

## Getting Ready For *Engineering*

Your name		
CAMTEC Engineering	Introduction to Engineering	Summer 2024

**We are delighted you have chosen to study Engineering at Worthing College.**

**Instructions:** This pack will help you make the best possible start to studying this subject.

The tasks in this pack:

- should take you **about 4 hours to complete**.
- should be brought with you when teaching starts **from 9<sup>th</sup> September 2024** with your name on it for assessment.
- are also available on the internet - follow the links in the document.

**If you need help:** The tasks are designed to get a bit more difficult as you work through them as they are preparing you for studying at a higher level and to become an effective independent learner. You should try to get as far as you can working on your own but if you do need help, please email us at [gettingreadyfor@worthing.ac.uk](mailto:gettingreadyfor@worthing.ac.uk), telling us which Getting Ready For pack you are working on and what help you need. Help is available throughout the summer holidays.

Skills Focus for this Getting Ready for Pack	
Research sources of information	Organisation
Quality of written communication	Maths skills
Clarity of mathematical communication	

### Work Experience week

All year 1 students are required to participate in a week-long work placement during their first year of study. You will be expected to locate one week's worth of work placement and submit your work experience form before October half term.

#### Placement Dates:

L2/L3 students on double /triple qualifications:

1 week course-specific placement, expected placement dates will be confirmed by the course leaders at the beginning of September.

Students with 2 or more single subjects:

1 week placement during the Easter holidays or w/c 23 June 2025

You can find the work experience form [HERE](#)

More information and guidance can be found [HERE](#)

Target Grade	Type of task	Task and subject specific skill reference	Deadline
All	Getting prepared	<p>Organisation is the first step to success in Engineering. Make sure you have the following things when you start in September:</p> <ul style="list-style-type: none"> <li>● Ring binder with dividers for each unit (there will be 3 in y12)</li> <li>● Scientific calculator</li> <li>● Maths set including protractor and 30cm ruler</li> <li>● Pens and pencils, eraser, pencil sharpener</li> </ul>	<b>from 9<sup>th</sup> September 2024</b>
All	Maths for Engineering	<p>Practicing your Maths Skills is the second step to success in Engineering. It's important to continually revisit previous learning and practice the skills you have learned.</p> <p>Answer the questions included in this pack. You can check your answers using the markscheme at the end.</p>	<b>from 9<sup>th</sup> September 2024</b>
All	Research and Communication	<p>Communication is vital for Engineers, and there is an important coursework component of your qualification to help you develop this.</p> <p>Complete Activity 2 to start honing those research skills!</p>	
All	Support	<p><b>YouTube:</b> Maths help: <a href="https://www.youtube.com/watch?v=9Y05pw9jH3Q&amp;list=PLxHVbxhSvleS6TaN5EqyV0mu1W35t33KL">https://www.youtube.com/watch?v=9Y05pw9jH3Q&amp;list=PLxHVbxhSvleS6TaN5EqyV0mu1W35t33KL</a></p> <p>Maths help: <a href="https://sites.google.com/view/tlmaths/home/gcse-to-a-level-maths-bridging-the-gap">https://sites.google.com/view/tlmaths/home/gcse-to-a-level-maths-bridging-the-gap</a></p>	<b>from 9<sup>th</sup> September 2024</b>
<b>Notes:</b>			

# Activity 1: Maths for Engineering

## Q1.

(a) Look at this information about recycling:

25 large plastic bottles can be recycled to make 1 fleece jacket.

Write the missing number in this sentence.

200 large plastic bottles can be recycled to make \_\_\_\_\_ fleece jackets.

[1 mark]

(b) In a survey, **9 out of 10** people said they would like to recycle more.

What percentage of people said they would like to recycle more?

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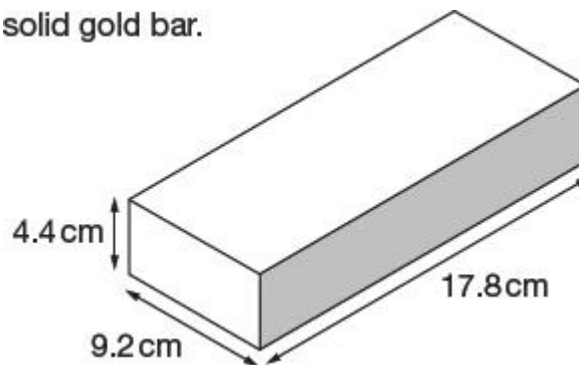
Answer \_\_\_\_\_ %

[1 mark]

## Q2.

Here are the dimensions of a solid gold bar.

solid gold bar.



Use the information below to calculate how much this gold bar is worth in British pounds (£).

- The gold bar is a cuboid.
- The density of gold is 19.3 grams per  $\text{cm}^3$
- 1 ounce is 28.35 grams.
- The price of gold is 670 US dollars per ounce.
- 1 US dollar is 0.508 British pounds.

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£ \_\_\_\_\_

[3 marks]

**Q3.**

You can work out the approximate age of a tree if you know its diameter.

The graph shows information about three types of trees.



An American beech, a silver maple and a white oak all have the **same diameter**.

Complete these sentences.

The age of the American beech is about \_\_\_\_\_ times the age of the silver maple.

[1 mark]

The age of the American beech is about \_\_\_\_\_ times the age of the white oak.

**Q4.**

Concorde could travel **1 kilometre every 2 seconds**.



How many kilometres per hour (km/h) is that?

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Answer \_\_\_\_\_ km/h

[2 marks]

**Q5.**

(a) One **light year** is approximately 9 430 000 000 000 kilometres.

Write this distance in standard form.

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Answer \_\_\_\_\_ km

[1 mark]

(b) A star called Wolf 359 is approximately **7.8 light years** from Earth.

About how many **kilometres** is this?

Write your answer in standard form.

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Answer \_\_\_\_\_ km

[1 mark]

**Q6.**

Here is a list of six different units of measure.

litres

metres

kilograms

millilitres

millimetres

grams

(a) Which of the units from the list best completes each sentence below?

Write them down.

Use \_\_\_\_\_ to measure the **mass** of an apple.

[1 mark]

Use \_\_\_\_\_ to measure the **volume** of water in a full bath.

[1 mark]

(b) Choose one of the units from the list that you did **not** use in (a).

Write down the units then give an example of **what it could measure**.

Use \_\_\_\_\_ to measure the \_\_\_\_\_

of \_\_\_\_\_.

[1 mark]

**Q7.**

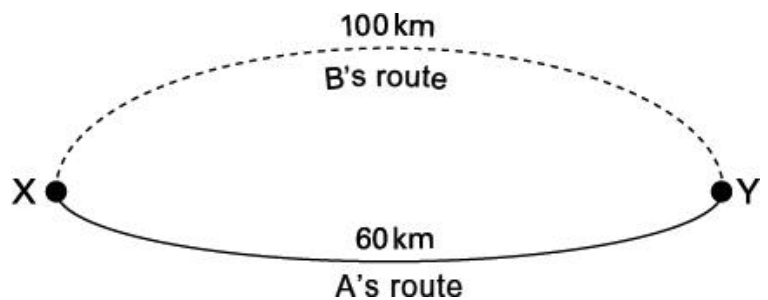
Two people, A and B, travel from X to Y along different routes.

Their journeys take the same amount of time.

B travels at an average speed of **40 km/h**.

What is A's average speed?

You **must** show your working.



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Answer \_\_\_\_\_ km/h

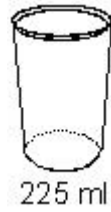
**Q8.**

- (a) A glass holds **225 ml**.

An adult needs about **1.8 litres** of water each day to stay healthy.

How many glasses is that?

You **must** show your working.



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Answer \_\_\_\_\_

[2 marks]

- (b) An adult weighs **80 kg**.  
**60%** of his total mass is water.

What is the mass of this water?

Answer \_\_\_\_\_ kg

[1 mark]

**Q9.**

The star nearest the Earth (other than the Sun) is Proxima Centauri.

Proxima Centauri is **4.22** light-years away.

(One light-year is  $9.46 \times 10^{12}$  kilometres.)

Suppose a spaceship could travel at **40 000 km per hour**.

- (a) Write what the following calculations represent.

The first one is done for you.

$$4.22 \times 9.46 \times 10^{12}$$

Number of km from Earth to Proxima Centauri

$$\frac{4.22 \times 9.46 \times 10^{12}}{40\,000}$$

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[1 mark]

$$\frac{4.22 \times 9.46 \times 10^{12}}{40\,000 \times 24 \times 365.25}$$

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[1 mark]

(b) Work out  $\frac{4.22 \times 9.46 \times 10^{12}}{40\,000 \times 24 \times 365.25}$

Give your answer to the nearest thousand.

Answer \_\_\_\_\_

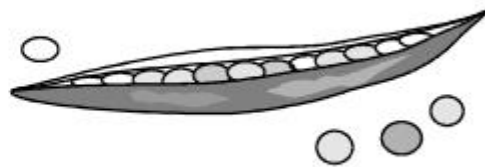
[1 mark]

**Q10.**

As part of a biology project, Dan and Ama are counting the number of peas in a sample of pea pods.

These are their results for the first 50 pods.

Number of peas in a pod	Number of pods
3	2
4	7
5	14
6	12
7	10
8	5



Dan and Ama correctly worked out the mode as 5 and the median as 6.

- (a) Work out the mean number of peas in a pod in their sample.  
You **must** show your working.

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Answer \_\_\_\_\_ peas

[2 marks]

- (b) Work out the number of peas in 200 pods.  
You should first decide whether to use the mode, median or mean.  
You **must** show your working.

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Answer \_\_\_\_\_ peas  
[2 marks]

(c) About how many pods out of 200 would you expect to have 3 or 4 peas?

\_\_\_\_\_  
\_\_\_\_\_

Answer \_\_\_\_\_ pods  
[1 mark]

(d) Dan takes another pod at random from the sample, opens it, and counts the number of peas.

Work out the probability that the pod contains **more** than six peas.

\_\_\_\_\_  
\_\_\_\_\_

Answer \_\_\_\_\_  
[1 mark]

**Q11.**

Sir Isaac Newton (1642–1727) was a mathematician, physicist and astronomer.

In his work on the gravitational force between two bodies he found that he needed to multiply their masses together.

(a) Work out the value of the mass of the Earth multiplied by the mass of the Moon.

Give your answer in standard form.

Mass of Earth = $5.98 \times 10^{24}$ kg Mass of Moon = $7.35 \times 10^{22}$ kg
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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Answer \_\_\_\_\_ kg  
[2 marks]

Newton also found that he needed to work out the square of the distance between the two bodies.

(b) Work out the square of the distance between the Earth and the Moon.

Give your answer in standard form.

Distance between Earth and Moon = $3.89 \times 10^5$ km
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Answer \_\_\_\_\_ km<sup>2</sup>  
[2 marks]

Newton's formula to calculate the gravitational force ( $F$ ) between two bodies is

$F = \frac{Gm_1m_2}{R^2}$  where  $G$  is the gravitational constant,  $m_1$  and  $m_2$  are the masses of the two bodies, and  $R$  is the distance between them.

(c) Work out the gravitational force ( $F$ ) between the Sun and the Earth using the formula

$F = \frac{Gm_1m_2}{R^2}$  with the information in the box below.

Give your answer in standard form.

$m_1m_2 = 1.19 \times 10^{55}$ kg <sup>2</sup> $R^2 = 2.25 \times 10^{16}$ km <sup>2</sup> $G = 6.67 \times 10^{-20}$
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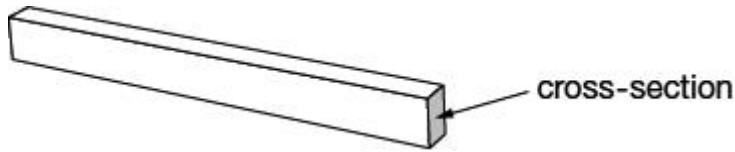
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gravitational force \_\_\_\_\_  
[2 marks]

**Q12.**

I am going to use a wooden beam to support a load.

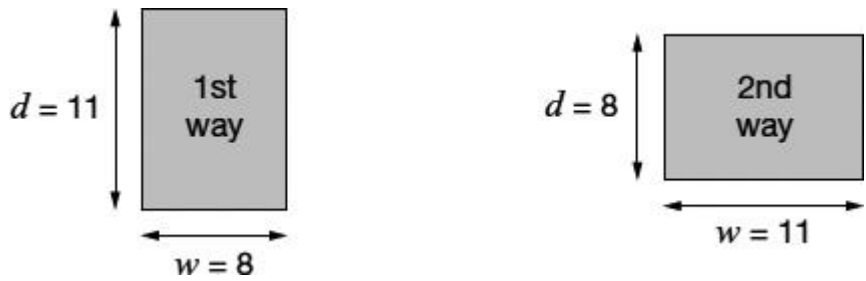
The cross-section of the beam is a rectangle.



The formula below gives the greatest load, Mkg, that a beam of this length can support.

$M = 5d^2w$ where $d$ is the depth of the beam in cm, $w$ is the width of the beam in cm.
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I can place the cross-section of the beam in two different ways.



In which way will the beam be able to support the greater load?

Calculate the difference.

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The \_\_\_\_\_ way supports the greater load, with a difference of \_\_\_\_\_ kg.

[3 marks]

**Q13.**

I think of a number.

I multiply this number by 8, then subtract 66  
The result is twice the number that I was thinking of.

What is the number I was thinking of?

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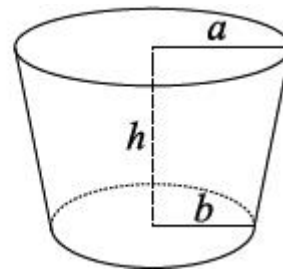
Answer \_\_\_\_\_

[2 marks]

**Q14.**

A formula to find the volume,  $V$ , of this bowl is

$$V = \frac{1}{3}\pi h \left( \frac{a^3 - b^3}{a - b} \right)$$



(a) When  $a = 10$  cm,  $b = 7$  cm and  $h = 5$  cm, what is the volume of the bowl?

Give your answer correct to 3 significant figures.

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[1 mark]

Answer \_\_\_\_\_ cm<sup>3</sup>

[1 mark]

(b) When  $b = 0$ , the bowl is a cone.

Write a simplified formula for the volume of this cone.

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$V =$  \_\_\_\_\_

[1 mark]

# Activity 2: Research and Discussion Task

## Electric Vehicles

Scenario:

As part of their on-going commitment to tackling climate change, the UK government announced in September 2023 that from 2035, the sale of all new petrol and diesel vehicles would be banned, meaning only fully electric cars will be sold in the UK.

Research and discuss the advantages and disadvantages for the environment of electric vehicles, and whether you think the ban is a good idea or not. Remember to include a bibliography showing where you got your information.

Aim for around 2 pages of work, and make sure you include:

1. Environmental advantages
2. Environmental disadvantages
3. Any other information you want to include
4. Conclusion – is the ban a good idea?
5. Bibliography

Not sure where to start? There is an interesting article here: [Why Electric Cars Are Better for the Environment | Earth.Org](#) that should help get you started, but you will need to include other research sources of your own as well.

Mark scheme for Activity 1

**Q1.**

(a) 8

1

(b) 90

1

[2]

**Q2.**

Gives a value between 163 000 and 171 000 inclusive

**! For 3m or 2m, answer not rounded to 2 decimal places**

*Condone*

3

**or** Shows a value between 321 000 and 336 000 inclusive  
[number of US dollars]

or

Shows a complete correct method with not more than one computational or rounding error

eg

- $17.8 \times 9.2 \times 4.4 \times 19.3 \div 28.35 \times 670 \times 0.508$

*Markers may find the following values useful:*

720.544	
$\times 19.3$	= 13906.499
$\div 28.35$	= 490.529
$\times 670$	= 328654.478
$\times 0.508$	= £166 956.48

2

**or** Shows a value between 479 and 502 inclusive [mass in ounces]

1

[3]

**Q3.**

Gives a value between 2.7 and 3.3 inclusive

1 (U1)

Gives a value between 1.1 and 1.4 inclusive

1

*Accept equivalent fractions or decimals*

[2]

**Q4.**

1800 km/h

2

**or** Shows or implies a correct rate, other than 1 kilometre every 2 seconds, even if it doesn't use single units of time

eg

30 (km) per minute

$\frac{1}{2}$

(kilometre) in a sec

15 kilometres in 30 seconds

30 kilometres every minute

or

Shows or implies a complete correct method with not more than one computational or rounding error

eg

•  $30 \times 60$

•  $1 \div 2 = 0.5$

$0.5 \times 60^2 = 1800$

**! For 1m, unit(s) abbreviated**

*Condone provided unambiguous within the context of the question*

*eg, for 1m accept*

• *30km per min*

1

[2]

**Q5.**

(a)  $9.43 \times 10^{12}$

**! Zero(s) given after the last decimal place within standard form notation**

*eg for part (a)*

•  $9.430 \times 10^{12}$

*Condone*

1

(b)  $7.35(54) \times 10^{13}$  or  $7.36 \times 10^{13}$  or  $7.4 \times 10^{13}$

**! For part (b), follow through**

*Accept  $7.8 \times$  their (a) provided this is written correctly in standard form to at least 2 s.f.*

1

[2]

**Q6.**

(a) *Indicates grams*

**Accept unambiguous indication**

1

*Indicates litres*

**! For both responses, correct but less suitable units indicated**

*Mark responses of kilograms then millilitres as 0, 1*

1

(b) Indicates one of the given units not credited in their (a), and gives an example of something it could measure  
eg

- Use metres to measure the distance of a running track
- Use millimetres to measure the length of a ruler
- Use kilograms to measure the mass of a person  
[only if kilograms not given for the first mark in (a)]
- Use millilitres to measure the volume of drink in a can  
[only if millilitres not given for the second mark in (a)]
- Use grams to measure the mass of a piece of cheese  
[only if grams not given for the first mark in (a)]
- Use litres to measure the capacity of water in a swimming pool  
[only if litres not given for the second mark in (a)]

**! Imprecise description of the property to be measured**

*Condone provided the pupil's intention is clear  
eg, accept*

- *Use metres to measure the size of a garden*
- *Use millilitres to measure the amount/quantity of drink in a can*
- *Use kilograms to measure the weight of a person*

**! Units for the correct property given, but not the most suitable for their example**

*Condone  
eg, accept*

- *Use millilitres to measure the volume of water in a swimming pool*

**! Property given with object unspecified or omitted**

*Condone  
eg, accept*

- *Use millimetres to measure the length of something*
- *Use kilograms to measure the mass*



**Do not accept object given without explicit indication of the property to be measured**

eg

- Use millimetres to measure a ruler
- Use kilograms to measure a person

**Do not accept units used that are not from the given list**

eg

- Use centimetres to measure the length of a ruler

U1

[3]

**Q7.**

24

2

or Shows the journey time is  $2\frac{1}{2}$  (hours)

or

Shows a complete correct method

eg

- $60 \div 2.5$
- $60 \div (100 \div 40)$
- $60 \times 2 \div 5$
- $40 \times 0.6$
- $60 = \frac{3}{5}$  of 100, so  $\frac{3}{5}$  of 40

or

The only error is to misread A for B, giving an answer of  $66\frac{2}{3}$

! Answer given as a decimal

**Accept 66.7 or 66.6 or 66.6(...)**

**Do not accept 67 unless a correct method or a more accurate value is seen**

1

[2]

**Q8.**

(a) 8

2

or Shows a complete correct method, eg

- $\frac{1.8 \times 1000}{225}$
- $1.8 \div 0.225$
- $225 \times 2 = 450$   
 $450 \times 2 = 900$   
 $900 \times 2 = 1800$   
 $2 \times 2 \times 2$

or

Shows the value 1800 or 0.225

*Accept value qualified, eg*

- *About 8*

1

(b) 48

1

[3]

### Q9.

(a) Correct interpretation

eg

- Number of hours it would take the spaceship to travel from Earth to the star
- How many hours the journey would take

*Accept minimally acceptable explanation*

*eg*

- *Number of hours to travel*
- *How many hours it takes*
- *Time taken to travel at 40 000 km per hour*

*Do not accept incomplete interpretation that does not refer to both the journey and the units of time*

*eg*

- *Number of hours*
- *How long it takes*
- *Time taken to travel*

*Do not accept no interpretation*

*eg*

- *Distance times light-years divided by speed*

1

Correct interpretation

eg

- Number of years it would take the spaceship to travel from Earth to the nearest star

- Number of years from E to PC

*Accept minimally acceptable explanation*

*eg*

- *Number of years to travel*
- *How many years to get there*

*Do not accept incomplete interpretation that does not refer to the journey*

*eg*

- *Number of years*

*Do not accept incomplete interpretation that does not refer to the units of time*

*eg*

- *Time taken to travel*

*Do not accept incorrect interpretation*

*eg*

- *Time taken to travel in years and in days*

1

(b) 114 000

1

[3]

### Q10.

(a) **For 2m** states correct mean value to one or two decimal places, eg:

- 5.72
- 5.7

**For only 1m** shows in work the number 286 or that the number of peas in a pod is multiplied by the corresponding number of pods, eg:

- $3 \times 2 = 6, 4 \times 7 = 28$  etc.

*At least two of the results of these multiplications have to be shown.*

2

(b) **For 2m** gives correct number of peas, or gives number of peas corresponding to multiplying correctly the mean given in part (a) by 200, or corresponding to the total number of peas found for 50 pods in part (a) correctly multiplied by 4, eg:

- 1144
- 1140
- 1100 if 5.5 given in part (a)

**For only 1m** 200 correctly multiplied by either the value of the mode or the median, eg:

- 1000

- 1200

*Allow follow through from part (a).*

*If 5 or 6 has been calculated as the mean in part (a) and this value has been correctly multiplied by 200 then **award 2m**.*

***Award 1m** if the mean calculated in part (a) is incorrectly multiplied by 200 or the total number of peas found for 50 pods in part (a) is incorrectly multiplied by 4.*

2

(c) States correct number of pods, eg:

- 36
- about 36

*8 + 28 or 8, 28*

1

(d) States correct probability, eg:

- $\frac{3}{10}$

- $\frac{15}{50}$

- 0.3

*Accept equivalent fractions or percentages eg*

- 30%
- 3 in 10

*Do not accept answers in ratio form, eg*

- 3:7

1

[6]

### Q11.

(a) **For 2m** states correct value in standard form, eg:

- $4.3953 \times 10^{47}$
- $4.4 \times 10^{47}$

**For only 1m** shows in work that indices are added together, eg:

- value is  $5.98 + 7.35 \times 10^{24+22} = 13.33 \times 10^{46}$
- $5.98 \times 10^{24} \times 7.35 \times 10^{22} = 43,953 \times 10^{46} = 43.953^{46} = 4.3953^{47}$

*Accept numbers rounded or truncated to one or more decimal places.*

***For only 1m** states correct answer but not in standard form eg*

- $43953 \times 10^{46}$
- $4395.3 \times 10^{44}$
- 43953 followed by 43 noughts
- 4.3953E + 47

(b) **For 2m** states correct value in standard form, eg:

- $1.5132 \times 10^{11}$
- $1.5 \times 10^{11}$

**For only 1m** shows in work that squaring  $10^5$  gives  $10^{10}$ , eg:

- $3.89 \times 3.89 \times 10^5 \times 10^5 = 3.89 \times 2 \times 10^{10} = 7.78 \times 10^{10} = 77800000000$
- $3.89 \times 10^5$  squared =  $3.89^5$  squared =  $15.1321^{10} = 1.51321^{11}$

*Accept numbers rounded or truncated to one or more decimal places*

**For only 1m** states correct answer but not in standard form eg

- $15.1321 \times 10^{10}$
- 151321000000
- 1.51321E + 11

2

(c) **For 2m** states correct value in standard form, eg:

- $3.5276888 \times 10^{19}$
- $3.5 \times 10^{19}$

**For only 1m** 3.5276888 or 3.5276889 or 3.5276882 (or one of these numbers rounded or truncated to one or more decimal places) shown in working or given in answer, eg:

- $6.67 \times 10^{-20} \times 1.19 \times 10^{55} = 7.973 \times 10^{35} \div 2.25 \times 10^{16} = 3.5276888 \times 10^{51}$   
=  $3.53 \times 10^{51}$

*Accept numbers rounded or truncated to one or more decimal places.*

**For 2m** accept

$3.5276889 \times 10^{19}$  or

$3.5276882 \times 10^{19}$

**For only 1m** states correct answer but not in standard form eg

- $35276889 \times 10^{12}$
- 35276882 followed by 12 noughts
- 3.5276888E + 19
- $35.3 \times 10^{18}$

2

[6]

## Q12.

Indicates the 1st way, and gives the correct difference of 1320

3

or Show the digits 132(0)

or

Show the digits 484(0) and 352(0)

or

Shows or implies correct substitution of all values into the formula and the intention to subtract

eg

- $5 \times 11^2 \times 8 - 5 \times 8^2 \times 11$
- $5 \times 11 \times 8(11 - 8)$
- $440 \times 3$
- $5 \times (968 - 704)$
- $5 \times 264$

or

Shows a complete correct method with not more than one computational error, and gives a correct decision for their values

eg

- $5 \times 11^2 \times 8 = 4440$  (error)
- $4440 - 3520 = 920$

so 1st way, difference 920

2

**or** Shows the digits 484(0) or 352(0)

or

Indicates the 1st way and gives an answer of 264 [the only error is to omit to multiply the substituted values by 5]

or

Indicates the 1st way and gives an answer of 6600 [the only error is to process

- $5 \times 11^2 \times 8$  as  $(5 \times 11)^2 \times 8$  and
- $5 \times 8^2 \times 11$  as  $(5 \times 8)^2 \times 11$

1

[3]

### Q13.

11

2

**or** Forms or implies a correct equation

eg

- $8x - 66 = 2x$

- $6y = 66$

- $66 \div 6$

**! Method used is trial and improvement**

*Note that no partial credit can be given*

**! Equation involving words**

*Accept provided the operation involved in 'twice the number I was thinking of' has been interpreted*

*eg, for 1m accept*

- $\text{Number} \times 8 \text{ minus } 66 = \text{number} \times 2$
  - $66 \text{ is the same as } 6 \text{ times the number}$
- eg, for 2m do not accept*
- $8x - 66 = \text{twice } x$

1

(U1)

[2]

### Q14.

- (a) Shows or implies correct substitution into the formula with correct evaluation of at least the part in brackets  
eg

- Value between 1134 and 1147 inclusive
- 1150
- $365\pi$

- $\frac{1}{3} \times \pi \times 5 \times 219$

- $5.2(\dots) \times 219$

**! For the first mark, value(s) rounded**

*For  $\frac{1}{3}$ , accept 0.33 or better*

*For  $\pi$ , accept 3.14 or 3.142 or better*

*eg, for the first mark accept*

- $0.33 \times 3.14 \times 5 \times 219$
- $5.1(\dots) \times 219$

1

Shows the correct value for the volume of the bowl to 3 significant figures,  
ie 1150

**! For the second mark, follow through from an incorrect volume or incorrect working**

*Accept provided their volume is greater than 1000, and needs rounding to be given correct to 3 significant figures*

*eg, from their volume as 1031.(...) or*

*working of  $4.71(\dots) \times 219$  accept*

- 1030

eg, from their volume as 1030 with no working, do not accept

- 1030

1

(b) Gives a correct formula

eg

- $\frac{1}{3} \pi a^2 h$
- $\frac{\pi a^2 h}{3}$

**! Unconventional notation**

Condone

eg, accept

- $\pi \times h \times a \times a \div 3$

**Do not accept formula not completely simplified**

eg

- $\frac{\pi a^3}{3a}$

**Do not accept incorrect name for variable within the context of the question**

eg

- $\frac{1}{3} \pi r^2 h$

1

[3]