THE BEWDLEY SCHOOL

Learning for Life - Achievement for All

Year 11

Work Booklet

This workbook contains English, Maths and Science Resources

English – Power and conflict poetry

You will be studying the 'Power and Conflict' poetry cluster for the GCSE English Literature Paper 2 Part B question. This cluster is comprised of 15 poems. You will be expected to meet the following assessment objectives in order to be successful:

· **AO1:** Read, understand and respond to texts. Students should be able to:
maintain a critical style and develop an informed personal response
use textual references, including quotations, to support and illustrate interpretations.

· **AO2:** Analyse the language, form, and structure used by a writer to create meanings and effects, using relevant subject terminology where appropriate.

· **AO3:** Show understanding of the relationships between texts and the contexts in which they were written.

Poem	Annotations in anthology (ü)	Revised (ü)	Notes
Ozymandias			
London			
The Prelude: Stealing the Boat			
My Last Duchess			
The Charge of the Light Brigade			
Exposure			
Storm on the Island			
Bayonet Charge			
Remains			
Poppies			
War Photographer			
Tissue			
The Emigrée			
Kamikaze			
Checking Out Me History			

Ozymandias

Summary of Poem (AO1)

What is the poem about?

Quotations (AO1)

Which quotations are the most important from this poem?

Language Features (AO2)

Important language features to remember

Structural Features (AO2)

Important structure features to remember

Context/Message (AO3)

Points about context and poet's message

Ozymandias

Task: Select ***two*** quotations from this poem and ***explode*** them in the spaces below. **(AO2)**

- Write the quotation down below
- Label all the word classes and techniques
- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

Ozymandias

Compares well with ...	Because ...

London

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Which quotations are the most important from this poem?

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Structural Features (AO2)

Important structure features to remember

Context/Message (AO3)

Points about context and poet's message

London

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- Write the quotation down below
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London

Compares well with ...	Because ...

The Prelude: Stealing the Boat

Summary of Poem (AO1)

What is the poem about?

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Which quotations are the most important from this poem?

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Points about context and poet's message

The Prelude: Stealing the Boat

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The Prelude: Stealing the Boat

Compares well with ...	Because ...

My Last Duchess

Summary of Poem (AO1)

What is the poem about?

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Which quotations are the most important from this poem?

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Important structure features to remember

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- Write the quotation down below
- Label all the word classes and techniques
- Briefly explain what inferences you can draw from the quotations
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My Last Duchess

Compares well with ...	Because ...

The Charge of the Light Brigade

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Important structure features to remember

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Points about context and poet's message

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- Write the quotation down below
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- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

The Charge of the Light Brigade

Compares well with ...	Because ...

Exposure

Summary of Poem (AO1)

What is the poem about?

Quotations (AO1)

Which quotations are the most important from this poem?

Language Features (AO2)

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Structural Features (AO2)

Important structure features to remember

Context/Message (AO3)

Points about context and poet's message

Exposure

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- Label all the word classes and techniques
- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

Exposure

Compares well with ...	Because ...

Storm on the Island

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What is the poem about?

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Which quotations are the most important from this poem?

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Important language features to remember

Structural Features (AO2)

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- Write the quotation down below
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- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

Storm on the Island

Compares well with ...	Because ...

Bayonet Charge

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- Label all the word classes and techniques
- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

Bayonet Charge

Compares well with ...	Because ...

Remains

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What is the poem about?

Quotations (AO1)

Which quotations are the most important from this poem?

Language Features (AO2)

Important language features to remember

Structural Features (AO2)

Important structure features to remember

Context/Message (AO3)

Points about context and poet's message

Remains

Task: Select ***two*** quotations from this poem and ***explode*** them in the spaces below. **(AO2)**

- Write the quotation down below
- Label all the word classes and techniques
- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

Remains

Compares well with ...	Because ...

Poppies

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What is the poem about?

Quotations (AO1)

Which quotations are the most important from this poem?

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Structural Features (AO2)

Important structure features to remember

Context/Message (AO3)

Points about context and poet's message

Poppies

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- Write the quotation down below
- Label all the word classes and techniques
- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

Poppies

Compares well with ...	Because ...

War Photographer

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- Label all the word classes and techniques
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War Photographer

Compares well with ...	Because ...

Tissue

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What is the poem about?

Quotations (AO1)

Which quotations are the most important from this poem?

Language Features (AO2)

Important language features to remember

Structural Features (AO2)

Important structure features to remember

Context/Message (AO3)

Points about context and poet's message

Tissue

Task: Select ***two*** quotations from this poem and ***explode*** them in the spaces below. **(AO2)**

- Write the quotation down below
- Label all the word classes and techniques
- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

Tissue

Compares well with ...	Because ...

The Emigrée

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Which quotations are the most important from this poem?

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- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

The Emigrée

Compares well with ...	Because ...

Kamikaze

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Important structure features to remember

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Kamikaze

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- Label all the word classes and techniques
- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

Kamikaze

Compares well with ...	Because ...

Checking Out Me History

Summary of Poem (AO1)

What is the poem about?

Quotations (AO1)

Which quotations are the most important from this poem?

Language Features (AO2)

Important language features to remember

Structural Features (AO2)

Important structure features to remember

Context/Message (AO3)

Points about context and poet's message

Checking Out Me History

Task: Select ***two*** quotations from this poem and ***explode*** them in the spaces below. **(AO2)**

- Write the quotation down below
- Label all the word classes and techniques
- Briefly explain what inferences you can draw from the quotations
- **Challenge:** How might the quotation link to the context, poet's message/intentions, or effect on the reader?

Checking Out Me History

Compares well with ...	Because ...

Compare the way that poets present memories in 'Remains' and one other poem from 'Power and Conflict'. [30 marks]

Plan your response in the space below.

Compare the way that the power of nature is presented in 'Storm on the Island' and one other poem from 'Power and Conflict'. [30 marks]

Plan your response in the space below.

Compare the way that the realities of conflict are presented in 'Bayonet Charge' and one other poem from 'Power and Conflict'. [30 marks]

Plan your response in the space below.

Compare the way that poets present loss in 'Poppies' and one other poem from 'Power and Conflict'. [30 marks]

Plan your response in the space below.

Compare the way that a location or place is presented in ‘London’ and one other poem from ‘Power and Conflict’. [30 marks]

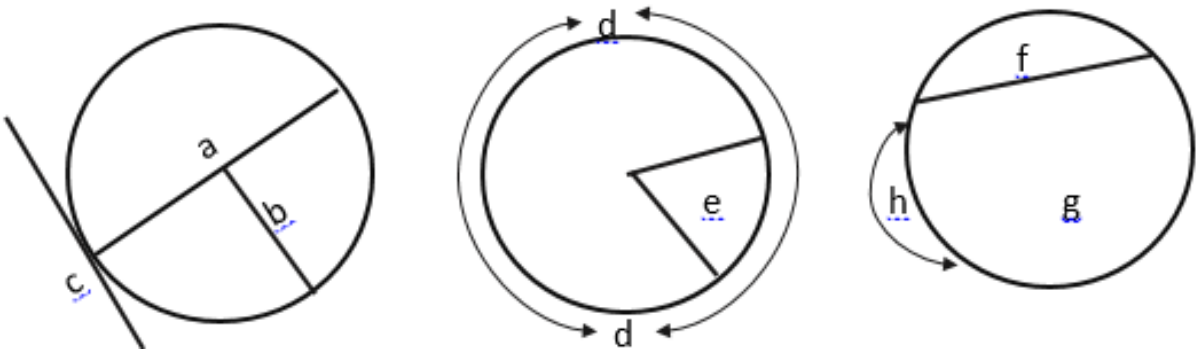
Plan your response in the space below.

Maths - The circle, converting between measures and volumes

Section A

Question 1

Write down the names of the labelled parts of the circles below.



a …… d …… f ……..

b …… e …… g ……..

c …… h ……..

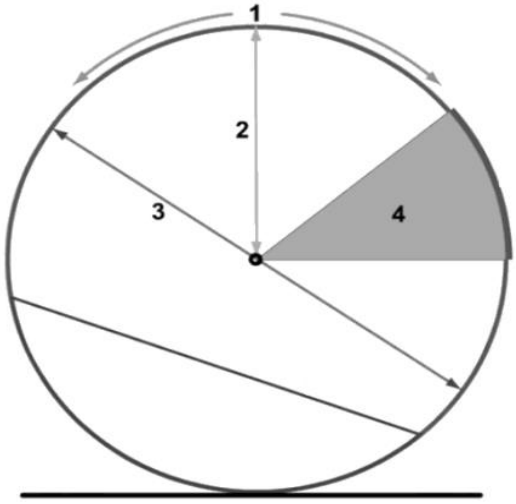
(Total 3 marks)

Question 2

Here is a list of words that are connected with circles.

arc radius chord diameter circumference sector

Label the four boxes on this diagram, by choosing the correct word from the list.



1 ……

2 ……

3 ……

4 ……

(Total 4 marks)

Question 3

A circle has a radius of 4 cm.

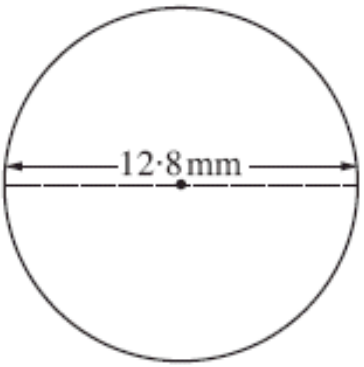
Write down the length of the diameter.

Answer ..... cm

(Total 1 mark)

Question 4

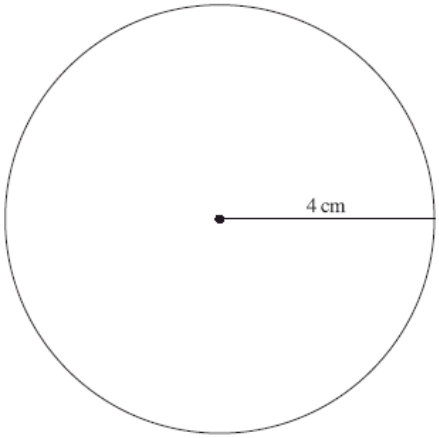
(a) Calculate the circumference of this circle.



..... mm

[2]

(b) The radius of this circle is 4 cm. Calculate the area of the circle.

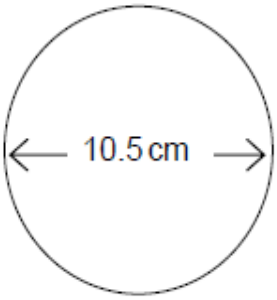


..... cm^2

[2]

Question 5

Work out the circumference of a circle of diameter 10.5 cm.



Not drawn accurately

.....

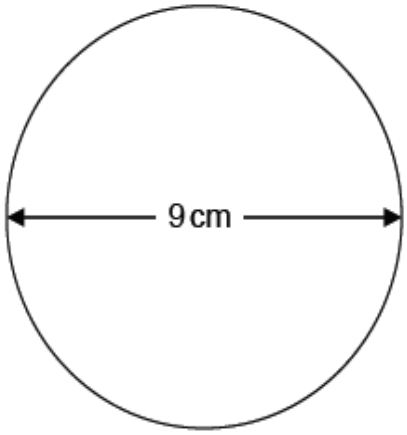
.....

.....

Answer ..... cm *(2 marks)*

Question 6

Calculate the circumference of a circle with a diameter of 9 cm.



Not drawn accurately

.....

.....

.....

.....

Answer ..... cm *(2 marks)*

Question 7

(a) Show that the area of a circle of diameter 10 inches is 78.5 square inches.

……………………………………………………………………………………………

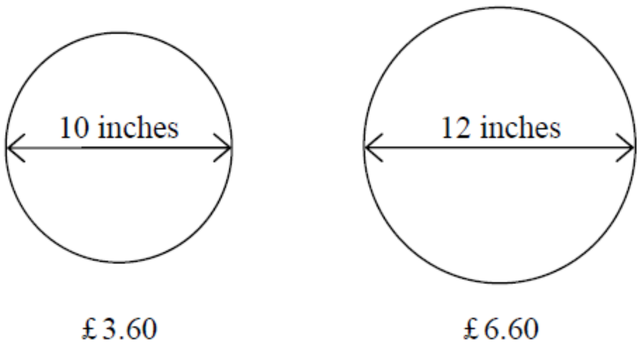
……………………………………………………………………………………………

……………………………………………………………………………………………

(2 marks)

(b) A circular 10 inch thin crust Margherita pizza costs £3.60

A circular 12 inch thin crust Margherita pizza costs £6.60



Which of these pizzas is the better value for money?

You **must** show your working.

……………………………………………………………………………………………

……………………………………………………………………………………………

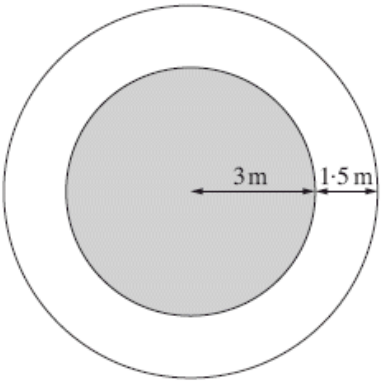
……………………………………………………………………………………………

……………………………………………………………………………………………

(4 marks)

Question 8

A path of width 1·5 m is laid round the pond, as shown in this plan view.



Not to scale

Calculate the area of the path.

..... m^2

[3]

Question 9

The area of a semi-circle is $36cm^2$. Calculate the radius, correct to three significant figures.

..... cm

[3]

Section B

Question 10

Change 7 m^2 to cm^2.

……cm^2

(Total 2 marks)

Question 11

The volume of a cube is 8 m^3. (b) Change 8 m^3 to cm^3.

..... cm^3

(2)

Question 12

The volume of a cylinder is 350cm^3. Express the volume in mm^3.

…… mm^3

(1)

Question 13

The area of a classroom is 5m^2. What is the area of the classroom in mm^2 ?

…… mm^2

(1)

Question 14

A field has an area of 105m^2. What is this in km^2 ?

…… km^2

(1)

Question 15

Convert :

(a) 94,000 mm^2 into cm^2

. ..... cm^3

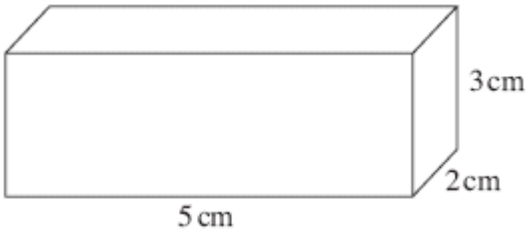
(b) 0.08cm^3 into mm^3

…… mm^3

(2)

Section C

Question 16



Calculate the volume of the cuboid. Give the units of your answer.

.....

[3]

Question 17

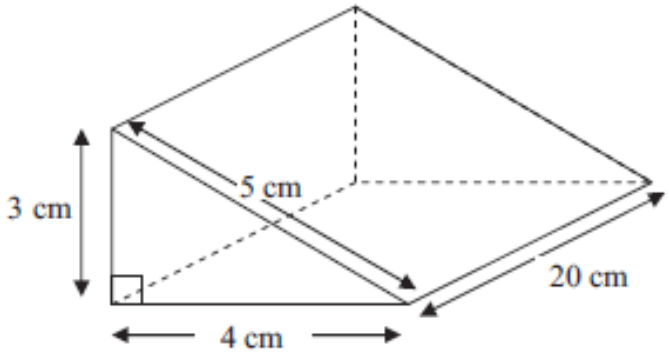


Diagram **NOT** accurately drawn

Work out the volume of the triangular prism.

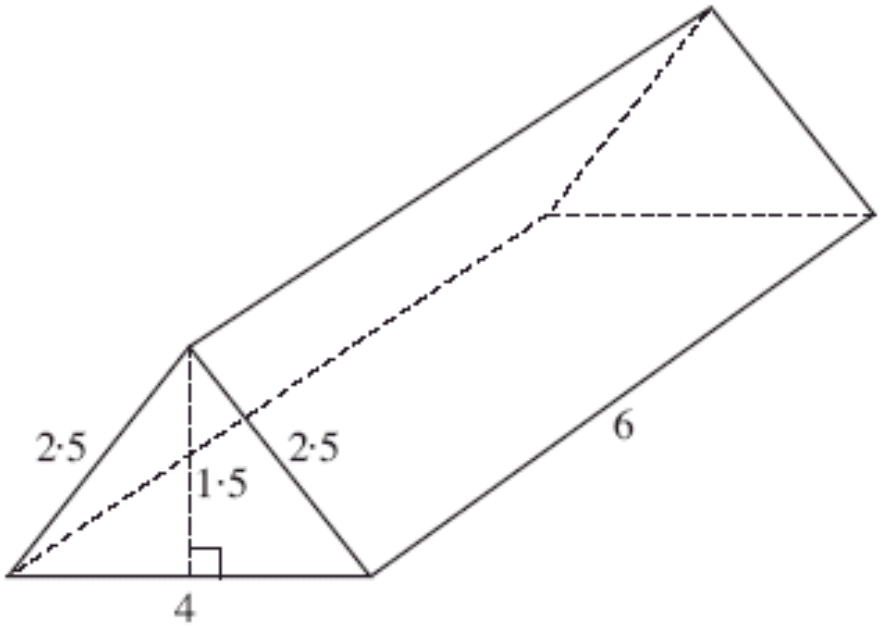
..... cm^3

(Total 2 marks)

Question 18

The sketch shows a triangular prism.

All the measurements are in centimetres.



Calculate the volume of the prism.

Show your method clearly.

Give the units of your answer.

.....

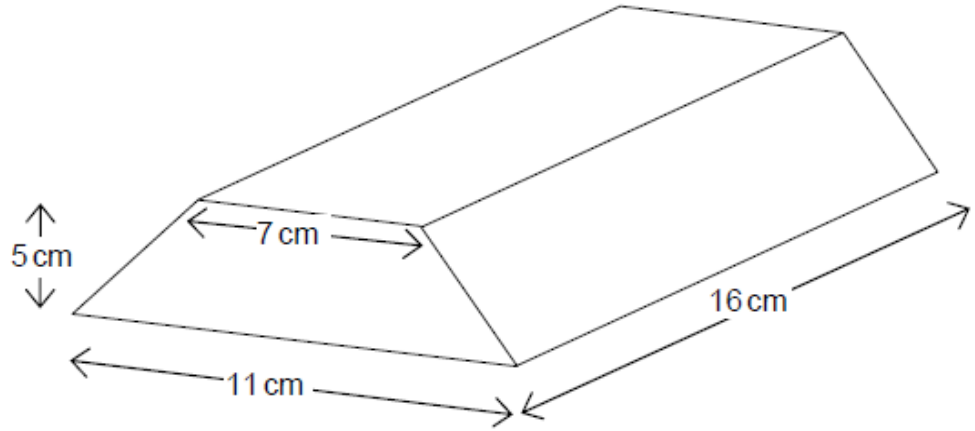
[4]

Question 19

A gold bar has a trapezium cross-sectional area.

The dimensions are shown in the diagram.

Not drawn accurately



Calculate the cross-sectional area of the gold bar.

.....

.....

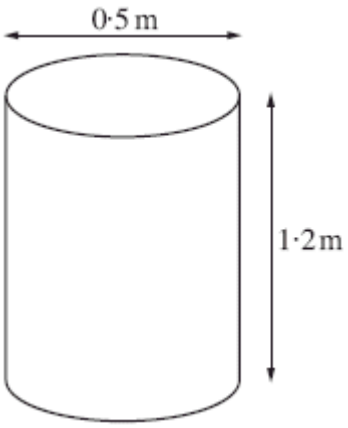
.....

.....

Answer ..... cm^2 *(2 marks)*

Question 20

A cylindrical drum is shown below.



Calculate the volume of the drum.

..... m^3

[3]

Question 21

Calculate the volume of this cylinder**.**

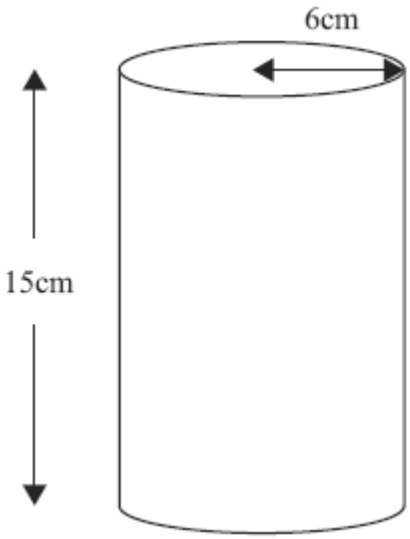
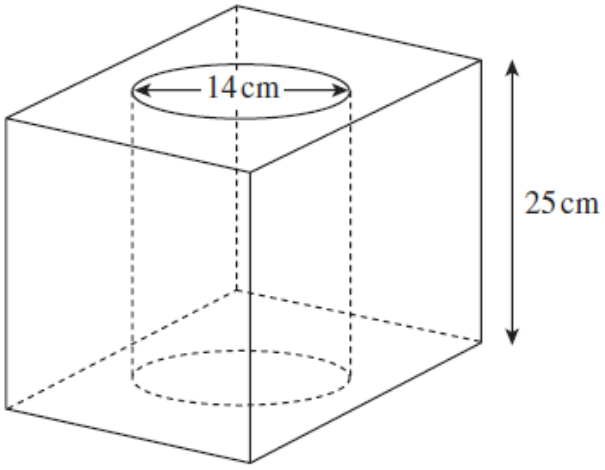


Diagram **NOT** accurately drawn

(**Total 2 marks**)

Question 22

A solid cube of side 25 cm has a circular hole cut through vertically.
The circle has a diameter of 14 cm.



Not drawn accurately

Calculate the volume remaining.

.....

.....

.....

.....

.....

.....

.....

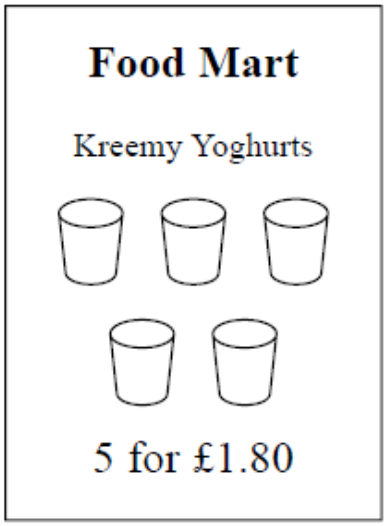
Answer ..... cm^3 *(4 marks)*

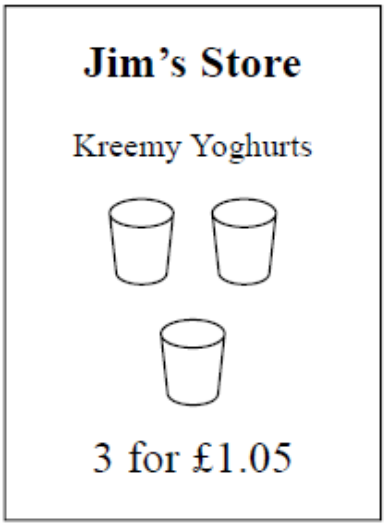
Best value comparisons

Section A – Do these questions by finding out the cost of a single item

Question 1

Two shops, Food Mart and Jim's Store, both sell Kreemy Yoghurts.





At which shop are Kreemy Yoghurts the better value for money?
You must show all your working.

Question 2

Here are the costs of pens in two shops.

Shop A	Shop B
3 pens for £2	5 pens for £3

Mrs Evans wants to buy 30 pens for the cheapest possible cost.

Which shop should she buy the pens from?
You must show all your working.

Section B

Question 3– now do this question again, by working out the cost of 30 pens in each shop

Here are the costs of pens in two shops.

Shop A	Shop B
3 pens for £2	5 pens for £3

Mrs Evans wants to buy 30 pens for the cheapest possible cost.

Which shop should she buy the pens from?
You must show all your working.

Question 4

Jack sees the bicycle he wants to buy in two shops.

Bye-cycles

Price without VAT £130

VAT is 20%

Just Bykes

Normal price £195

Now $\frac{1}{4}$ off

VAT is included

In which shop is the bicycle cheaper?
You **must** show your working.

[5 marks]

Section C

Question 5

Simon is a salesman.
He gets paid expenses of 40p for every mile that he drives during work.
He also gets £12 expenses as a meal allowance for any day that he drives during work.
The table gives information about the number of miles Simon drove on 5 days in one week.

Day	Number of miles
Monday	48
Tuesday	37
Wednesday	0
Thursday	78
Friday	21

(a) Work out Simon's total expenses.

(4)

Sasha works for the same company.
She gets paid expenses of 40p for each mile she drives during work.

Last year she worked for 48 weeks.

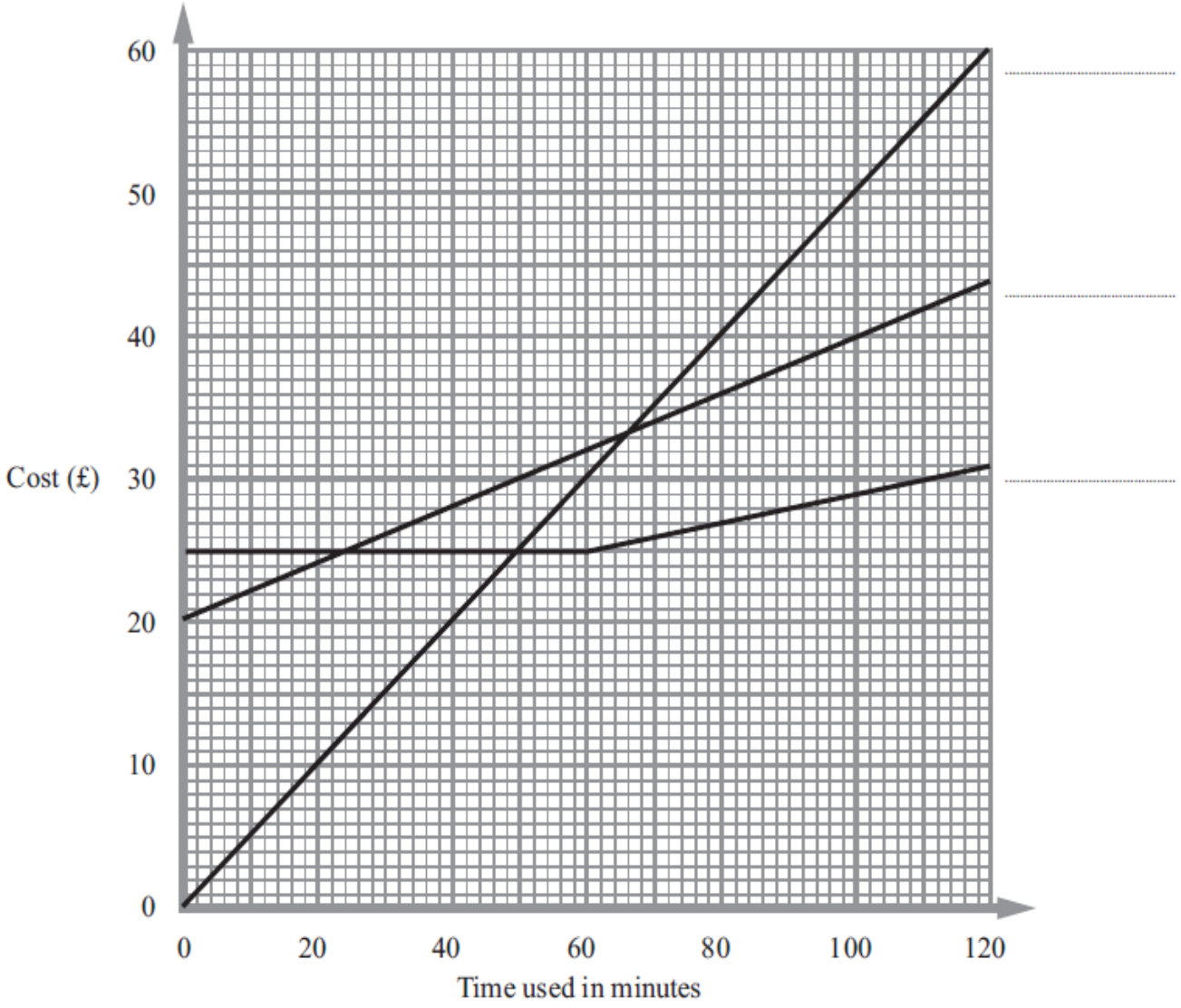
Her total **expenses** for driving for the year were £2116.80

(b) Work out an estimate for the average number of miles Sasha drove during work each week last year.

(3)

Question 6

The graph shows the cost of using a mobile phone for one month for three different tariffs.



The three tariffs are

Tariff A	Rental £20	every minute costs 20p
Tariff B	Pay as you go	every minute costs 50p
Tariff C	Rental £25	first 60 minutes free, then each minute costs 10p

(a) Label each line on the graph with the letter of the tariff it represents.

(1)

Jim uses tariff A for 100 minutes in one month.

(b) Find the total cost.

(1)

£ .....

Fiona uses her mobile phone for about 60 minutes each month.

(c) Explain which tariff would be the cheapest for her to use.
You **must** give the reasons for your answer.

(2)

Question 7

Samantha wants to buy a new pair of trainers.

There are 3 shops that sell the trainers she wants.

Sports '4' All	**Edexcel Sports**	**Keef's Sports**
Trainers	**Trainers**	**Trainers**
£5	$\frac{1}{5}$ off	**£50**
plus	usual price of	plus
12 payments of £4.50	**£70**	VAT at 20%

From which shop should Samantha buy her trainers to get the best deal?

You must show all of your working.

Question 8

The table gives information about an estate agent's charges for selling a house.

Value of the house	Estate agent's charges
Up to £60 000	2% of the value of the house
Over £60 000	2% of the first £60 000 plus 1% of the remaining value of the house

Ken uses this estate agent to sell his house.

The estate agent sold Ken's house for £80 000.

Work out the total charge that Ken will have to pay.

Question 9

A customer who cancels a holiday with Funtours has to pay a cancellation charge. The cancellation charge depends on the number of days before the departure date the customer cancels the holiday.

The cancellation charge is a percentage of the cost of the holiday.

The table shows the percentages.

Number of days before the departure date the customer cancels the holiday	Percentage of the cost of the holiday
29–55	40%
22–28	60%
15–21	80%
4–14	90%
3 or less	100%

The cost of Amy's holiday was £840
She cancelled her holiday 25 days before the departure date.

(a) Work out the cancellation charge she had to pay.

£ ……

(2)

The cost of Carol's holiday was £600
She cancelled her holiday and had to pay a cancellation charge of £480

(b) Give the range of the number of days in which Carol cancelled her holiday.

…….

(3)

Pricing problems involving area and volume

Section A

Question 1

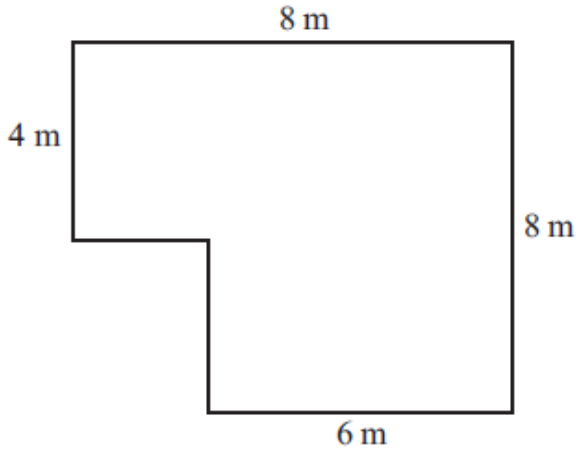


Diagram **NOT** accurately drawn

The diagram is a plan of the floor of Nikola's room.
All the angles are right angles.
Nikola is going to lay flooring to cover all the floor.

She can choose either carpet tiles or wood strips.

Carpet tiles come in packs of 32 and are square. They measure 50 cm by 50 cm.
Wood strips come in packs of 10 and are rectangular. They measure 2 m by 25 cm.

She only wants to use one type of flooring and buy as few packs as she can.
Which type of flooring should she choose?

(Total 6 marks)

Question 2

Harry and Sally want to keep free range hens.

They have a rectangular piece of land that they intend to use for a chicken run.

The length of the land is 30 m and the width is 10 m.

Harry and Sally will need to put a fence, with a gate, around the chicken run.

They are advised that the least area a free range hen needs is 0.8 m^2.

They want to have as many hens as they can.

Hens cost £7.50 each.
Putting in the fence and gate will cost £9.85 per metre.

Work out the total cost of buying the hens and fencing the land.

(Total 9 marks)

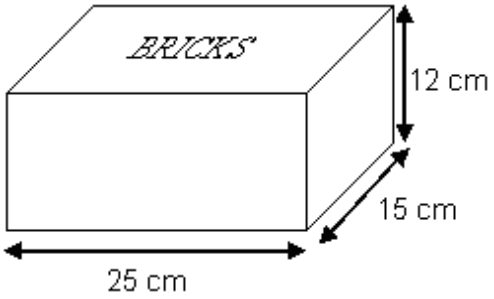
Question 3

A company makes building bricks for children.
The bricks are all 5 cm cubes.

The bricks are going to be packed in boxes.

John designs a box for the bricks.
The box is a cuboid.

The size of the box is 25 cm by 15 cm by 12 cm.



Will the box be big enough for 36 bricks?
You must give reasons for your answer.

(Total 4 marks)

Question 4

The diagram shows a wall in Jenny's kitchen.

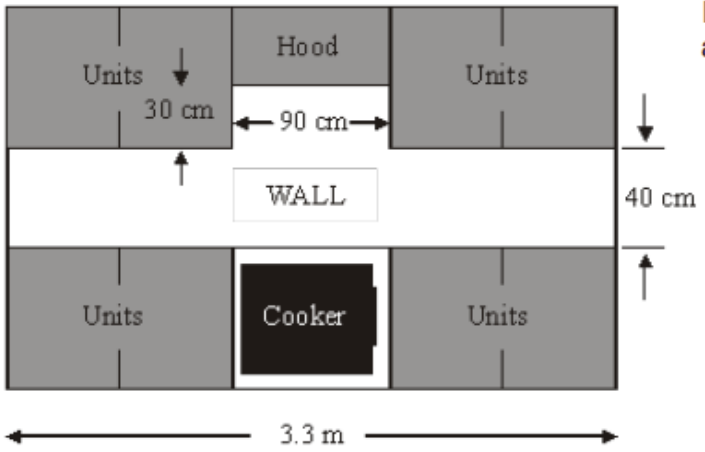
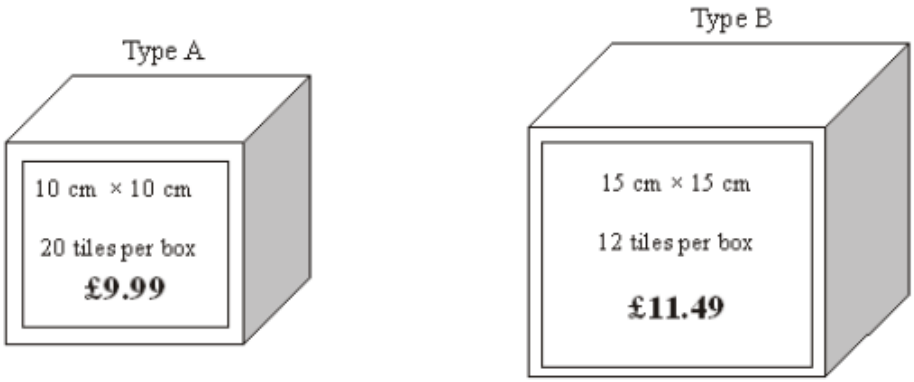


Diagram **NOT** accurately drawn

Jenny wishes to tile this wall in her kitchen.
She chooses between the two types of tile shown below.



Which tiles should Jenny use to spend the least amount of money on tiling the wall?
You must show all of your working.

(Total 6 marks)

Question 5

Jerry is making some shelves.
He needs
5 pieces of wood of length 65 cm
2 pieces of wood of length 110 cm.

The wood is sold in three different lengths.
Information about these lengths is shown in the table.

Length	Cost
100 cm	£21
150 cm	£25
180 cm	£28

Jerry wants to pay as little money as possible.
How much will Jerry have to pay?

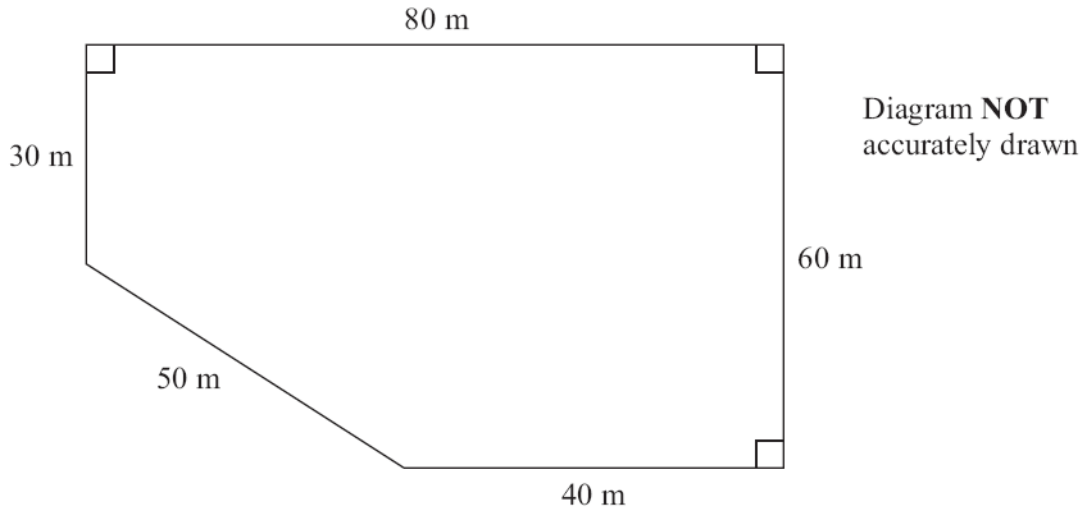
You must show your working.

(Total 4 marks)

Section B

Question 6

The diagram shows the plan of a playground.



Bill is going to cover the playground with tarmac.

It costs £2.56 to cover each square metre with tarmac.

Work out the total cost of the tarmac Bill needs.

£.....

(Total 4 marks)

(Total 5 marks)

Question 7

The diagram shows the floor of a small field.

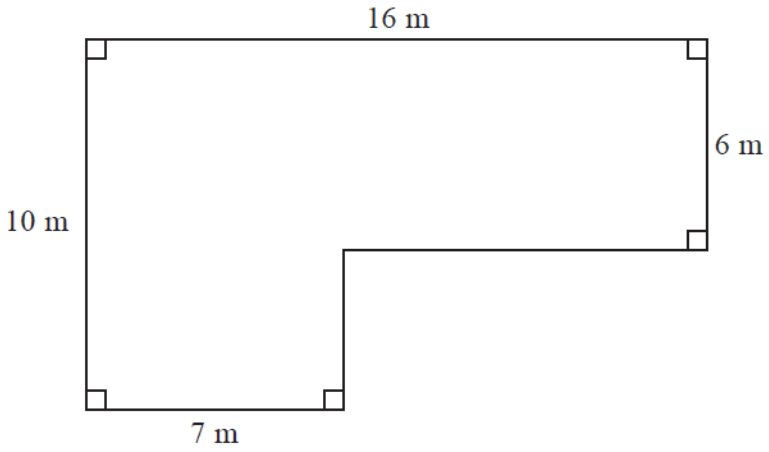


Diagram **NOT** accurately drawn

Kevin is going to keep some pigs in the field.

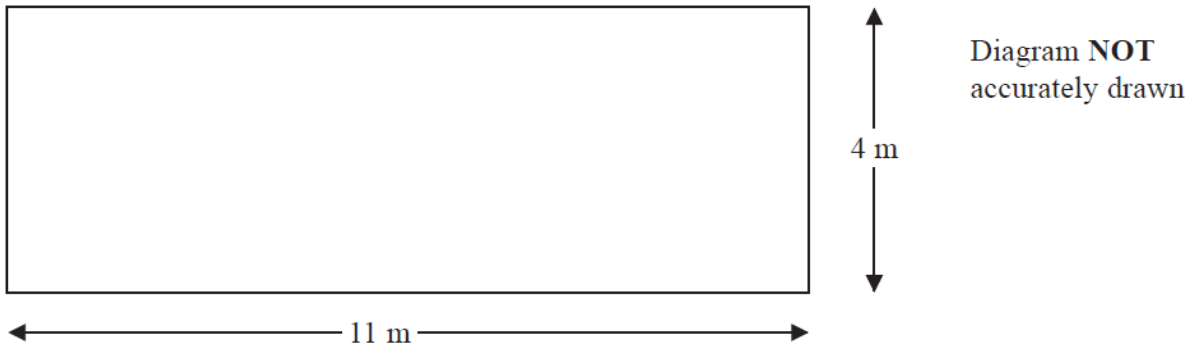
Each pig needs an area of 36 square metres.

Work out the greatest number of pigs Kevin can keep in the field.

(Total 4 marks)

Question 8

Here is a plan of Martin's driveway.



Martin is going to cover his driveway with gravel.

The gravel will be 6 cm deep.

Gravel is sold in bags.

There are 0.4 m^3 of gravel in each bag.

Each bag of gravel costs £38.

Martin gets a discount of 30% off the cost of the gravel.

Work out the total amount of money Martin pays for the gravel.

£.....

(Total 5 marks)

Section C

Question 9

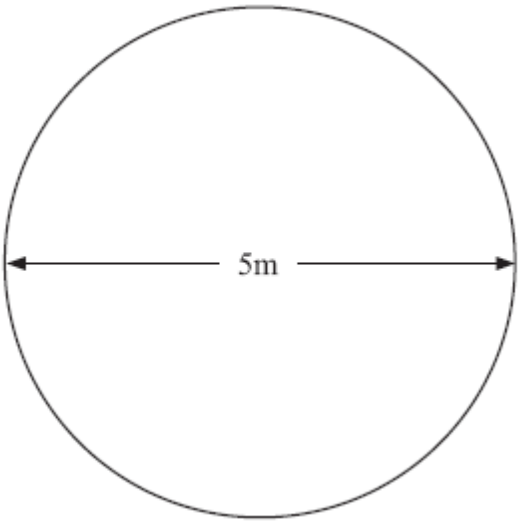


Diagram **NOT** accurately drawn

Jon has a flower garden in the shape of a circle.

The diameter of the garden is 5 metres.

Jon wants to put fencing around the edge of the garden.

The fencing costs £1.80 per metre.

Work out the total cost of the fencing.

£.....

(Total 3 marks)

Question 10

The diagram shows a swimming pool in the shape of a prism.

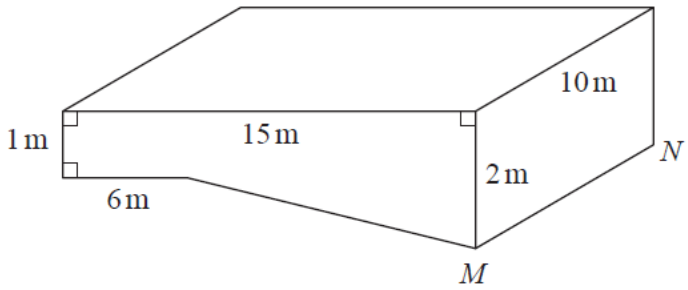


Diagram **NOT** accurately drawn

The swimming pool is empty.

The swimming pool is filled with water at a constant rate of 50 litres per minute.

Work out how long it will take for the swimming pool to be completely full of water.

Give your answer in hours.

(1 m^3 = 1000 litres)

.....hours

(5)

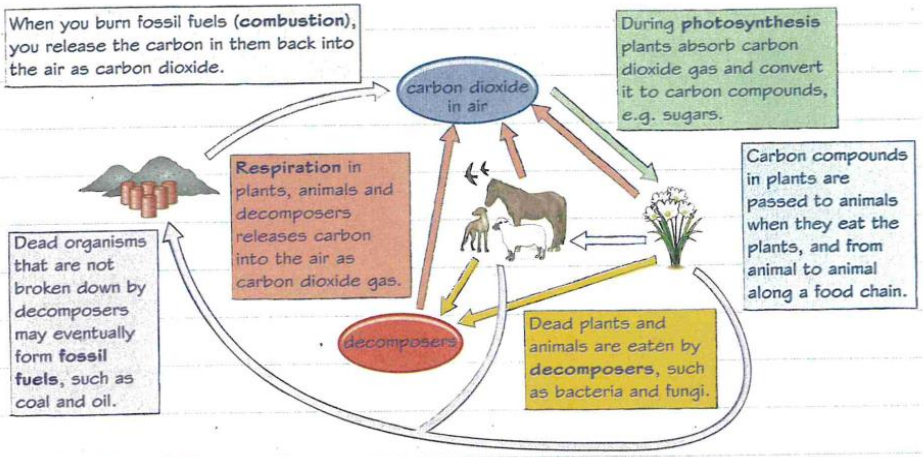
Had a look ☐ Nearly there ☐ Nailed it! ☐

Biology Paper 2

The carbon cycle

Living organisms need substances from the environment. As the amount of these on Earth is limited, they are recycled through both living (**biotic**) and non-living (**abiotic**) parts of the ecosystem. The **carbon cycle** shows how the element carbon passes between the environment and living organisms.

Controls of the carbon cycle



In the air, carbon is part of carbon dioxide gas. In organisms, it is part of complex carbon compounds. The carbon cycle is important because it recycles carbon dioxide released in respiration to be taken in by plants in photosynthesis, to make organic molecules in living organisms.

Worked example

A large forest is cleared by burning. What effects will this have on the amount of carbon dioxide in the air (a) immediately, and (b) over a longer period? **(4 marks)**

(a) Large amounts of carbon dioxide will be released into the air by the burning (combustion) of the trees.

(b) Less carbon dioxide will be removed from the air than before because the trees would have used some for photosynthesis. So the amount of carbon dioxide in the air is likely to remain high.

Two key processes in the carbon cycle are **respiration** and **photosynthesis**. These processes are important in maintaining oxygen and carbon dioxide concentrations in the air. Combustion can change this balance.

Remember that plants photosynthesise in the light but, like all other living organisms, they respire all the time.

Now try this

1 Describe the importance of decomposers in the carbon cycle. **(1 mark)**

Decomposers respire using dead plant and animal matter, releasing carbon dioxide into the atmosphere.

2 Explain the effect of respiration, photosynthesis and combustion in the carbon cycle in transferring carbon dioxide to and from the atmosphere. **(3 marks)**

In each case, explain whether these release carbon dioxide into the atmosphere, or remove it.

Biology Paper 2

Had a look ☐ Nearly there ☐ Nailed it! ☐

Extended response — Ecosystems and material cycles

There will be at least one 6-mark question on your exam paper. For these questions, you will need to think scientifically and structure your answer logically, showing how the points you make are related to each other. You can revise the topics for this question, which is about **the impact of human interactions on ecosystems** and **plant uptake of nitrates**, on pages 81 and 85.

Worked example

Explain why farmers are advised not to spread fertilisers on their crops when heavy rain is due. **(6 marks)**

Fertilisers contain nitrates and other mineral ions that plants need for healthy growth. Mineral ions in fertilisers dissolve in water, and are absorbed from the soil through plant roots.

If it rains heavily, then the mineral ions could be washed away from the crops and drain into nearby water, such as streams or rivers. This means that there will be fewer mineral ions for the crop plants so they will not grow so well. This will have been a waste of money for the farmer.

Extra mineral ions added to the streams and rivers will cause eutrophication. This will cause rapid growth of algae and water plants. The extra growth blocks light to organisms deeper in the water, meaning these organisms die, and takes oxygen from the water for respiration.

Bacteria that decompose dying plants and animals will also take oxygen from the water. If not enough oxygen is left in the water, fish and other animals may die and biodiversity may be reduced.

Remember the importance of mineral ions in plant growth when discussing fertilisers. This is a good way to start this answer.

Command word: Explain

In **explain** answers, make sure you give reasons for the statements you make. Use linking words like **because** or **this means that** to link cause and effect.

Use appropriate science words, such as eutrophication, in your answers, and make sure it is clear what you mean when you use them.

In questions about the environment, remember to consider how the interdependency of organisms, including microorganisms, can result in changes to biodiversity in the ecosystem.

Remember to consider the **advantages** and the **disadvantages** to ecosystems and biodiversity of fish farming.

Now try this

Wild salmon take up to five years to reach adult size. Farmed salmon are kept in conditions so they reach this size in less than two years. Explain the impact of fish farming on ecosystems. **(6 marks)**

Chemistry Papers 3 & 4

Had a look ☐ Nearly there ☐ Nailed it! ☐

Hazards, risks and precautions

You should be able to evaluate the risks in a practical procedure. You should also be able to suggest suitable precautions.

Hazards

A **hazard** is something that could cause:

- damage or harm to someone or something
- adverse health effects, which may occur immediately or later on.

For example, ethanol is flammable. This is a hazard. If the ethanol ignited, it could cause burns or a fire.

Practical skills Risks

A **risk** is the chance that someone or something will be harmed if exposed to a hazard. The amount of risk depends on factors such as:

- ✓ how much someone is exposed to a hazard
- ✓ the way in which exposure happens
- ✓ how serious the effects of exposure are.

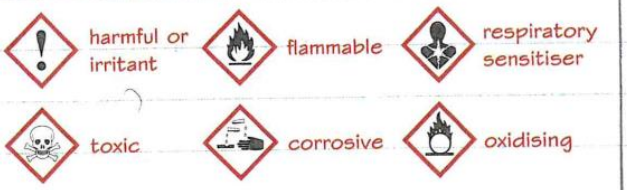
The risk from heating ethanol using a hot water bath is less than when using a Bunsen burner.

Hazard symbols

The labels on containers of hazardous substances include **hazard symbols**. These are intended to:

- warn about the dangers associated with the substance in the container
- let people know about the precautions to take when they use the substance.

Some common hazard symbols



Precautions

A **precaution** is something that you can do to reduce the risk of harm from a hazard. Precautions include:

- using a less hazardous substance
- using protective clothing, such as gloves and eye protection
- using a different method or apparatus.

Worked example

A student is preparing a dry sample of copper sulfate. She heats some copper sulfate solution in an evaporating basin. She then allows it to cool. Crystals of copper sulfate appear.

Describe and explain one safety precaution she should use. **(3 marks)**

She should heat the solution gently. This reduces the risk that it will spit out of the evaporating basin. The hot solution could cause skin burns or eye damage.

Now try this

1 State **one** reason why hazard symbols are used. **(1 mark)**

2 A student carries out electrolysis on a concentrated sodium chloride solution. Toxic chlorine gas and flammable hydrogen gas are produced.
Describe **two** precautions the student could take to reduce the risk of harm in this experiment. **(2 marks)**

The answer is specific to this activity.

It is not a general lab rule such as not running or not drinking the solution.

Other suitable precautions that could be mentioned, if linked to the activity, include:

- wearing gloves if toxic substances are used
- tying hair back or tucking in a tie if a Bunsen burner is used for heating.

Relative formula mass

You should be able to calculate relative formula masses when given relative atomic masses.

Calculating relative formula mass

Relative formula mass has the symbol M_r.

To calculate the M_r of a substance, add together the relative atomic masses of all the atoms shown in its formula:

oxygen molecule – formula O_2
relative atomic mass of oxygen = 16
relative formula mass = 2 × 16
= 32

No units

M_r values are just numbers.

This is because an M_r value is the mass of a molecule or unit of a substance compared with 1/12th the mass of a ^{12}C atom. The *M* in M_r stands for 'molecular'.

You might see or hear the term 'relative molecular mass'. This really applies only to covalent substances.

Worked example

Calculate the relative formula mass of aluminium oxide, Al_2O_3. **(1 mark)**
(relative atomic masses: Al = 27, O = 16)

atoms in Al_2O_3:
(2 × Al) + (3 × O)
M_r = (2 × 27) + (3 × 16)
= 54 + 48
= 102

You do not need to learn any relative atomic masses. You will be given them in questions or you can find them on the periodic table.

This answer shows you the working out needed to obtain the answer.

If you show the working for steps in the calculation you may gain some marks even if your final answer is incorrect.

Worked example

Calculate the relative formula mass of calcium nitrate, $Ca(NO_3)_2$. **(1 mark)**
(relative atomic masses: Ca = 40, N = 14, O = 16)

atoms in $Ca(NO_3)_2$:
(1 × Ca) + (2 × 1 × N) + (2 × 3 × O)
M_r = (1 × 40) + (2 × 14) + (6 × 16)
= 40 + 28 + 96
= 164

Maths skills You may find it easier if you first add up the A_r values for the atoms inside the brackets:

M_r of NO_3 = 14 + (3 × 16)
= 14 + 48
= 62

Then multiply your answer by the number outside, and add that to the remaining A_r values:

M_r of $Ca(NO_3)_2$ = (2 × 62) + 40
= 124 + 40
= 164

Now try this

relative atomic masses: H = 1, C = 12, O = 16, Na = 23, Al = 27, S = 32, Cl = 35.5, Cu = 63.5

Calculate the relative formula masses, M_r, of the following substances.

(a) H_2O **(1 mark)**
(b) CO_2 **(1 mark)**
(c) NaOH **(1 mark)**
(d) CCl_4 **(1 mark)**
(e) $CuCl_2$ **(1 mark)**
(f) Na_2SO_4 **(1 mark)**
(g) $Al(OH)_3$ **(1 mark)**
(h) $Al_2(CO_3)_3$ **(1 mark)**

Empirical formulae

An **empirical formula** is the simplest whole number ratio of atoms of each element in a compound.

Calculating an empirical formula

A 10 g sample of a compound **X** contains 8 g of carbon and 2 g of hydrogen.

		C	H
1	Write the symbol of each element as a header.		
2	Write down the mass of each element in g.	8	2
3	Write down the A_r of each element.	12	1
4	For each element, calculate: mass ÷ A_r	$\frac{8}{12} = 0.667$	$\frac{2}{1} = 2$
5	Divide each answer by the smallest answer (0.667 here).	$\frac{0.667}{0.667} = 1$	$\frac{2}{0.667} = 3$
6	You may then need to multiply all the numbers to remove fractions, then write out the empirical formula.	CH_3	

Finding a molecular formula

You can find the molecular formula of a compound from its empirical formula:
- if you know its relative formula mass, M_r.

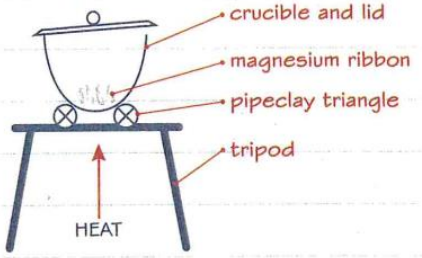
The M_r of **X** in the example above is 30:

1. Calculate the M_r of the empirical formula:
   M_r of $CH_3 = 12 + (3 \times 1) = 15$
2. Divide the M_r of **X** by answer 1:
   $\frac{30}{15} = 2$
3. Multiply each number in the empirical formula by answer 2:
   CH_3 becomes C_2H_6 – the molecular formula

Practical skills: Determining empirical formula

You need to be able to describe an experiment to determine an empirical formula.

The apparatus below can be used to obtain results to do this for magnesium oxide.



The crucible and its contents are weighed before and after heating the magnesium.

Worked example

The table shows the results of an experiment to find the empirical formula of magnesium oxide.

Object	Mass (g)
empty crucible and lid	19.06
crucible, lid and Mg before heating	19.42
crucible, lid and Mg after heating	19.66

(a) Calculate the mass of magnesium used. **(1 mark)**

mass of magnesium = 19.42 – 19.06
= 0.36 g

(b) Calculate the mass of oxygen gained. **(1 mark)**

mass of oxygen = 19.66 – 19.42
= 0.24 g

Now try this

(a) Use the masses given in the Worked example to determine the empirical formula of magnesium oxide. (relative atomic masses: O = 16, Mg = 24) **(3 marks)**

(b) In the experiment described on this page, a lid is needed on the crucible. The lid must be kept slightly open during heating.
Give **two** reasons why. **(2 marks)**

Concentration of solution

You need to be able to calculate the concentration of solutions in g dm^{-3}.

Solute, solvent and solution

A **solution** is a mixture of a solute in a solvent:
- The **solute** is the substance that dissolves.
- The **solvent** is the substance that the solute dissolves in.

Water is the solvent in an **aqueous solution**. The state symbol for an aqueous solution in balanced equations is (aq). The symbol (l) is for substances in the liquid state.

Mass and volume

To calculate the **concentration** of a solution, you need to know:
- the mass of solute in **grams**, g, and
- the volume of solution in **cubic decimetres**, dm^3.

If you are making a solution, you can use the volume of the solvent instead.

dm^3 and cm^3

Measuring cylinders and other lab apparatus show volumes in cubic centimetres, cm^3. You need to convert these measurements into cubic decimetres, dm^3, when you calculate concentrations. It helps to know that:

- ✓ $1\ dm^3 = 10 \times 10 \times 10 = 1000\ cm^3$
- ✓ To convert cm^3 to dm^3, divide by 1000.

Mass, volume and concentration

You use this equation to calculate the concentration of a solution in g dm^{-3}:

$$\text{concentration (g dm}^{-3}\text{)} = \frac{\text{mass of solute (g)}}{\text{volume of solution (dm}^3\text{)}}$$

LEARN IT! IT'S NOT ON THE EQUATIONS LIST

Maths skills Units

The unit g dm^{-3} means 'grams per cubic decimetre'. You may also see it written as g/dm^3.

Maths skills Rearranging equations

You need to be able to change the subject of an equation. For example:

- ✓ mass of solute = concentration × volume
- ✓ $\text{volume} = \frac{\text{mass of solute}}{\text{concentration}}$

Worked example

2.50 g of sodium hydroxide is dissolved in 250 cm^3 of water. Calculate the concentration of the solution formed in g dm^{-3}. **(2 marks)**

$250\ cm^3 = \frac{250}{1000} = 0.250\ dm^3$

$\text{concentration} = \frac{2.50\ g}{0.250\ dm^3} = 10\ g\ dm^{-3}$

Remember to convert the volume to dm^3 if it is given to you in cm^3.

The units are shown in the concentration calculation here. This makes it easier for you to see how it is done. You do not need to show units in your working out, but you must show the units in your final answer.

Now try this

1 Calculate the concentrations of the following solutions formed:
(a) 0.40 g of glucose dissolved in 0.50 dm^3 of water. **(1 mark)**
(b) 1.25 g of copper chloride dissolved in 100 cm^3 of water. **(2 marks)**

2 Calculate the mass of sodium hydroxide needed to make 150 cm^3 of a 40 g dm^{-3} solution. **(2 marks)**

Other resources

If you require any other additional work, please visit the websites below:

English:

https://www.gcsepod.com/

https://www.bbc.co.uk/bitesize/subjects/z3kw2hv

https://www.educationquizzes.com/ks3/english/

https://www.senecalearning.com/

Maths:

www.vle.mathswatch.co.uk

Students have their own log in - Example name and Year (John Smith Year 9 – Johsmit9@lighthall)

123456

www.mathsgenie.co.uk

www.corbettmaths.com

Science:

Primary resources - https://www.gcsepod.com - requires student login (provided by school)

Additional resources:

https://www.bbc.co.uk/bitesize/subjects/zrkw2hv

https://www.youtube.com/channel/UCqbOeHaAUXw9Il7sBVG3_bw

https://www.gcsepod.com - requires student login (provided by school)

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