	C	D	E
$(3, 1, 1\frac{1}{2})$	$(3, 2, 1\frac{1}{2})$	(3, 2, 3)	(3, 1, 3)	$(6, 1, 1\frac{1}{2})$

(Total 1 mark)

22.

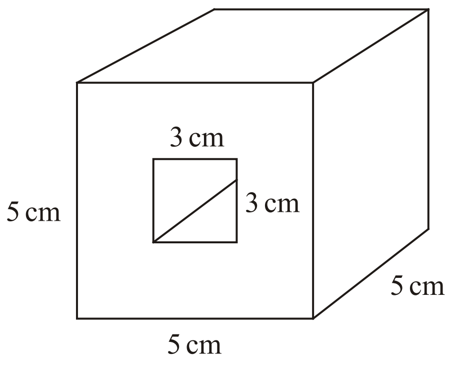


Diagram **NOT** accurately drawn

The solid shape, shown in the diagram, is made by cutting a hole all the way through a wooden cube.
The cube has edges of length 5 cm.
The hole has a square cross section of side 3 cm.

(a) Work out the volume of wood in the solid shape.

.... cm^3

(2)

The mass of the solid shape is 64 grams.

(b) Work out the density of the wood.

.... grams per cm^3

(2)

(Total 4 marks)

23. What are the coordinates of the midpoint of the line joining P (–3, 2, 4) to Q (5, 1, 8)?

(1, 1.5, 6)	(2, –1, 4)	(8, –1, 4)	(1, –0.5, 2)	(2, 3, 12)
A	**B**	**C**	**D**	**E**

(Total 1 mark)

24. The diagram shows a cuboid drawn on a 3-D grid.

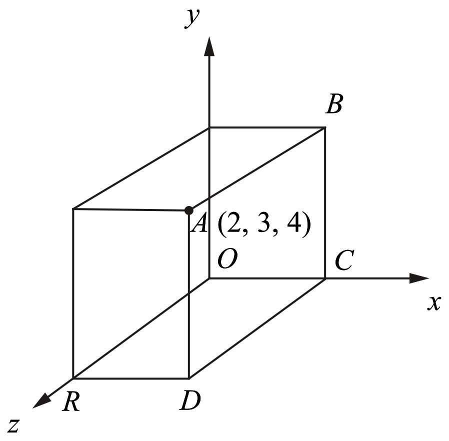


Diagram **NOT** accurately drawn

The base of the cuboid is *OCDR*.
The point *C* is on the *x*-axis.
The point *R* is on the *z*-axis.

A = (2, 3, 4).

What is the area of the face *ABCD* ?

9	6	8	24	12
A	**B**	**C**	**D**	**E**

(Total 1 mark)

1. 22.2º — 4

$EB = 60 \times \tan 30°$
$BD = \sqrt{(60^2 + 60^2)}$
$\tan BDE = 34.64 \div 84.85$
OR
$EB = 60 \times \tan 30°$ (= 34.64)

$$ED^2 = 60^2 + \left(\frac{60}{\cos 30}\right)^2$$

$$ED = \sqrt{8400} = (91.65)$$

$$\text{Angle} = \sin^{-1}\left(\frac{EB}{\sqrt{8400}}\right) = 22.2$$

M1 for EB = 60 × tan30
M1 for BD = $\sqrt{(60^2 + 60^2)}$
M1 for tan BDE = "34.64" ÷ "84.85"
A1 22.17 – 22.21
M1 for EB = 60 ×tan 30° oe
M1 for fully correct method for ED
M1 for sin BDE = $\left(\frac{'34.84'}{'\sqrt{8400}'}\right)$ (oe)
A1 22.17 – 22.21

[4]

2. 264 cm^2 — 4

$2 \times \frac{1}{2} \times 6 \times 8$ or 48
$8 \times 9 + 6 \times 9 + 10 \times 9$
or 72 + 54 + 90

M1 attempt to find the area of one face;
$\frac{1}{2} \times 6 \times 8$ or (8 × 9) or (6 × 9) or (10 × 9) or 72 or 54 or 90
or 24 or 48
M1 all five faces with an intention to add
A1 cao numerical answer of 264
B1 (indep) cm^2 with or without numerical answer

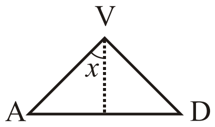
[4]

3. (a) 5.66 — 2

$6^2 - 2^2 = 32$

M1 for $6^2 - 2^2$ (= 32)
A1 5.65 – 5.66

(b) 38.9 3



$DVA = 2 \times \sin^{-1}(\frac{2}{6})$

OR

$\cos DVA = \frac{6^2 + 6^2 - 16}{2 \times 6 \times 6}$

$= \frac{56}{72}$

$DVA = \cos^{-1}\left(\frac{56}{72}\right) = 38.94$

M1 $\sin x = \frac{2}{6}$ *oe*

M1 for $DVA = 2 \times \sin^{-1}\left(\frac{2}{6}\right)$

A1 38.9 – 38.95

OR

M1 for $(\cos DVA =) \frac{6^2 + 6^2 - 4^2}{2 \times 6 \times 6}$

M1 for $DVA = \cos^{-1}\left(\frac{56}{72}\right)$

A1 38.9 – 38.95

(c) 33.6 4

$AC^2 = 2^2 + 2^2 - 2 \times 2 \times 2 \times \cos 120°$

$AC = \sqrt{12}$

OR

$AN = 2 \times \sin 60 = \sqrt{3}$

OR

$VN = \sqrt{"32"+1} = \sqrt{33}$

$\cos AVC = \dfrac{6^2 + 6^2 - 12}{2 \times 6 \times 6}$

$\cos AVC = \dfrac{60}{72}$

OR

$AVC = 2 \times \sin^{-1} \dfrac{\sqrt{33}}{6}$, using AN

OR

$AVC = 2 \times \cos^{-1} \dfrac{\sqrt{33}}{6}$, using VN

M1 for any valid method for AC or AN or VN where N is the midpoint of AC

A1 for $AC^2 = 12$ or $AC = \sqrt{12}$ (= 3.46…) or $AN = \sqrt{3}$ (=1.73…)or $VN = \sqrt{33}$ (=5.74…)

M1 (indep) for correct method to find angle AVC

A1 33.55 – 33.6

[9]

4. $(\frac{1}{2} \times \pi \times 30^2 + 60 \times 45) \times 90$ 4

$(1/2 \times 2827.43 + 2700) \times 90$
$(1413.7.. + 2700) \times 90$
$4113.7.. \times 90 = 370234.5...$
$= 370\ 000$

Cross-section approach:

M1 for $(\frac{1}{2} \times)\pi \times 30^2$" (= 2827.4 or 1413.7) or 60×45 (= 2700)

M1 for "$(\frac{1}{2} \times)\ \pi \times 30^2$" $+ 60 \times 45$ *(complete method)*

M1 for "any area" × 90 or 4110 – 4115

A1 for 370 000 to 370300

Volume approach:

M1 for $(\frac{1}{2} \times)\pi \times 30^2$ *or* 60×45

M1 for "$(\frac{1}{2} \times)\pi \times 30^2$" $\times 90$ *(= 127234 or 254468)* *or* $60 \times 45 \times 90$ *(= 243000)*

M1 for addition of two volumes

A1 for 370 000 to 370300 (370 235)

[4]

5. $60 \times 40 \times 2$ 5

4800

"4800"$= \pi \times 4^2 \times h$

$\frac{\text{"4800"}}{\text{"50.265..."}}$

$= 95.5$

M1 60 × 40 × 2

A1 for 4800

M1 for $\pi \times 4^2$ *or 50.265...*

M1 for "4800" ÷ "$\pi \times 4^2$"

A1 95.49 – 95.5

[5]

6. $\frac{49152}{12000}$ or 4.096 — 4

M1 for $\frac{49152}{12000}$ *or 4.096 oe*

$\sqrt[3]{4.096}$ or 1.6
"1.6"^{2} or 2.56
= 3800

M1 for $\sqrt[3]{4.096}$ *or 1.6 oe*
M1 for "1.6"^{2} *or2.56 oe*
A1 for 3800 cao

[4]

7. (a) $\frac{96}{24}$ or 4
$\sqrt{4}$ or 2 = 8 — 3

M1 for $\frac{96}{24}$ *or* $\frac{24}{96}$ *or 4 or* $\frac{1}{4}$ *oe*
M1 for $\sqrt{\frac{96}{24}}$ *or* $\sqrt{\frac{24}{96}}$ *or* $\sqrt{'4'}$ *or* $\frac{1}{\sqrt{'4'}}$ *or 2 or* $\frac{1}{2}$ *oe*
A1 cao

(b) $12 \times 2^3 = 96$ — 2

M1 for '2'^{3} *or 8*
A1 cao

[5]

8. $\pi(2x)^2 h = \frac{4}{3}\pi(3x)^3$

$h = \frac{\frac{4}{3}\pi(3x)^3}{\pi(2x)^2} = 9x$ 3

M1 for $\pi(2x)^2 h = \frac{4}{3}\pi(3x)^3$ (condone absence of brackets)

M1 (dep) for valid algebra that gets to h = ax (condone one error in powers of numerical constants)

A1 cao

[3]

9. $\sin 32 = \frac{AB}{12}$

$AB = 12 \times \sin 32$

$AB = 6.35903\ldots$

6.36 3

M1 $\sin 32 = \frac{AB}{12}$ (accept Sin $\frac{AB}{12}$)

M1 12 × sin 32 or 12 × 0.5299..

A1 accept 6.359 – 6.360

SC Gradians 5.78(1…)

Radians 6.62

Get M1M1A0 or

Use of Sine Rule

$\frac{\sin 32}{AB} = \frac{\sin 90}{12}$ *or* $\frac{AB}{\sin 32} = \frac{12}{\sin 90}$ *M1*

$AB = \frac{12 \times \sin 32}{\sin 90}$ *M1*

AB = 6.359 – 6.36 A1

SC Gradians 5.85(…)

Radians 7. 40(…)

M1M1A0

[3]

10. (a) $\frac{1}{3} \times \pi \times 5^2 \times 8 = \pi \times 25 \times 8 \div 3 = 209.4395$

209 – 210 2

M1 for $\frac{1}{3} \times \pi \times 5^2 \times 8$

A1 for 209 – 210

(b) Base radius = $\frac{216}{360} \times 15 = 9$

Height = $\sqrt{(15^2 - 9^2)} = 12$ 4

M1 for 216 ÷ 360
A1 for 9
M1 for $\sqrt{(15^2 - \text{“}9\text{”}^2)}$, where “9” < 15
A1 cao

[6]

11. $3^2 + 4^2 + 12^2 = 169$ 3

$\sqrt{169} = 13$

M1 for $3^2 + 4^2$ or $3^2 + 12^2$ or $4^2 + 12^2$ or $a^2 + 12^2$
(where a is the length of their base diagonal)
M1 for $3^2 + 4^2 + 12^2$
A1 for 13 cao

[3]

12. Volume 27 : 125

Length 3 : 5

= 100

Area 9 : 25 3

M1 for recognising need for cube root of 27 or 125
M1 for recognising need to square their scale factor A1 for 100

[3]

13. $DC^2 = 5^2+8^2$; $DC = \sqrt{89}$

$DB^2 = 5^2 + 10^2$; $DB = \sqrt{125}$

$BC^2 = 8^2 + 10^2$; $BC = \sqrt{164}$

$\cos CDB = \dfrac{89+125-164}{2\times\sqrt{89}\times\sqrt{125}} = 0.23702$

$= 76.3$ 6

M1 $(DC^2 =)\ 5^2 + 8^2$ *or* $DC = \sqrt{89} = 9.4(3)$

M1 $(DB^2 =)\ 5^2 + 10^2$ *or* $DB = \sqrt{125} = 11.1(8)$

M1 $(BC^2) = 8^2 + 10^2$ *or* $BC = \sqrt{164} = 12.8(1)$

M2 $\cos CDB = \dfrac{'89'+'125'-'164'}{2\times'\sqrt{89}'\times'\sqrt{125}'}$

A1 76.2 × 76.3

or

M1 correct sub into cosine rule on formula sheet

$\sqrt{'164'}^2 = \sqrt{'89'}^2 + \sqrt{'125'}^2 - 2\times\sqrt{'89'}\times\sqrt{'125'}\times\cos x$

M1 correct rearrangement to $\cos CDB = \dfrac{'89'+'125'-'164'}{2\times'\sqrt{89}'\times'\sqrt{125}'}$

A1 76.2 – 76.3

[6]

14. $\pi x^2(2x) = \dfrac{1}{3}\pi(x)^2h$

$6x$ 3

M1 for a correct volume formula in terms of x, e.g. $\pi x^2(2x)$ *or* $\dfrac{1}{3}\pi x^2h$

A1 for $\pi(2x) = \dfrac{1}{3}\pi h$ *or* $3\pi x^2(2x) = \pi x^2h$ *or* $x^2(2x) = \dfrac{1}{3}x^2h$ *(or better)*

A1 for 6x cao

[3]

15. 10 × 5 × 8 (= 400) 4
"400" × 0.6 = 240

M2 for 10 × 5 × 8 (= 400)
(M1 for two of 10, 5, 8 seen as part of a volume calculation)
M1 for "400" × 0.6
A1 cao

[4]

16. (a) (10, 4, 0) 1

B1 cao

(b) (10 ÷ 2, 4 ÷ 2, 0) 2
(5, 2, 0)

*M1 for **two** correct coordinates or for **two** of "10" ÷ 2, "4" ÷ 2, "0" ÷ 2, ft from (a)*
A1 ft from (a)

***If the answer to (a) is correct, ie (10, 4, 0),** then in part (b);*
(5, 2, 0) gets 2 marks.

*(**5**, **2**, 4), (**5**, 4, **0**), (10, **2**, **0**) all get 1 mark for **two** correct coordinates.*

(5, 4, 4), (10, 2, 8), (10, 4, 0) all get 0 marks.

***If the answer to (a) is incorrect, for example (4, 10, 8)**, then in part (b)*
(2, 5, 4) gets 2 marks, following through; ie dividing each of the coordinates by 2

(2, 5, 0), (4, 5, 4), (2, 6, 4) all get 1 mark for two "correct" coordinates.

(5, 4, 4), (2, 2, 8), (4, 5, 0) all get 0 marks.

[3]

17. C

[1]

18. E

[1]

19. (a) (5, 2, 0) 1

B1 for (5, 2, 0) cao

(b) $\left(\frac{0+5}{2}, \frac{2+0}{2}, \frac{3+3}{2}\right)$

$\left(\frac{5}{2}, 1, 3\right)$ 3

B1 for (0,2,3) or for (5,0,3) or for (0,0,3) seen or implied

M1 for $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}, \frac{z_1+z_2}{2}\right)$

A1 for $\left(\frac{5}{2}, 1, 3\right)$ *oe*

B1 SC for (x, y, 3)

Alternative mark scheme

B1 for each coordinate correct.

[4]

20. C

[1]

21. B

[1]

22. (a) $5^3 - 5 \times 3 \times 3$

125 – 45

(5 × 5 – 3 × 3) × 5

(25 – 9) × 5

16 × 5

80 2

M1 for attempt to find volume of cube (e.g. 5 × 5 × n where n ≠ 6) and subtract volume of the hole (e.g. 3 × 3 × n where n ≠ 6) (needs to be dimensionally correct)

A1 cao

Alternative method

M1 for attempt to find area of the cross section and multiply by the depth of the prism (depth ≠ 6)

A1 cao

(b) $64 \div 80$
0.8 2

M1 ft 64 ÷ "80"
A1 ft (to 2 sf or better)

[4]

23. A

[1]

24. E

[1]

1. Mathematics A Paper 6

3D trigonometry questions have been rare on paper 6, so it was a pleasure to see good attempts. Candidates first had to use tangent in triangle *EBA* to find *EB.* Once they had located angle *EDB,* the approach was to find either *BD,* by using Pythagoras in triangle *ABD,* or to use a combination of cosine (to find *EA*) and Pythagoras in triangle *AED* to find *ED.*
A very common error was to think that the required angle was *EDA.*

Mathematics B Paper 19

This question was poorly done. Many candidates failed to make their method of solution clear. A number of candidates thought that they had to find angle *EDA* rather than angle *EDB*.

2. Specification A

Higher Tier

Many candidates were able to score at least half the marks for this question- one mark for working out the area of any face and one mark for giving the units. Common errors were due to simple arithmetic errors (such as'9 × 6 = 52'), finding the area of only four of the faces, and finding the volume of the prism. Some candidates, taking a minimalist approach, simply calculated $\frac{1}{2} \times 6 \times 8 \times 9$.

Intermediate Tier

Weaker candidates confused volume with surface area, giving an answer of 216, whilst some merely added lengths of edges together. A predictable common error was in calculating the area of the triangular face as 8 × 6 (ignoring the 1/2). It was surprising to find some candidates still failed to give the units with their answer, even when prompted.

Specification B

A fully correct answer was rare, some failing to give the correct units but more often failing to find the area of each of the five faces. The most common mistake was an answer of 48 for the area of one triangle. Arithmetic errors were common (usually in working out 6 × 9 or 8 × 9) and some only considered four faces, usually omitting the base.
A small number of candidates found, or tried to find, the volume of the prism by mistake. These sometimes could be awarded one mark for correctly finding the area of the triangular cross section.
Many ignored the request for units, while for some this was their only mark gained.

3. Specification A

This was a multi-step 3d trigonometry/Pythagoras question. Candidates needed to be able to identify the correct triangles to work in. For part (a) most chose triangle *AOV* and found $6^2 - 2^2$. Some misunderstood the notion of height and found the altitude of triangle *VBC* from $6^2 - 1^2$. For part (b) The preferred triangles were either *VAD* with the use of the cosine formula or triangle *AOV* with the use of sin. Many candidates who adopted the first approach were unable to rearrange correctly the given formula into the form cos *V* = Common misconception were to assume that angle *AVD* was double angle *BVC*, or that it was three times angle *BVC*.
For part (c), the preferred triangle was *AVC*. Initially candidates had to use the cosine rule in triangle *ABC*, or equivalent, to find the length of *AC*. Then a second use of the cosine rule in the alternative form yields the angle *AVC*. One common misconception in this part was to assume that *AC* could be found by using Pythagoras. Another was to assume that angle *AVC* was double angle *BVC*.

Specification B

Very few fully correct solutions were seen to this question. Candidates should be encouraged to include labelled sketches of the triangles used in questions of this nature. Pythagoras's theorem was frequently incorrectly used in part (a) with many candidates obtaining a value for the height that was longer than the length of the hypotenuse in their right angled triangle. In parts (b) and (c) the most successful candidates were those who sketched the relevant triangle and worked from that. There were two main approaches to part (b) either the cosine rule was used to find the required angle directly or trigonometry was used to find half the required angle. Candidates who used the cosine rule often had trouble rearranging it appropriately so that the angle could be found. Only a very small minority of candidates were able to identify a triangle that contained the required angle in part (c).

4. Many candidate made a valiant attempt at this unstructured question, but there were too many considerations and decisions to be taken, and it was perhaps inevitable that at some stage candidates would fail to make a correct decision. These included using 60 as the radius, failing to halve for a semicircle, quoting the formula for circumference instead of area, and multiplying the wrong dimensions together. Handling circular formulae is a general weakness. Most candidates picked up two marks for showing methods which included finding the area of a cuboid volume, or showing an appreciation that the volume was up of an area multiplied by 90. At the final stage candidates again showed their inability to round to 3 significant figures.

5. Virtually all candidates were able to calculate the volume of water in the rectangular tray. Most then went on to divide this volume by something (either 8 or $\pi\times 8$ or $\pi\times 4^2$), with many then getting the full 5 marks. Once source of error was of those who correctly wrote 4800 divided by 16π but who incorrectly calculated this as $\frac{4800}{16} \times \pi$.

6. This type of question is always found difficult by the candidature. Many candidates assume that volume scales in the same way as length and get one mark for comparing volumes. For candidates that are aware of different scale factors, some selected the wrong process - for example, squaring the volume scale factor to get the area scale factor.

7. This question was not answered well. The vast majority of candidates that attempted this question were able to find the scale factor 4 of the enlargement, usually by dividing 96 by 24 or by ratios, but few of these knew how to proceed from this to the linear scale factor 2 in part (a) and the volume scale factor 8 in part (b). Most candidates simply multiplied the height by 4 to get 16cm in part (a), and multiplied the volume by 4 to get 48cm^3 in part (b).

Very few candidates attempted to use the area and volume formulae for a cone.

8. Few candidates were able to achieve full marks in this question. A surprising number of candidates used incorrect formulae, particularly for the sphere, indicating that many candidates were perhaps unfamiliar with the contents of the formula page.

By far the most common error was the omission of the implied brackets for the powers of $2x$ and $3x$, so that only the x's were squared and cubed. Of those who tried to deal with the numbers a very common error was $3^3 = 9$. The use of algebra to make h the subject of the formula was a problem for some candidates- subtraction often taking the place of division. It was encouraging to see that candidates are now much happier dealing with π by not replacing it with a decimal approximation.

9. The direct method is to use $\sin x = \frac{\text{opp}}{\text{hyp}}$ and many candidates used this to get full marks. A minority of candidates fell to temptation from the formula sheet and used the sine rule in the triangle. They were generally less successful, but those that did get the correct answer got full marks.

10. Part (a) proved to be straightforward. However, part (b) proved to be challenging. In particular many candidates could not visualise how the sector could turn into the curved surface of the cone and consequently concentrated on the 144° instead of the 216°. Many candidates assumed that the base radius of the cone had to be 15cm and then worked out $15^2 + 15^2$, mistaking the position of the right angle. Of those that got the correct answer, most did it by finding the arc length of the sector and then realising that this would become the circumference of the base of the cone. They then found the radius of the base (9cm) from $\frac{\text{arc lenght}}{2\pi}$. A correct, but less common successful approach was to calculate the area of the sector and then use the formula for the curved surface area of the cone to find the radius from $\frac{\text{area of sector}}{\pi + 15}$.

11. The majority of candidates recognised the need to use Pythagoras in some part of this question, but few were able to do as the single calculation $\sqrt{a^2 + b^2 + c^2}$ Some candidates had difficulty visualising the right angled triangle for the base diagonal, and thought that they could calculate this by halving the area of the base. Poor arithmetic proved an obstacle for some, typically when calculating 12^2 or $\sqrt{169}$. A small number of candidates were able avoid any calculations and simply wrote down the length of the diagonal from their knowledge of 3, 4, 5 and 5, 12, 13 Pythagorean triangles.

12. About a quarter of the candidates recognised the need to find the linear scale factor of the enlargement by taking the cube root of the ratio, but only the best went on to square this to find the area scale factor. A common incomplete approach was $\sqrt[3]{27} : \sqrt[3]{125} = 3 : 5$, so $\frac{5}{3} \times 36 = 60$.

A common incorrect approach was
27 : 125 = 3 : 15(sic), so 3 × 12 : 15 × 12 = 36 : <u>180</u>.

13. Although as a whole this was a challenging question to finish off the paper, many candidates recognised that they had to find the 3 sides of the triangle. This many of them succeeded in doing by employing Pythagoras 3 times. (Unfortunately, many found BC to be 6 cm). The next stage was much more difficult. Many assumed that the median of triangle CDB was also perpendicular to the base and thus lost all the remaining marks. Others tried to use the cosine rule from the formula page but were unable to perform the correct algebraic manipulations to isolate the cosine. Candidates who had taken the trouble to learn the cosine rule in this form who generally more successful.

14. Many candidates were able to score one mark for writing a correct formula for the volume of the cone or the volume of the cylinder in terms of x, and some were able to equate two correct formulae, but few could rearrange the equation accurately to find h in terms of x. A common error here was $\frac{2x}{\left(\frac{1}{3}\right)} = \frac{2}{3}x$. A small number of candidates were able to compare the two volume formulae and simply write down the answer without working.

15. There were many interesting approaches to this question. Many tried to find the surface area rather than the volume and some tried to divide by the density rather than multiply by 0.6. Only about 35% of candidates obtained the fully correct answer of 240 grams though 40% of candidates achieved partial success.

16. Part (a) of this question was not answered well, many giving the coordinates of *F* as their answer for *E*. The wrong answer (10, 0, 8) was also popular. In part (b), many candidates realised that the midpoint of *OE* could be found by simply halving their coordinates of *E*, gaining full marks. However the answers to parts (a) and (b) were often completely unrelated.

17. No Report available for this question.

18. No Report available for this question.

19. Candidates realised what was required in this question but could not often carry out the execution of the task. In part (a) it was common to see a repetition of the coordinates of A whilst in (b) some candidates gained credit for realising that the z coordinate was in the same plane as *ABCD* and so gained a mark for using 3.

20. No Report available for this question.

21. No Report available for this question.

22. Fully correct answers to this question were only given by 23% of candidates. In part (a) it was common to see the volume of the 5cm cube being given correctly but then incorrect calculations for the hole were frequently seen. Some candidates thought the hole was a 3 cm cube and not a square prism with length 5cm. Where candidates tried to subtract two sensible volumes they were awarded a mark, however it was quite common to see candidates try to subtract 9cm^2 away from 125cm^3 and therefore achieve no marks.

In part (b) full marks were awarded for dividing the mass of 64 grams by the volume calculated in part (a) and 39% of candidates scored 2 marks usually for doing this. A large number of candidates divided volume by mass or multiplied mass and volume and so gained no credit. It was disappointing to see 39% of candidates gaining no marks at all in this question.

23. No Report available for this question.

24. No Report available for this question.