Bluecoat Beechdale Academy

Belong, Believe, Achieve

Suspension Work Pack

Year 11

Maths

Mean, mode, median and range

Question 1: Work out the mode for the each of the following

(a) 5, 6, 6, 7, 8, 10

(b) 1, 1, 1, 4, 6, 8, 12

(c) 5, 5, 7, 7, 7, 8, 8, 9

(d) 5, 7, 3, 5, 8, 9, 10, 2

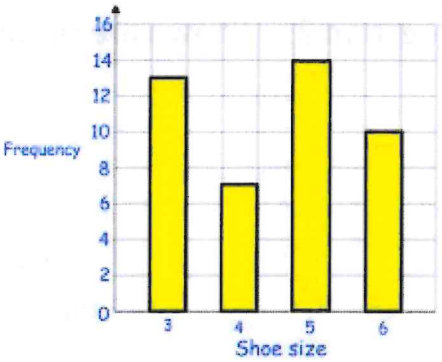
(e) 8, 3, 3, 4, 6, 8, 13, 3, 18

(f) 12, 14, 15, 17, 15

(g) 2.3, 2.6, 2.8, 2.7, 2.8, 2.7, 2.4, 2.3, 2.1, 2.3

(h) −2, −1, 5, 8, −2, 2, −1, 9, −1, 1, 2, −1

Question 2: The bar chart shows the shoe sizes of a group of students.



(a) How many students in total are there?

(b) What is the modal shoe size?

Question 3: Work out the mode for the each of the following

(a) 8, 1, 1, 7, 2, 1, 5, 9, 4, 1, 5, 5, 9, 6, 4, 3, 2, 3, 1, 1, 9, 8, 7, 3, 2, 4, 5, 1, 1, 9, 1

(b) 8, 9, 7, 3, 4, 7, 9, 3, 4, 5, 1, 2, 2, 1, 3, 0, 0, 8, 1, 4, 7, 8, 6, 6, 3, 3, 3, 1, 3, 3, 5

Question 4: The tally chart shows the favourite sport of the students in a class.

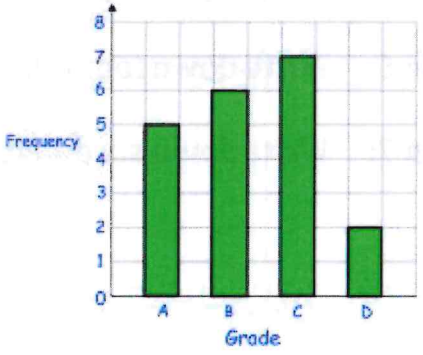
Sport	Tally
Rugby	IIII
Football	𝍸 𝍸 I
Hockey	𝍸 𝍸 II
Cricket	III

(a) What is the modal sport?

(b) How many students are in the class?

(c) How many more students liked football than rugby?

Question 5: Mrs Green gives her class a test. The results are shown in the bar chart below.



(a) What is the modal grade?

(b) How many students sat the test?

A grade C or above is a "pass."

(c) What fraction of the students passed the test?

Question 1: Work out the median for the each of the following

(a) 5, 1, 4, 6, 8

(b) 9, 1, 3, 6, 7, 8, 9

(c) 6, 4, 7, 1, 3, 8, 1, 10

(d) 7, 3, 8, 9, 6, 5

(e) 9, 8, 6, 6, 6, 7, 1, 2, 6, 8

(f) −4, 5, −7, −1, 2, 0, 9

(g) 20, 30, 10, 20, 40, 50, 60, 10, 80, 30

(h) 49, 34, 12, 10, 53, 20, 65, 34, 90, 100, 33

(i) 6.2, 6.8, 6.6, 7.2, 6.4, 7.4, 5.8

(j) 124, 53, 39, 230, 155, 180

Question 2: Shown are the ages and weights of 5 dogs.

	Fido	Lucky	Toto	Barney	Tess
Age	4	12	7	9	1
Weight	14kg	9kg	30kg	16kg	8kg

(a) Which dog has the median age?

(b) Which dog has the median weight?

Question 3: The height of some footballers are listed below:

1.81m, 1.78m, 1.88m, 1.79m, 1.86m, 1.85m, 1.78m, 1.93m

(a) Work out the median height

(b) What is the modal height?

Question 4: Write down five numbers with a median of 7

Question 5: Write down eight numbers with a median of 10

Question 6: Write down four different numbers with a median of 4.5

Question 7: Write down six different numbers with a median of 0

Question 1: Find the mean for each of the sets of data below

(a) 4, 9, 7, 10, 5 (b) 2, 8, 6, 3, 12, 7, 4 (c) 3, 2, 1, 3, 2, 2, 1, 3, 1, 2, 3, 2, 1

(d) 1, 8, 7, 5, 6, 4, 7, 6 (e) 20, 30, 24, 32 (f) 12, 8, 14, 5, 1, 3, 0, 8, 10, 11

(g) 9, −3, −6, 5, 0 (h) 1.4, 2.8, 2.4, 2.5, 2.8, 3.1, 1.1

Question 2: A basketball team plays 8 matches.
The number of points they score in each match are:

62, 68, 67, 79, 82, 50, 74, 62

(a) Work out the mean number of points scored

(b) Write down the modal number of points scored

(c) Write down the median number of points scored

Question 3: Mr Holland gives his class a test. The results are:
34%, 44%, 75%, 21%, 98%, 86%, 71%, 76%, 63%, 55%

(a) Work out the mean mark

(b) Work out the median mark

(c) How many students scored above the mean mark?

Question 5: The mean of four numbers is 10. Three of the numbers are 9, 11 and 7.
Work out the fourth number.

Question 6: The mean of six numbers is 5. Five of the numbers are 6, 6, 5, 3 and 1.
Work out the sixth number.

Question 7: The mean of five numbers is 8.2. Four of the numbers are 8, 10, 12 and 10.
Work out the fifth number.

Question 1: Find the range for each of the following

(a) 5, 9, 1, 5, 7, 4, 3 (b) 6, 7, 10, 8, 9, 9 (c) 21, 15, 19, 24, 30, 26

(d) 210, 250, 260, 180, 240 (e) 6.2, 7.3, 8.8, 1.5, 4.1 (f) 3, 1, 2, 1, 3, 4, 5, 0, 1

(g) −5, 1, 3, 6, −8, 1 (h) −6, −10, −2, −9 (i) 0, 7, 9, −21, 10, −4

(j) 7, 9, −2, 13, 9, 8, 20, −8, 1 (k) −10, −6, −15, −9, −8, −7, 8, −3

Question 2: The range for a list of numbers is 7. The smallest value is 4.
What is the largest value in the list?

Question 3: The range for a list of numbers is 8. The largest value is 13.
What is the smallest value in the list?

Question 4: The range for a list of numbers is 1. The largest value is 4.
What is the smallest value in the list?

Question 5: The range for a list of numbers is 27. The smallest value is 87.
What is the largest value in the list?

Question 6: The number of points that Randalstown Rugby Club scored in eight matches are 24, 17, 19, 35, 9, 43, 15, 30.

(a) Work out the range of the number of points scored.

(b) Work out the median of the number of points scored.

Question 7: The table shows the midday temperature over five days.
Each temperature is in degrees celsius.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Temperature	-4	1	-6	1	-2

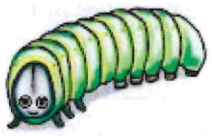
(a) Work out the range of the temperatures.

(b) Work out the mean temperature.

Question 1: The length of nine caterpillars are listed below

9cm 4cm 8cm 10cm 7cm 5cm 13cm 10cm 6cm

(a) Find the mode
(b) Find the median
(c) Find the mean
(d) Find the range



Question 2: James plays six games of darts.
His scores are 120, 71, 80, 14, 90, 117

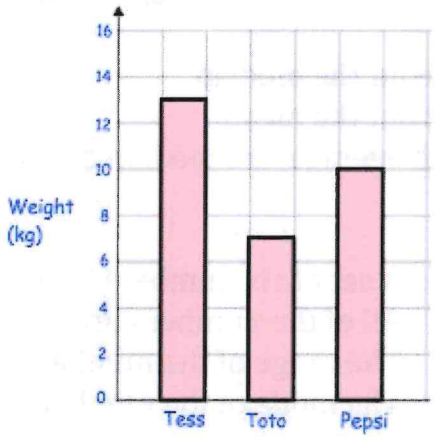
Should James use the mean or the median to give him the highest average score?

Question 3: Shown are the weights of 3 puppies.

(a) Work out range of the weights

(b) Work out the median weight

(c) Work out the mean weight



Question 4: The amount of water in some containers are:

2 litres, 330ml, 0.08 litres, 0.7 litres, 75ml, 5000ml, 0.15 litres

(a) Work out the median (b) Find the range

Question 5: The median height of 11 footballers is 1.85m.
Only one footballer has a height of 1.85m
How many footballers have a height under 1.85m?

Question 6: Write down seven numbers that have a range of 10 and a mean of 12.

Question 7: Write down six numbers that have a median of 8, a mean of 9 and a range of 13

Question 8: Five numbers have a range of 14.
Four of the numbers are 20, 22, 31 and 25.
Work out the two different possible values for the fifth number.

Question 9: Belfast Giants have played 5 matches and the mean number of goals scored is 3
When they play the 6th match, the mean increases to 4.

How many goals were scored in the 6th match?

Question 10: James is a car salesman.
He has a target of selling 5 cars a day from Monday to Friday.
Over Monday to Thursday, he has sold a mean of 6 cars a day.
How many cars must he sell on Friday to meet his target?

Question 11: A teacher surveys a group of students.
He asks how much pocket money they receive each week. They respond

£5 £8 £4 £50 £6 £8 £7.50 £10 £8 £7

(a) Work out the median
(b) Work out the mean
(c) Which average, the median or the mean, is most suitable for this data?

Question 12: A set of six numbers have a median of 9.
All of the numbers are even.
The range of the numbers is 8.
The mode of the numbers is 6.

Write down a possible set of six numbers.

Question 13: Shown below are five cards which are arranged in order from smallest to largest

5				

The range of the cards is 6.
The median of the cards is 7.
The mean of the cards is 8.

Work out the 4 missing numbers.

Estimating the mean

(a)

Length	Frequency	Midpoint	
$0 < L \leq 10$	6		
$10 < L \leq 20$	7		
$20 < L \leq 30$	5		
$30 < L \leq 40$	1		
$40 < L \leq 50$	1		

(b)

Cost	Frequency	Midpoint	
$0 < c \leq 4$	2		
$4 < c \leq 8$	3		
$8 < c \leq 12$	5		
$12 < c \leq 16$	12		
$16 < c \leq 20$	3		

(c)

Length	Frequency	Midpoint	
$0 < t \leq 5$	11		
$5 < t \leq 10$	37		
$10 < t \leq 15$	43		
$15 < t \leq 20$	9		

(d)

Mass	Frequency	Midpoint	
$50 < m \leq 55$	3		
$55 < m \leq 60$	5		
$60 < m \leq 65$	10		
$65 < m \leq 70$	12		
$70 < m \leq 75$	10		

Question 2: Work out an estimate of the mean for each of these frequency tables.

(a)

Duration (years)	Frequency
$0 \leq d < 10$	9
$10 \leq d < 20$	13
$20 \leq d < 30$	16
$30 \leq d < 40$	2

(b)

Length (cm)	Frequency
$0 \leq L < 30$	8
$30 \leq L < 60$	43
$60 \leq L < 90$	25
$90 \leq L < 120$	4

(c)

Mass	Frequency
$20 < m \leq 25$	12
$25 < m \leq 30$	24
$30 < m \leq 35$	17
$35 < m \leq 40$	15
$40 < m \leq 45$	4

(d)

Height	Frequency
$120 < h \leq 130$	51
$130 < h \leq 140$	120
$140 < h \leq 150$	66
$150 < h \leq 160$	59
$160 < h \leq 170$	4

Question 1: Sally is raising money for charity for a fun run.
The table below has been given to her from the website.

Sally says the average donation is £10.
By calculating the estimated mean, decide if you agree with Sally.

Donation	Frequency
$0 < d \leq 5$	44
$5 < d \leq 10$	35
$10 < d \leq 20$	16
$20 < d \leq 50$	3
$50 < d \leq 100$	2

Question 2: Nathan delivers pizzas.
The table below shows information about his delivery times.
The pizza company has a promotion that if the delivery time is over 30 minutes, the customer gets their meal for free

(a) Calculate an estimate for the mean delivery time

(b) What percentage of deliveries took over 30 minutes?

Nathan's manager thinks that the promotion should be changed to 40 minutes

(c) Do you agree? Explain your answer.

Delivery Time	Frequency
$0 < t \leq 10$	3
$10 < t \leq 20$	10
$20 < t \leq 30$	14
$30 < t \leq 40$	19
$40 < t \leq 50$	4

Question 3: The manager of a small company is calculating the mean salary for his workers.
He has calculated this to be £568,500 per year.
Can you spot any mistakes?

Salary	Frequency	Midpoint	fx
$0 < s \leq 15000$	2	7500	15000
$15000 < s \leq 30000$	15	22500	337500
$30000 < s \leq 45000$	6	37500	2250000
$45000 < s \leq 60000$	2	52500	105000
$60000 < s \leq 100000$	2	67500	135000
			2842500

Mean salary = 2842500 ÷ 5 = £568500

Pie charts

Question 1: Draw a pie chart for each set of data below

(a)

Method of Transport	Frequency
Car	8
Bus	11
Walk	12
Cycle	5

(b)

Rugby Team	Frequency
England	20
France	5
Ireland	15
Scotland	25
Wales	25

(c)

Colour	Frequency
Blue	25
Green	14
Red	21

(d)

Grade	Frequency
A	10
B	15
C	13
D	5
E	2

(e)

Make	Frequency
Ford	8
Mazda	14
Volkswagen	21
Fiat	20
Honda	9

(f)

Sport	Frequency
Cricket	7
Football	16
Gaelic Football	48
Hockey	33
Judo	4
Rugby	72

(g)

Language	Frequency
French	14
German	4
Polish	9
Spanish	3

(h)

Opinion	Frequency
Yes	3
No	11
Undecided	4

(i)

Drink	Frequency
Tea	410
Coffee	120
Fruit Juice	140
Water	50

Question 2: Draw a pie chart for each set of data below
You may use a calculator.

(a)

Holiday Destination	Frequency
France	102
Ireland	78
Portugal	24
Spain	36

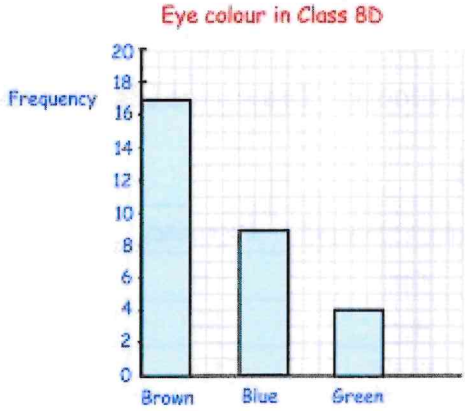
(b)

Year Group	Frequency
7	5
8	17
9	20
10	8

(c)

Meal	Frequency
Chinese	54
Indian	49
Italian	17
Thai	8

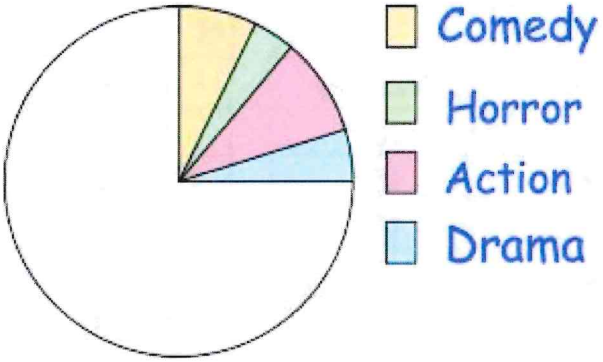
Question 1: Anne-Marie has drawn a bar chart to show the eye colours in class 8D.



(a) How many students are there in class 8D?
(b) Show this information in a pie chart.
(c) What fraction of the students have brown eyes?
(d) What fraction of the students have blue eyes?
(e) What fraction of the students have green eyes?

Question 2: Bill has drawn a pie chart to show his friends' favourite genre of film.

Genre	Frequency
Comedy	26
Horror	14
Action	33
Drama	17



(a) Can you explain to Bill what he has done wrong?
(b) Draw a correct pie chart for Bill.

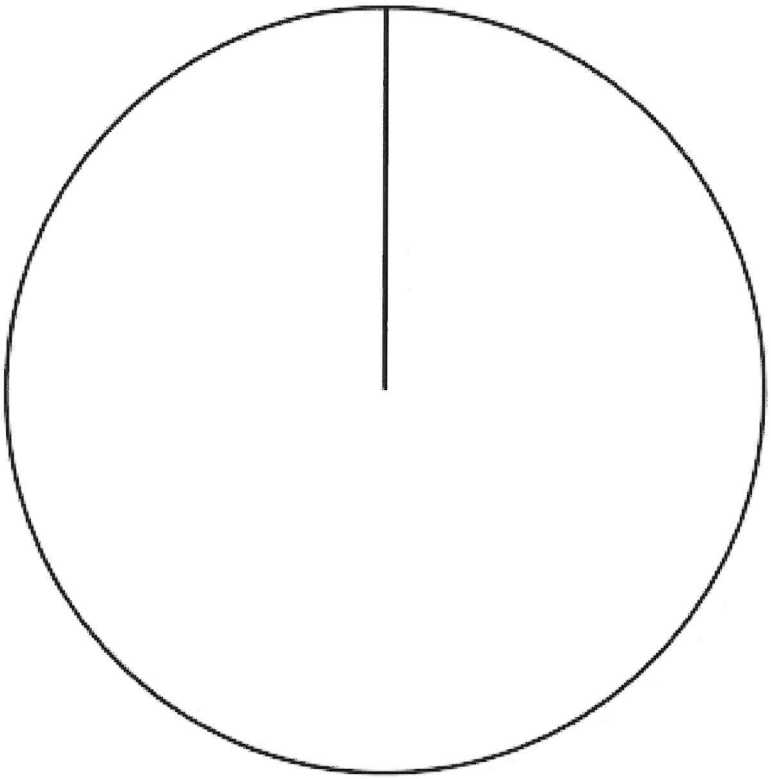
Question 3: Erin is calculating the size of each angle for a pie chart.

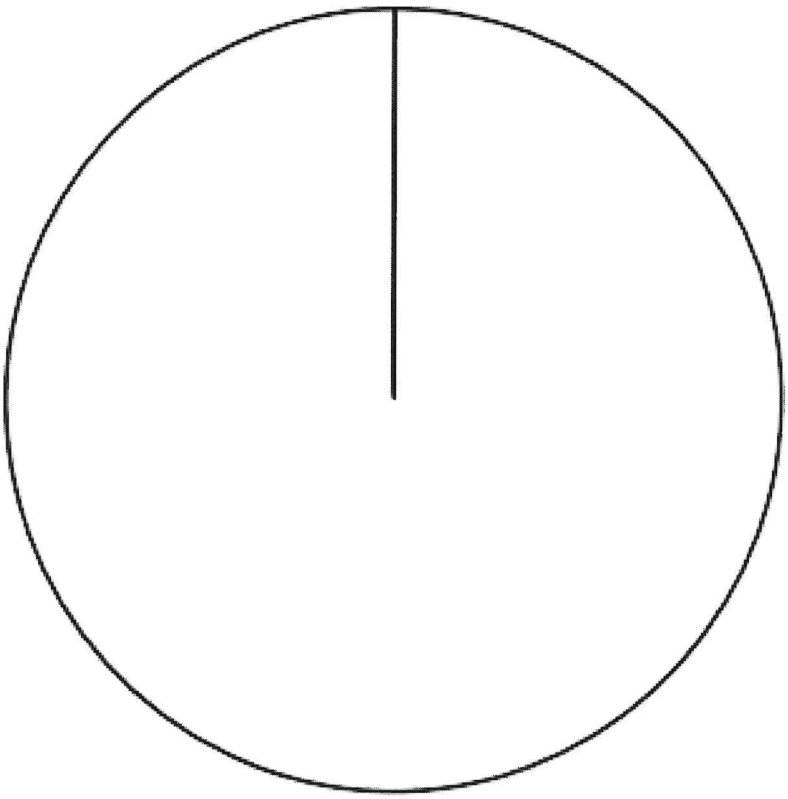
(a) Can you spot what Erin has done wrong?
(b) Calculate the correct angles
(c) Draw a correct pie chart for Erin

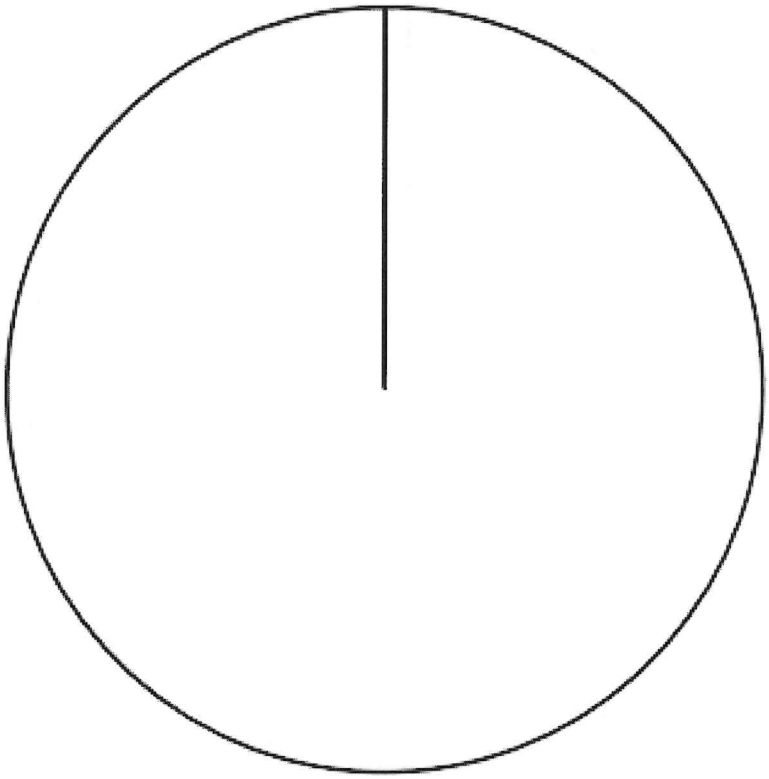
Destination	Frequency	
Employment	15	$\times$ 0.2 = 3°
Apprenticeship	11	$\times$ 0.2 = 2.2°
Further Education	40	$\times$ 0.2 = 8°
Gap Year	6	$\times$ 0.2 = 1.2°

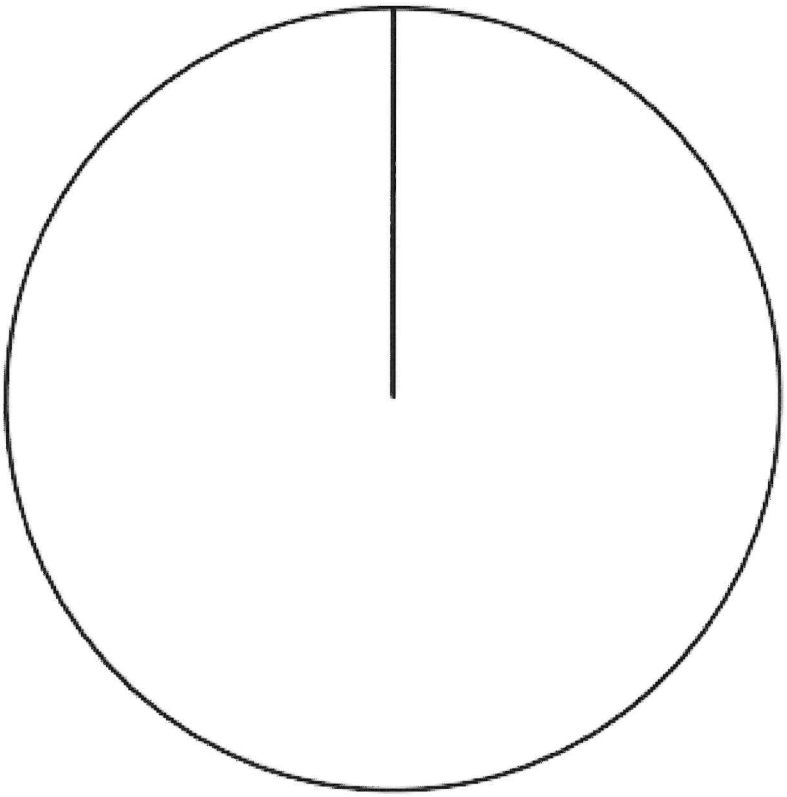
15 + 11+ 40 + 6 = 72

72 ÷ 360 = 0.2° per person







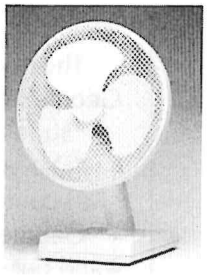


English

Information and Ideas

Q1 Read the text below.

> Dani approached the roller coaster with wide eyes. She had never been a big fan of rides, but her friend Amara had offered to give £20 to charity if Dani agreed to ride the biggest roller coaster in the park — a towering steel beast with four loops and six corkscrew turns. Her stomach churned at the thought.
>
> "You can do it, Dani," Amara said, squeezing her shoulder. "You might even enjoy it!"



Dani kept insisting she wasn't a big fan, but the rotating blades and constant whirring suggested otherwise.

Tick the **one** statement that is true.

a) Dani's friend Amara loves theme park rides. ☐

b) Dani is nervous about going on the roller coaster. ☐

c) It was Dani's idea to get sponsored to go on the ride. ☐

Q2 Underline the words and phrases which show that the writer has a negative view of the zoo.

> Last weekend we found ourselves with nothing to do on a warm, sunny day, so we decided on a trip to the zoo. The entrance to the zoo was via a rusty iron gate that looked in serious need of repair. We went into the ticket office, only to discover that the floor was filthy; as we looked closer, we realised there was revolting leftover food scattered everywhere. Inside, the animals looked malnourished and miserable in their enclosures, which all seemed dull and empty, with precious little space for them to run around. All in all, a pretty depressing place.

Q3 From lines 3-8 of the text below, write down **three** facts about the garden.

> "If the boiler hadn't broken, we'd have enough money to go to Hawaii by now," said Tim glumly, skirting a puddle of mud in order to peg the laundry onto the washing line.
>
> Alex frowned and sat down heavily on the bench, which took up almost all of the space in their tiny back garden.
>
> "I bet it's sunny there," she said wistfully, pulling her cardigan in closer.
>
> The wind was whistling a discordant chorus through the gaps in the fence, making the damp grass shiver. The gnarled, stunted apple tree in the corner emitted an ominously loud groan that made Tim jump.

1) .....

2) .....

3) .....

Information and Ideas

Now you've got the theory sorted, it's time to put it into practice with these exam-style questions.

Q4 Read the following extract from a novel.

> The doorbell rang. Someone must have answered it, because moments later I heard George's nasal tones in the hallway.
> "So lovely to be here!" he cried, his voice carrying easily across the living room.
> "Did you invite him?" I hissed, staring desperately at Rosa.
> "I could hardly leave him out," she said coolly. "It would have been too obvious."
> George entered the room. His garish purple suit and elaborate hairstyle made him stand out sharply from the other guests. "George, darling," Rosa cooed. "You made it."
> "Rosa!" he said, presenting her with a bottle of cheap-looking wine. "And Pritha," he said to me with a smirk, extending a greasy hand adorned with several gaudy rings. "Good to see you."
> "You too," I said, forcing a smile and letting go of his hand quickly. "Drink?"
> "Oh, go on then," said George, "I'd love a nice whisky, if you have any?"
> "Nothing but the best for you, George," I replied through gritted teeth.

List **four** facts from the text about George.

Q5 Read the following extract from a review of a holiday park, then tick the **four** statements that are **true**.

> You would need a fortnight to try all the activities at Lowbridge Park. From abseiling to zorbing, the park offers a mind-boggling range of activities. I was only there for a long weekend, so I had to prioritise!
> I began with a pony trek. Although it drizzled the entire morning, it was a great way to explore the woodland. In the afternoon I debated between rock climbing and mountain biking. I settled on the former, primarily to stay out of the rain!
> The next day, the weather was much better, so my choice fell between canoeing and sailing. I settled for a canoe and headed out on the lake, which was simply stunning early in the morning, clear, calm and blue. The good weather lasted into the afternoon, which meant that I was lucky enough to go paragliding. What an exhilarating experience!
> The next morning, I decided to finish my weekend with a spot of archery. Alas, I'm no Robin Hood, but the instructor was patient and funny, and I did improve a little over the course of the morning.

1) The writer went mountain biking. ☐
2) On the second day, the writer got up early. ☐
3) The writer had time to try everything. ☐
4) The writer enjoyed the pony trek. ☐
5) The weather stayed sunny all weekend. ☐
6) You can abseil at Lowbridge Park. ☐
7) The writer liked the archery instructor. ☐
8) The writer went canoeing down a river. ☐

List four reasons why you love studying for GCSE English — umm...

Some questions will simply ask you to find information and ideas in a text. That doesn't sound like too tough a task, but remember that sometimes you'll need to read between the lines a bit — it won't always be dead obvious, I'm afraid.

Summarising and Linking

Q1 Read the text below.

> "We're going to be late, Rakesh," warned Rita, biting her thumbnail nervously.
> "We'll be fine!" insisted Rakesh from the depths of his wardrobe. After a moment he emerged, triumphantly holding his favourite leather jacket aloft.
> Rita glared pointedly at her watch, then at Rakesh, who grinned.
> "We'll be fine," he repeated, trying on the jacket and admiring his reflection in the full-length mirror.
> "It's bad enough that we have to go at all, and now we're going to show up late too," complained Rita. "This is all your fault. If it were up to me, we'd never have agreed to go. I hated that school."
> "Oh, cheer up, Rita — it's a reunion, not a funeral," said Rakesh. "It'll be fun!"

Circle whether each of the following statements refers to Rakesh or Rita, then write down a quote on the dotted line to support your choice.

a) The character who is reluctant to go to the reunion. (Rakesh / Rita)

.....

b) The character who cares most about time management. (Rakesh / Rita)

.....

c) The more confident character in the extract. (Rakesh / Rita)

.....

Q2 Summarise the two views given in the text below.

> Human beings have eaten meat for millions of years. Meat eaters argue that we have evolved with the ability to eat and digest meat, proving that it forms a natural part of the human diet. Furthermore, meat contains many vitamins and minerals, particularly iron, that are important for human function.
> However, vegetarians argue that, biologically, we have very little in common with other species of meat-eaters. For example, we lack the ability to kill an animal and take its meat without tools. Additionally, they argue that a high consumption of red meat contributes to a range of health problems in humans, such as cardiovascular disease and some cancers.

Meat Eaters: .....

.....

Vegetarians: .....

.....

Summarising and Linking

Paper 2, question 2 tests your summarising and linking skills — have a go at the practice questions below.

Q3 Read the following extracts. Source A is a letter written in the 19th century, and Source B is an extract from a diary written in the 20th century.

Source A

Dearest Caroline,

Lady Jennings and I paid a visit to the slum dwellings today, with a view to helping the children there by investing our funds in a charitable orphanage. I was simply astonished to see the extent of the poverty in which these poor orphans currently live. Of course I had heard that the conditions were unpleasant, but nothing could have prepared me for the destitution I witnessed there. We must do all we can to help these poor, unfortunate souls — it is our duty as their fellow men.

Source B

Dear diary,

Today I've been helping out at an underfunded local orphanage, which was built for the children who lost their families in the influenza epidemic. It's been really sad to see so many children having to live in such basic conditions, although it's not really that surprising given the state of the area in general.

They need more support, but even if I had money to give, it shouldn't be my job to help them. Their government should be providing for them better.

Use details from **both** sources to write a summary of the differences between the writers in Source A and Source B.

Q4 Read the following extracts. Source A is from a housekeeping magazine written in the 19th century, and Source B is a newspaper article that was written in the 21st century.

Source A

The secret to our harmonious marriage lies in the willingness of my wife to be amenable to my needs.

My wife does not pester me, nor will she bore me with gossip or domestic trivialities. Instead, she will endeavour to be sweet and charming, always fulfilling my needs. If I wish to complain, she listens; if I seek quiet, she is silent. The home is her sphere, and she strives to make it a haven for me, in which I need not lift a finger.

Source B

In the 21st century, a marriage is a partnership of equals. As both my wife and I work full time, we believe that it is essential for our domestic responsibilities to be shared evenly too. Whilst housework was once considered the domain of women, my wife spurns the idea that she should work full-time and take sole care of a home. In fact, whenever she hands me a mop or a chopping board, she reminds me sweetly that I am just as capable of cleaning and cooking as her.

Use details from **both** sources to write a summary of the differences between the behaviour of the wives.

Summarise the similarities between a raven and a writing desk...

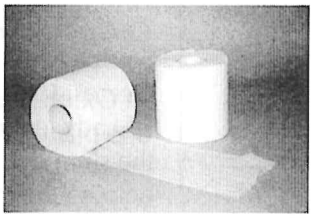
Luckily, you won't be given any Mad Hatter-style riddles in the exam, but comparing texts is an important skill, especially in paper 2. For top marks, you need to infer differences between the texts rather than just list a lot of surface-level facts.

Audience and Purpose

Q1 For each sentence, circle the word which best describes its intended audience.

a) "Do you yearn for a simpler, more reliable way of managing your finances?" **children / adults**

b) "When buying a used car, try to get as much information from the dealer as you can." **experts / novices**



When buying a used toilet roll — don't.

Q2 Draw lines to match each text to its main purpose.

a) "Shop around for the best quote — some insurers are much more expensive than others."

b) "As the train moved south, first crawling, then increasing to a steady gallop, the scenery gradually changed from the flat and drab to the dramatic and beautiful."

c) "Who could disagree with the fact that children should eat healthily?"

To entertain

To persuade

To advise

Q3 Find **two** words or phrases that show this text is aimed at a younger audience, and explain how they show this.

Are you looking for a cool summer job?

We've got loads of temporary vacancies with no experience required!

All you need is some free time over the holidays, a positive attitude and plenty of energy. If you've got your own wheels that's even better!

With Spondon Summer Jobs you can:
- gain real-world work experience
- earn a few quid
- make new friends

Whatever you fancy, we can find you a job that suits you down to the ground! Interested? Fill out the application form on our website, or find us on social media.

Word or phrase: .....

Explanation: .....

.....

Word or phrase: .....

Explanation: .....

.....

Audience and Purpose

Have a go at these exam-style questions. Keep in mind the extracts' audience and purpose as you're writing.

Q4 Read the following extract from a leaflet about an aquarium.

Oxton Aquarium is a whale of a time!

At Oxton Aquarium you can see lots of different sea creatures all in one place. You could be eyed up by an octopus, shaken by a shark or peered at by a pike! They're all here in a very special underwater world — and it's open every day in the school holidays.

Whether you come with your school, your family or your friends, you're bound to have a fantastic time.

"I've had the best day ever. Can we go round again?" — Adam Rodgers, age 9.

Oxton Aquarium is a fun and fishy day out that you'll never forget!

How does the writer use language to describe the aquarium?

Q5 Read the following extract from a newspaper opinion piece.

Is it really that time of year again? The decorations go up and suddenly the nation is whipped up into a frenzy, convinced that the only way to survive the coming holiday is to grab a trolley and raid the supermarket. We stock up as if an apocalypse is coming, buying up vast quantities of everything from over-priced tins of chocolate right down to the last bruised parsnip.

It's time we admitted that the whole process is utterly ridiculous. Don't get me wrong, I love Christmas. I love the decorations, the merriment and, most of all, the abundance of delicious food.

But what simply must end is the bizarre mentality that causes us to frantically race to the shops five minutes before closing time on Christmas Eve. We've all been there, haven't we? Running around like headless chickens, gripped by a sudden and deathly terror that we might not have stockpiled enough after-dinner mints to last the festivities.

Britain, we need to take a stand against festive stress. Christmas is a special time of year; it should be a time to sit back and take a break from the stresses of everyday life. So please, enjoy your holiday — and try to remember that the world won't end should you happen to forget the cranberry sauce.

How does the writer use language to describe people's preparations for Christmas?

I took a stand once — I needed something to put my sheet music on...

As it turns out, it's surprisingly difficult to make a living playing the nose flute, but that's beside the point. Audience and purpose are really important in your exam, so use the questions on these pages to really nail your understanding of them.

Informative and Entertaining Texts

Q1 Put an **I** next to the statements that are informative, and an **E** next to the entertaining ones.

a) "Steven Morrissey was born in Manchester on 22nd May 1959." ☐

b) "The gig was absolute mayhem. Swathes of bodies ebbed and flowed in a sea of delirium — enjoyment and a survival instinct competed for my attention." ☐

c) "The next event at Spark Bridge village hall is a performance by Jim Dodd and the Budgies, at 7.30 pm on December 12th." ☐

Q2 Underline **two** words or phrases in the text below which suggest that its purpose is to entertain. Then explain why these examples suggest this on the lines below.

> The woman was incredibly old. Her back was bent permanently by the sheer weight of the years she'd lived, and her skin was papery thin, revealing a labyrinth of thick blue veins that crisscrossed her trembling hands.
> She spoke quietly and kindly to the lost child, then, once he had stopped crying, gently guided him to sit down on a nearby bench. As they walked, the discordant clink and clank of her jewellery sang through the air.

.....

.....

.....

Q3 Read the text below, which is from the travel section of a newspaper.

> Public bathing may not be a familiar experience to a British tourist, but the tranquillity of the beautiful Gellért Baths is enough to convert even the most apprehensive of travellers. Here, bathers luxuriate across eight thermal pools, each of a different temperature. The hottest pool (an immersive 40 degrees) soothed my sightseeing-weary muscles as well as any massage I've ever received.

a) Write down **two** facts about the Gellért Baths that you can learn from this text.

Fact 1: .....

Fact 2: .....

b) Explain how the writer has presented **one** of these facts in an engaging way.

.....

.....

Informative and Entertaining Texts

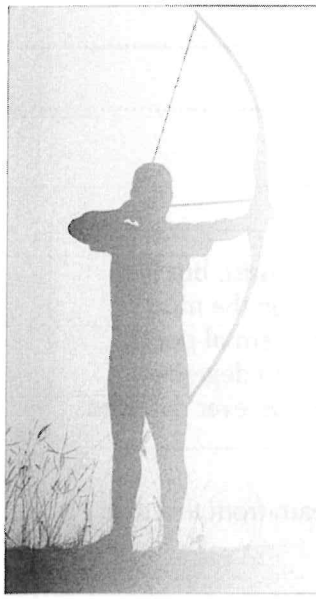
Focus on how language is used to inform or entertain the reader as you answer these exam-style questions.

Q4 Read the following extract from a short story.

> For her thirteenth birthday, Jasmine's parents had bought her a hockey stick. The thought process behind this baffling decision was a total mystery. They should have known better than anyone that she wasn't remotely interested in sport. Wasn't it obvious? She was nearing the point of needing to be surgically removed from her game console, and she had already mastered the art of the forged sick note. Lounging on the sofa was her passion — one to which she dedicated herself with all the staunch tenacity of an Olympic athlete. Going outside with her parents, meanwhile, was more daunting than an icy trek over an arctic precipice. She wasn't at all hopeful for a sudden transformation of her sofa-bound self into a hockey-stick wielding, goal-scoring demon. Those girls terrified her. She was Jasmine the gamer, a silent lone wolf. She was not, nor would she ever be, Jasmine the whooping and cheering team-player.

How does the writer use language here to describe Jasmine's personality?

Q5 Read the following text from a history magazine.



The Battle of Hastings was fought on October 14th 1066, on a field near Hastings in East Sussex. Led by William the Conqueror, it was the Normans' most important victory over the Anglo-Saxons.

William's army was a well-trained body of respected fighters. In contrast to Harold's army, which consisted mostly of foot soldiers, William's force had significant numbers of cavalry and archers — the cavalry sat proudly atop horses bred specially for their strength. At the helm of the Norman host stood a man with years of military experience.

Beginning at around nine o'clock in the morning, the battle was furious and bloody, and vast numbers of soldiers were brutally slain. At one stage, the English, led by King Harold II, were fooled into thinking they had won the battle, so they stormed towards their enemy, only to be mercilessly ambushed and trampled like insects.

How does the writer use language to describe the Battle of Hastings?

Entertaining texts — I thought phones weren't allowed in the exam...

Entertaining and informing are at opposite ends of the spectrum in lots of ways, but they can also be combined. It's really important to keep an eye out for texts with multiple purposes in the exam — they're often the ticket to a good answer.

Texts that Argue, Persuade or Advise

Q1 Draw lines to match each statement below to its purpose.

a) "The barbaric practice of bear-baiting must be stopped completely and immediately." — **To argue**

b) "If you want to make a difference, there are many organisations you can sign up to." — **To persuade**

c) "By joining our march and signing this petition, you will be helping to put an end to this disgraceful act of cruelty." — **To advise**

Q2 Read the following text.

Flamingos are the most fascinating birds in the world. Their beguiling beauty is unrivalled in the animal kingdom. Should such beauty go unsupported?

I'm starting a vital campaign to sponsor flamingos in zoos. By donating just a few pounds, you can help fund the establishment of breeding programmes for these most special of birds. The head keeper at my local zoo, Jane Sutton, says, "Flamingos really are wonderful animals. A dedicated breeding programme would be invaluable to their endurance as a species."

The table below shows the techniques used by the writer to persuade the reader. Fill in the table by picking out examples of each technique.

Technique	Example from text
rhetorical question	
opinion stated as fact	
expert opinion	
direct address to the reader	

Q3 Choose **one** word or phrase from the text below which shows that its purpose is to advise. Then explain how it helps the writer to achieve this purpose.

It's easy to get bogged down in all the choices when you're choosing a new mobile phone, but don't worry — there are plenty of people out there to help you. You could consider going into a phone shop to chat to an expert, or check out a handy online forum.

Example: .....

Explanation: .....

.....

Texts that Argue, Persuade or Advise

Make sure you think about how the writer uses language to argue, persuade or advise in these questions.

Q4 Read the following extract from an advice leaflet about an election.

It's Decision Time — But Who Do I Vote For?

Unless you've been living under a rock for the past month, you'll probably have noticed that there's an election coming up. Deciding who to vote for can be a daunting task, but it's also an important one. Luckily, there's plenty of help out there.

Learn the Lingo

Firstly, you need to be well-informed on the principles and policies that each party stands for. If you start to feel overwhelmed by all the political lingo in their leaflets, don't panic — have a look online, where there are plenty of websites that break it down for you.

Choose a Capable Candidate

It's also a good idea to look into the candidates in your constituency. They represent you in parliament, so you'll want to vote for someone who has a strong voice, and who will stand up for what your area needs.

It's true — choosing who to vote for isn't easy. However, if you take the time to do a bit of research, you will be able to make the right decision for you.

How does the writer use language to describe how to decide who to vote for?

Q5 Read the following letter to the editor of the *Daily Muncaster* local newspaper.

Dear Sir,

I was frankly horrified to read your article about the new soft drink 'Swampy Water' being served in the tuck shop at Muncaster Primary School. This dangerous fad for drinking green, slimy water is clearly idiotic.

Firstly, young children may become confused and think it acceptable to drink real swamp water. I know from my time in the Territorial Army that this would be an ill-advised and perhaps even fatal decision. Secondly, 'Swampy Water' is packed full of unhealthy sugar and additives — how else would it acquire that lurid green tinge? Finally, the drink is eye-wateringly expensive, which means children don't have sufficient funds to purchase the normal, healthy snacks that any sane parent would endorse.

To conclude, it is my firm belief that 'Swampy Water' should be immediately removed from the tuck shop at Muncaster Primary School.

Yours faithfully,
Gerry Bowness

How does the writer use language to describe 'Swampy Water'?

I'm rooting for Teresa Green — her policies woodwork for us all...

Whether it's arguing, persuading or advising, a text's purpose has a big impact on the way the author writes. To get the most out of your revision, make sure you practise linking a text's purpose to the writer's use of language techniques.

Writer's Viewpoint and Attitude

Q1 Read these play reviews. Write down whether each attitude is **positive**, **negative** or **balanced**.

a) This playwright's recent offerings on the London stage had established high expectations, but his latest "masterpiece" falls far short of that hype. .....

b) I have never left a matinee performance and rushed straight to the box office to buy a ticket for that evening. Until now. .....

c) I can't say I was dazzled, but I certainly wasn't disappointed. A pleasant evening, if not one to write home about. .....

Q2 Draw lines to match the extracts below to the viewpoints they're expressing.

a) *"I'd be loath to send one of my own children to one, but the idea of abolishing mixed sex schools entirely is simply absurd."*

b) *"I've always considered mixed schools to be a barrier to educational progress. We should all stick with traditional segregation."*

c) *"Mixed schools are clearly superior, but parents should have a choice."*

d) *"The outdated concept of single-sex education has persisted for far too long. All education should be gender-blind."*

i) Prefers mixed schools and thinks single-sex schools should be abolished.

ii) Prefers mixed schools but thinks single-sex schools should still be an option.

iii) Dislikes mixed schools but thinks they should be offered as an option.

iv) Dislikes mixed schools and thinks all schools should be single-sex.

Q3 Summarise **one** thing that these two writers agree on, and **one** thing that they disagree on. Use evidence from the text to support your answer.

Source A Mobile phone disruptions in lessons are a nightmare for any teacher. Surely the best way to prevent this is simply to ban them from school entirely.

Source B I'm not about to suggest that students should be permitted to use mobiles during lessons, but I fail to see that any harm can be caused by allowing them during lunchtimes.

The writers agree that .....

.....

.....

The writers disagree that .....

.....

.....

Writer's Viewpoint and Attitude

Q4 Read the following extracts. Source A is from a letter written in the 19th century, and Source B is from a newspaper article written in the 20th century.

Source A
Dear Miss Tinsham,
I read with concern your recent article on the new wave of art reaching British shores. With all due respect, I see it as nothing short of an abomination. It is created with a flagrant disregard for the conventions and traditions of classical art. These 'artists' seem not to have learnt from their predecessors, but instead insist on violating their canvasses with an assault of colour, which to view, in perfect honesty, is simply excruciating.

Source B
The London art scene has rarely been so exciting. We are seeing a real influx of artists who aren't afraid to throw off the iron shackles of 'traditional art' and champion self-expression. They're rule breakers, not intimidated by the giants of the past. They're revolutionaries, constantly looking forward, never back. Only by pushing the boundaries of modern art are we going to see any progression in the medium. When art conforms, it stagnates, and these new experimenters understand that.

Compare how the writers convey their different attitudes towards art.

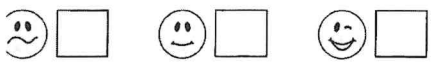
Q5 Read the following extracts. Source A is an extract from a diary written in the 19th century, and Source B is from a speech written in the 21st century.

Source A
Dear Diary —
I've had quite a day today! Daddy and I took a trip to see the new steam train, which was being exhibited in James Square. It was fascinating — a clanking, grinding steel colossus, shiny as a new penny, with a great puff of steam that emerged from its funnel and curled into the summer sky. I've never seen the like — and to think, Daddy says one day they may be able to carry people from one end of the country to the other! I for one cannot wait.

Source B
Residents of Station Crescent! I know that you, like me, are plagued day-in, day-out with the sounds, smells and sights of the railway. Like me, many of you moved here at a time when three or four trains a day passed by, barely disturbing us at all. And like me, you've seen our area systematically invaded by a non-stop army of trains, impacting our quality of life — not to mention the price of our homes. The time has come to take a stand against the relentless growth of the railways.

Compare how the writers convey their different attitudes towards rail transport.

Compare how the students convey their different attitudes towards exams...
"Student A seems rather miffed that she's stuck indoors revising when she could be outdoors enjoying the sunshine. In contrast, Student B is getting really stuck into his revision material... no, wait, he's just fallen asleep on top of his book."



Literary Fiction and Literary Non-Fiction

Q1 Each of the sentences below use a technique that is common in literary fiction. Label each sentence with the number of the technique used.

a) The waves whispered to them; the sound of the surf seemed to say, "Come in come in". .....

b) Somewhere in the house, glass smashed. Cate froze. There were voices downstairs. Strange voices. Someone had broken in. .....

c) "Didn't you hear?" whispered Farah covertly. "They're going to make you break into the library." .....

1. short sentences for suspense

2. dialogue to move the plot along

3. personification to create an enticing atmosphere

Q2 **a)** Read the literary fiction text below. Underline the words and phrases which suggest the narrator is angry.

> As I stared at the letter, no longer absorbing the words on the page, I realised my hands were starting to shake. How dare they! After all I'd done for that family... their betrayal cut me like a knife. Without even realising it, I'd begun to tear the paper into pieces; ripping, shredding, mutilating the letter until I was left with a pile of limp paper-snowflakes. Then, just for good measure, I aimed a sharp kick at the pile, scattering it across the carpet.

b) Choose one of your answers to **a)** and explain how it shows that the narrator is angry.

.....

.....

Q3 Use the words in the box to complete the following sentences about literary non-fiction.

purpose	fact	argument	biographies	dialogue	entertain

Literary non-fiction texts are based on ..... . They include things like travel writing, diary entries and ..... . Their ..... is often to inform the reader or to make an ....., but they also ..... . They use features such as description and ..... .

My autobiography is very entertaining, I promise...

Literary Fiction and Literary Non-Fiction

After trying these exam-style questions, tick a box below to show how well you think you've done.

Q4 Read the following extract from a novel.

Annie went from room to room, shaking her head at the disarray. The house looked as if it had been burgled. In the living room, a bookcase had been thrown onto the floor, and paperbacks were scattered chaotically across the carpet. In the kitchen, the floor was a treacherous landscape of smashed crockery and broken glass.

Annie frowned and headed cautiously up the stairs, following the crashing sounds into the master bedroom. Lucas stood with his back to her. His hair was a frantic mess, his movements manic as he pulled every item of clothing out of his wardrobe and launched them behind him. He was muttering frenetically under his breath.

"Lucas," Annie said calmly. He span around, surprised by her presence. His wide eyes were wild, beads of sweat had appeared on his forehead and his cheeks were red.

"I can't find it," he said. "I've looked everywhere. It's lost. They'll kill me."

"Don't be ridiculous. They're not going to kick you out just because you've lost your key to the clubhouse," said Annie, her arms folded.

"What would you know about it, Annie?" said Lucas, his eyes flashing in annoyance. "They're obsessed with not letting any outsiders in. If they find out I've lost it... I'm doomed. Finished. Condemned."

How does the writer use language here to describe Annie and Lucas?

Q5 Read the following texts about teaching. Source A is from a speech written in the 19th century. Source B is from an autobiography written in the 20th century.

Source A

A schoolmaster must view himself always as a military officer. He must demand respect from his troops, give no ground and yield no position. If he is not thorough, poor discipline and wayward behaviour will surely ensue. When a schoolmaster allows himself to be seen as a friend, all respect is lost. Imparting a meaningful and comprehensive academic education will become impossible. A schoolmaster without control is like a dog without bite.

Source B

As my sepia-toned school-days become steadily more indistinct, the stern face of Mr Wan remains as clear as day. Wan was a firm disciplinarian, and his strict laws meant that I spent much of my adolescent life languishing in detention. But despite the inevitable resentment I felt for him at the time, Mr Wan did give me a lasting education. Not, sadly, in his beloved Chemistry; but certainly in the priceless lesson of human decency. Though my teenage self was unable to see it, Wan listened to me.

Compare how the two writers convey their different attitudes to teaching.

You're writing a book? What a novel idea...

There's a lot to think about when you're reading a literary fiction or non-fiction text — so many literary devices... On the plus side, that gives you lots to write about. Besides, the more you practise identifying this stuff, the less torturous it gets.

Science

Biology Paper 1 Workbook

Contents

Top Revision Tips

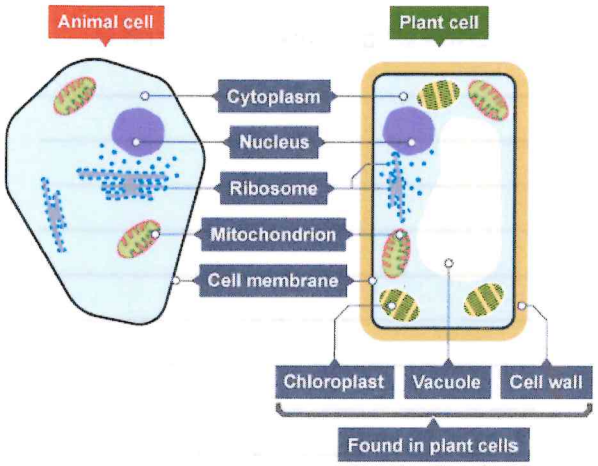
- Find a quiet place to work (no TV, Xbox, Netflix ect...)
- Use your class book, revision guides, textbooks, Doddle, BBC Bitesize, Youtube, to make revision notes, flash cards & concept maps
- Summarise information using bullet points & diagrams
- Try to revise with another student, and explain concepts to each other
- Put up posters with key points around your home
- Look at & work through past papers from www.AQA.org.uk
- Take regular breaks & get enough sleep

Cells Revision Workbook

Contents

- Cell structure / plant and animal cells / eukaryotes and prokaryotes / cell specialisation / cell differentiation / microscopy / culturing microorganisms.
- Chromosomes / mitosis and cell cycle / stem cells.
- Diffusion / osmosis / active transport.

Cells Revision

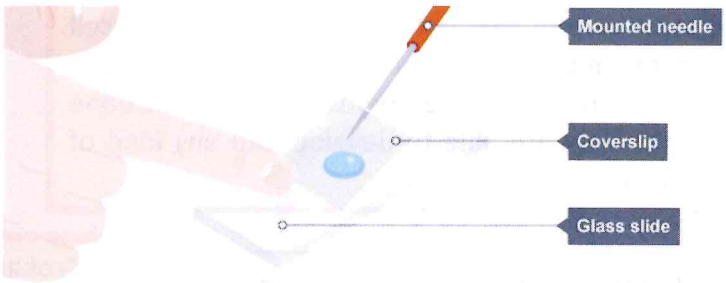


Organelle	Function (Complete this section)
Cytoplasm	
Nucleus	
Ribosome	
Membrane	
Mitochondria	
Cell wall	
Vacuole	
Chloroplast	

Yeast
Yeast is a single-celled organism. Like bacterial cells, yeast cells have cytoplasm and a membrane surrounded by a cell wall. But unlike bacterial cells, yeast cells have a nucleus

Bacterial cells
A bacterium is a single-celled organism. A bacterial cell has a different structure to an animal or plant cell. It has cytoplasm, a membrane and a surrounding cell wall, but the genetic material in a bacterial cell is not in a distinct nucleus.

Describe the safety procedures when making a slide



Making a glass slide

1. Rub a clean cotton bud gently on the inside of your cheek.
2. Smear the sample across a clean glass slide.
3. Cells are transparent, place a few drops of a dye called methylene blue onto the smear so the cells will be visible under the microscope.
4. Use a mounted needle to gently lower a glass coverslip onto the sample on the slide, take care not to form air bubbles under the coverslip.

Cells Revision

Leaf cell: Absorbs light energy for photosynthesis. Packed with chloroplasts. Regular shaped, closely packed cells form a continuous layer for efficient absorption of sunlight.

Root hair cell: Absorbs water and mineral ions from the soil. Long 'finger-like' process with very thin wall, which gives a large surface area.

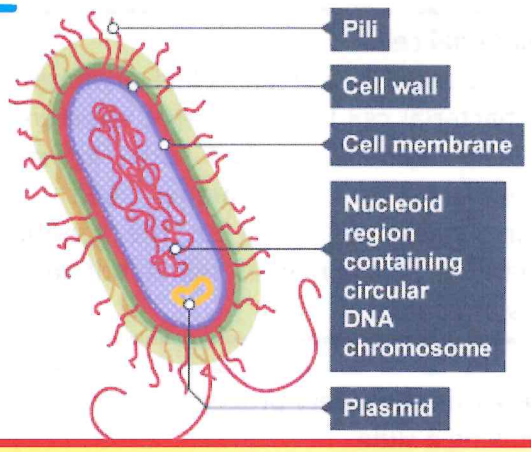
Sperm cell: Fertilises an egg cell - female gamete. The head contains genetic information and an enzyme to help penetrate the egg cell membrane. The middle section is packed with mitochondria for energy. The tail moves the sperm to the egg.

Red Blood cell: Contains haemoglobin to carry oxygen to the cells. Thin outer membrane to let oxygen diffuse through easily. Shape increases the surface area to allow more oxygen to be absorbed efficiently. No nucleus, so the whole cell is full of haemoglobin.

Describe what a specialised cell is

Highlight key words or phrases

Stem cells can be made to differentiate to form different types of cell, such as nerve cells. Human embryonic stem cells can come from the eight-cell stage of embryo development. Human stem cells can come from human embryos or from adult bone marrow. They are able to develop into any kind of human cell.

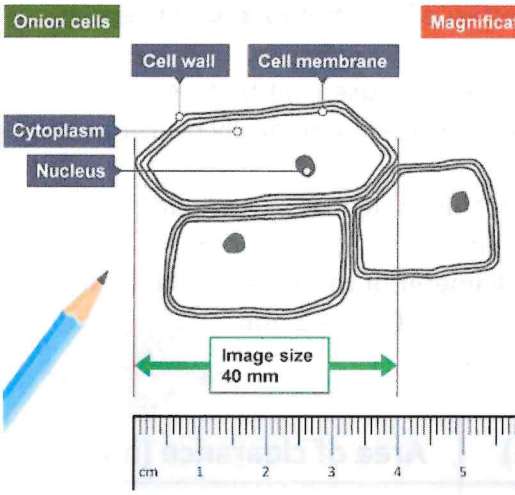


Features of Prokaryotes	Features of Eukaryotes

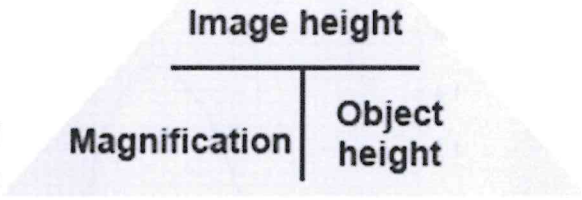
Prokaryotes

- Bacteria are prokaryotes. They do not have a membrane-bound nucleus and their DNA is free in the cytoplasm.
- Bacteria have a single circular chromosome in the centre of the cell that holds all the genes needed for that bacterium. Bacteria also have extra circles of DNA called plasmids.
- These plasmids contain additional genes, such as for antibiotic resistance, which may increase a bacterium's chance of survival. Bacteria can exchange plasmids with other bacteria through hair-like extensions on their surface called pili.

Cells Revision



If the object is placed between the principal focus (F) and the lens, a converging lens will produce a magnified, upright, virtual image.



A **transmission electron microscope** fires a beam of electrons *through* a specimen to produce a magnified image of an object.

1. A high-voltage electricity supply powers the cathode.
2. The cathode is a heated filament, a bit like the electron gun in an old-fashioned cathode-ray tube (CRT) TV. It generates a beam of electrons that works in an analogous way to the beam of light in an optical microscope.
3. An electromagnetic coil (the first lens) concentrates the electrons into a more powerful beam.
4. Another electromagnetic coil (the second lens) focuses the beam onto a certain part of the specimen.
5. The specimen sits on a copper grid in the middle of the main microscope tube. The beam passes through the specimen and "picks up" an image of it.
6. The projector lens (the third lens) magnifies the image.
7. The image becomes visible when the electron beam hits a fluorescent screen at the base of the machine. This is analogous to the phosphor screen at the front of an old-fashioned TV .
8. The image can be viewed directly (through a viewing portal), through binoculars at the side, or on a TV monitor attached to an image intensifier

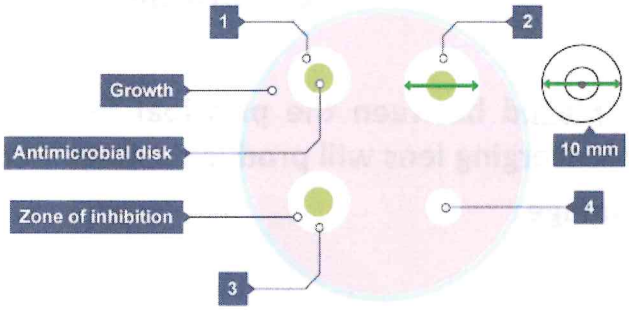
A light microscope uses focused light and lenses to magnify a specimen, usually a cell. In this way, a light microscope is much like a telescope, except that instead of the object being very large and very far away, it is very small and very close to the lens.

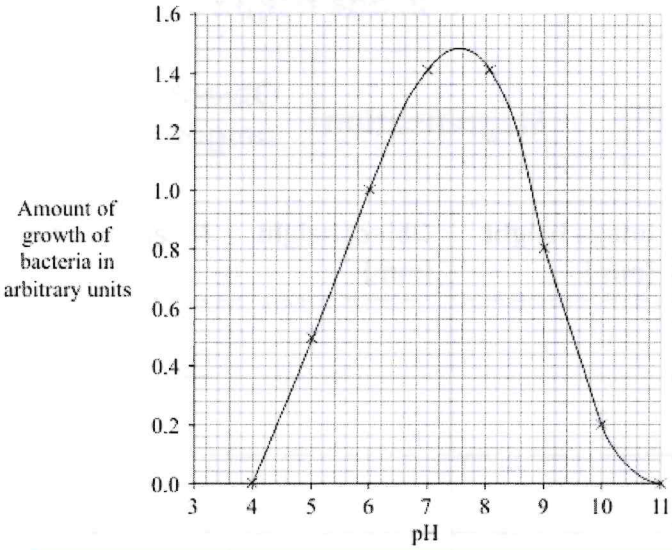
Image height (mm)	Object height (mm)	Magnification

Highlight key words or phrases

Light Microscope	Electron Microscope
	Expensive to buy & operate
Small & portable	
	Complex sample preparation
No vacuum required	
	Samples can only be seen in black & white
Relatively low magnification	
	Samples must be dead

Cells Revision





Calculating the effect of antibiotics and antiseptics

The effectiveness of the chosen antibiotic or antiseptic can be measured numerically by using the formula πr^2

- For π use 3.14. This value may vary slightly in a specific question.
- Measure the diameter of the zone of inhibition and divide it by 2 eg 10 ÷ 2 = 5 mm
- Use the equation πr^2

Radius (mm)	Area of clearance (mm²)
2	
4	
6	

Use the graph to estimate the pH at which the bacteria would grow best.

pH_____

Highlight key words or phrases

Bacteria are microscopic organisms. They come in many shapes and sizes, but even the largest are only 10 micrometres long - 10 millionths of a metre.

Bacteria are living cells and, in favourable conditions, can multiply rapidly. Once inside the body, they release poisons or toxins that make us feel ill.

Gonorrhoea is a sexually transmitted infection (STI) caused by bacteria called Neisseria gonorrhoeae or gonococcus.. Typical symptoms of gonorrhoea include a thick green or yellow discharge from the vagina or penis, pain when urinating and (in women) bleeding between periods.

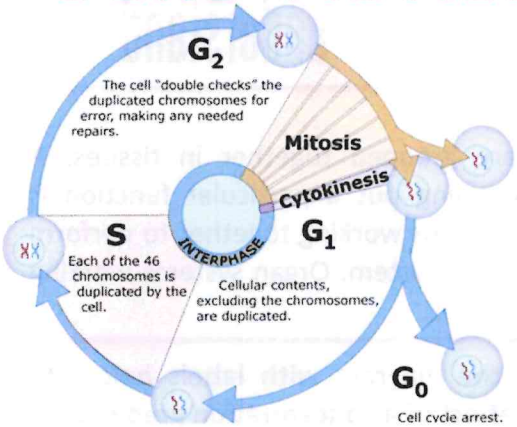
How do we make growing microbes safe?

Culturing microorganisms

The action of antibiotics and disinfectants can be investigated using cultures of microorganisms (populations of microorganisms that have been grown for a purpose). It is important that the cultures are uncontaminated by other microorganisms, so sterile conditions are needed:

- the Petri dishes, nutrient agar jelly and other culture media must be sterilised
- the inoculating loops used to transfer microorganisms must be sterilised (usually by passing the metal loop through a Bunsen burner flame)
- the lid of the Petri dish is sealed with sticky tape to stop microorganisms from the air getting in and contaminating the culture.

Cells Revision



The cell cycle or cell-division cycle is the series of events that take place in a cell leading to its division and duplication of its DNA (DNA replication) to produce two daughter cells.

Highlight key words or phrases

- G1: also called the first gap phase, the cell grows physically larger, copies organelles, and makes the molecular building blocks it will need in later steps.
- S phase: In S phase, the cell synthesizes a complete copy of the DNA in its nucleus.
- G2: During the second gap phase, or G2, the cell grows more, makes proteins and organelles, and begins to reorganize its contents in preparation for mitosis.
- M phase: During the mitotic (M) phase, the cell divides its copied DNA and cytoplasm to make two new cells.
- In cytokinesis, the cytoplasm of the cell is split in two, making two new cells. Cytokinesis usually begins just as mitosis is ending, with a little overlap.
- The G0 phase is a period in the cell cycle in which cells exist in a normal state.

Mitosis

Stage 1: The cell spends most of its life in the interphase. During this phase the cell grows to its maximum size and performs its normal functions.

Stage 2: The DNA condenses into chromosomes (human cells have 46 chromosomes – 23 from your father and 23 from your mother). Each chromosome eventually can be seen to consist of two strands or chromatids joined at a central centromere in an X shape.

Stage 3: The nuclear membrane disappears. Spindle threads form between the poles.

Stage 4: Chromosomes lie on the equator of the cell. Each chromosome is attached to the spindle microfibers by its centre. The chromosomes appear in a straight line across the middle of the cell.

Stage 5: The centre of the chromosome splits. Each chromosome divides into two sister chromatids. Each chromatid is moved to opposite poles of the cell by the shortening of the spindle fibres. Chromatids (now called daughter chromosomes) gather at opposite poles of the cell.

Stage 6: A nuclear membrane forms around each of the daughter chromosomes that have gathered at the poles. The daughter chromosomes uncoil.

Stem cells from a recently dead embryo can be grown in special solutions.

- Stem cells from an embryo can grow into any type of tissue.
- Stem cells may grow out of control, to form cancers.
- Large numbers of stem cells can be grown in the laboratory.
- Stem cells may be used in medical research or to treat some human diseases.
- Patients treated with stem cells need to take drugs for the rest of their life to prevent rejection.
- Collecting and growing stem cells is expensive.

- **Give two advantages of using stem cells.**

_____

_____

_____

_____

- **Give two disadvantages of using stem cells.**

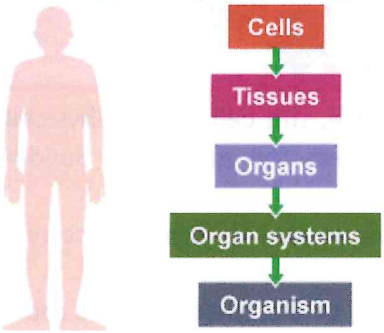
_____

_____

_____

_____

Cells Revision



Cells, tissues and organs

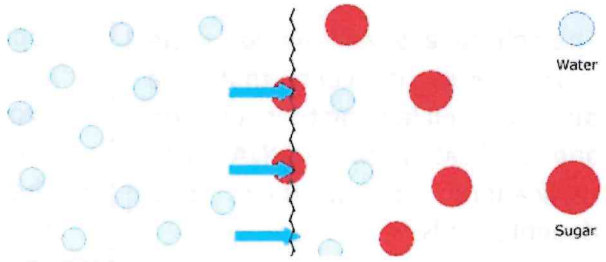
Cells with a similar function are grouped together in tissues. A collection of different tissues carrying out a particular function is called an organ. Several different organs working together to perform specific functions are called an organ system. Organ systems working together form an organism.

Concentration Gradients

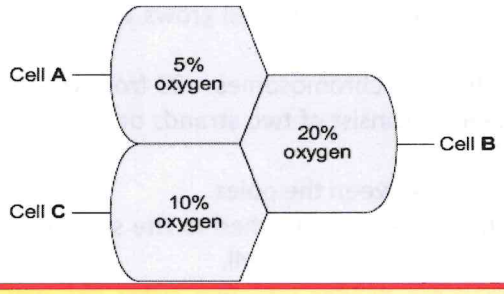
A concentration gradient exists when there is a region of high concentration leading to a region of low concentration:

- going from high to low concentration is going down the concentration gradient
- going from low to high concentration is going against the concentration gradient

Complete the diagram with labels below to show the effect of a concentration gradient



Draw arrows to show the directions the oxygen would diffuse



Diffusion

Diffusion is the movement of particles from a region where they are in high concentration to a region where they are in low concentration, and is one of the ways substances can move across the cell membrane, into or out of the cell. Particles diffuse down a concentration gradient. This is known as passive transport.

Osmosis

Osmosis is the diffusion of water molecules, from a region of higher concentration to a region of lower concentration, through a selectively permeable membrane.

A dilute solution contains a high concentration of water molecules, while a concentrated solution contains a low concentration of water molecules.

Diffusion is an important process in animals and plants. The movement of many substances into and out of cells occurs by diffusion. Describe why diffusion is important to animals and plants.

In your answer you should refer to:

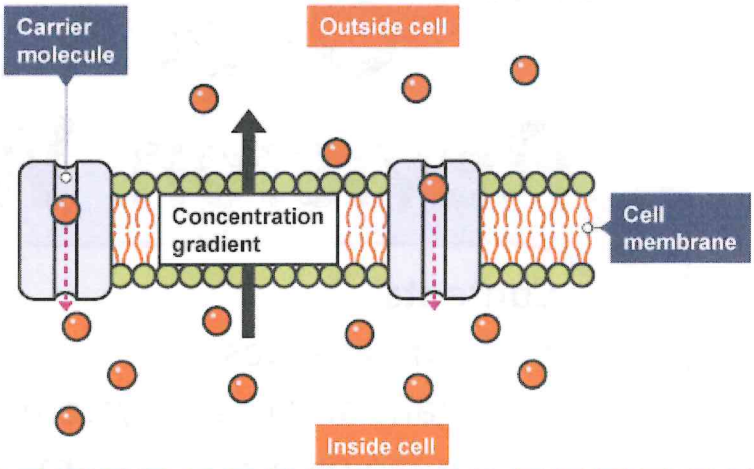
- animals
- plants
- examples of the diffusion of named substances.

Cells Revision

Active transport

Active transport is the movement of dissolved molecules into or out of a cell through the cell membrane, from a region of lower concentration to a region of higher concentration. The particles move against the concentration gradient, using energy released during respiration.

Sometimes dissolved molecules are at a higher concentration inside the cell than outside, but because the organism needs these molecules, they still have to be absorbed. Carrier proteins pick up specific molecules and take them through the cell membrane against the concentration gradient.



Plant roots obtain some of their mineral salts from the soil by active transport. What is involved in active transport? _____

_____

_____

_____

_____

_____

Complete the table below:

	Diffusion	Osmosis	Active transport
Down a concentration gradient			
Against a concentration gradient			
Energy needed			
Substance moved			
Notes	Gases and dissolved gases also diffuse	Partially permeable membrane needed	Carrier protein needed

Osmosis in potatoes

Cylinders or discs of fresh potato are often used to investigate osmosis in living cells. To carry out this type of experiment, you need to:

1. cut equal-sized pieces of potato
2. blot with tissue paper and weigh
3. put pieces into different concentrations of sucrose solution for a few hours
4. remove, blot with tissue paper and reweigh

Diagram A shows the cell in a hypotonic solution., **Diagram B** shows the same cell in a hypertonic solution. What is a hypertonic solution?

_____

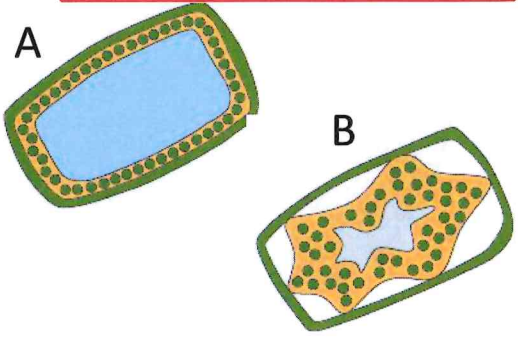
_____

_____

_____

_____

_____



Organisation Revision Workbook

Contents

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Quantitative Chemistry Revision Workbook

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Top Revision Tips

- Find a quiet place to work (no TV, Xbox, Netflix ect...)
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- Look at & work through past papers from www.AQA.org.uk
- Take regular breaks & get enough sleep

Quantitative chemistry Revision

Highlight key words or phrases

The law of conservation of mass states that mass in an isolated system is neither created nor destroyed by chemical reactions or physical transformations. According to the law of conservation of mass, the mass of the products in a chemical reaction must equal the mass of the reactants..

Balance the equation below

- $Na + Cl_2 \rightarrow NaCl$
- $Fe + 3O_2 \rightarrow Fe_2O_3$
- $Na + O_2 \rightarrow Na_2O$

Measuring the rate where a gas is produced The apparatus needed depends on the nature of the product being measured:

- the mass of a substance - solid, liquid or gas - is measured with a balance
- the volume of a gas is usually measured with a gas syringe (or sometimes with an upside-down measuring cylinder)

Relative formula mass can be found by adding up the relative atomic masses of each element in a compound.

E.g. Carbon Dioxide (CO_2)

- Carbon has a relative atomic mass of 12
- Oxygen has a relative atomic mass of 16
- The relative formula mass of Carbon Dioxide is therefore:

  12 + (16 x 2) = 44

Calculate the RFM of:

- H_2O _____
- CH_4 _____
- NH_3 _____

Key Word	Definition
Control variable	
Dependant variable	
Independent variable	
Continuous variable	
Categoric variable	

Draw a diagram of the equipment you'd use to measure volume of gas produced

What are the key things to think about when investigating the vol of gas produced?

Quantitative chemistry Revision

Problems with conservation of mass

In practice, it is not always possible to get all of the calculated amount of product from a reaction:

- reversible reactions may not go to completion
- some product may be lost when it is removed from the reaction mixture
- some of the reactants may react in an unexpected way

Highlight key words or phrases

Reactions in closed systems

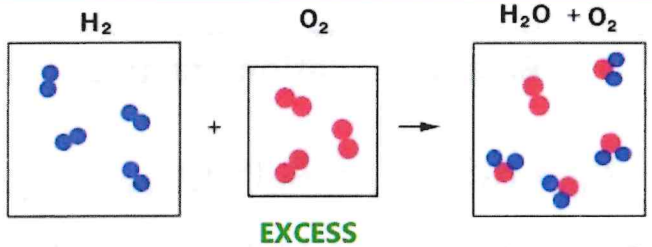
No substances can enter or leave a closed system, such as a stoppered flask. Sometimes, reactions that happen in open beakers are closed systems, for example acid-alkali neutralisation reactions. Since all the reactants and products stay in the beaker, the total mass of the beaker and the substances in it stay the same during the reaction.

Reactions in non-enclosed systems

Substances can enter or leave a non-enclosed system. These systems include open flasks, boiling tubes or crucibles that let gases enter or leave. For example:

- copper carbonate decomposes on heating to make solid copper oxide, which stays in the boiling tube, and carbon dioxide gas, which escapes
- magnesium reacts with oxygen, gained from the air, to produce magnesium oxide

If a gas escapes, the total mass will look as if it has decreased. If a gas is gained, the total mass will look as if it has increased. However, the total mass stays the same if the mass of the gas is included.



LIMITING REACTANT

EXCESS REACTANT

Amount of PRODUCT is determined by limiting reactant

During a reaction the mass of the reactants was 23.2g and the mass of the products was only 20.1g. Use measurements of mass before and after an experiment to explain what has happened to the mass during the experiment and why it has happened.

10.0 g of calcium carbonate, CaCO3, was heated in a thermal decomposition reaction. 5.60 g of solid remained after heating. The equation below represents the reaction:

$CaCO3(s) \rightarrow CaO(s) + CO2(g)$

Explain the change in mass.

Limiting Reactant

In a chemical reaction involving two reactants, it is common to use an excess of one of the reactants to ensure that all of the other reactant is used. The reactant that is completely used up is called the limiting reactant because it limits the amount of products.

Quantitative chemistry Revision

The idea of excess

In a balanced equation like the one below, it is often assumed that all of the reacting chemicals change into products.

$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

In that case, at the end of the reaction, no $CaCO_3$ or HCl will be left behind. However, if there is a shortage of, say, $CaCO_3$ then the reaction will stop when the $CaCO_3$ runs out. Some HCl will be left over, unable to react, as there is no more $CaCO_3$. The HCl is said to be in excess.

Take the reaction: $NH_3 + O_2$ -> NO + H_2O. In an experiment, 3.25 g of NH_3 are allowed to react with 3.50 g of O_2

a. Which reactant is the limiting reagent?

b. How many grams of NO are formed?

c. How much of the excess reactant remains after the reaction?

Worked Example

Calculate which reactant is in excess, when 10 g of calcium carbonate reacts with 50 cm^3 of 2 mol l^{-1} hydrochloric acid.

Step 1: Calculate the number of moles of each reactant present:

$CaCO_3$

Moles = mass ÷ GFM

= 10 ÷ 100

= 0.1

HCl

Moles = volume (litres) × concentration

= 0.05 × 2

= 0.1

Step 2: From the balanced equation, work out the mole ratio for the reactants:

$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

There is 1 mole of $CaCO_3$, and 2 moles of HCl.

Step 3: Using the number of moles in step 1, choose one reactant, and work out the number of moles of the other reactant needed to react with it:

1 mole $CaCO_3 \leftrightarrow$ 2 moles HCl

Substitute the moles of $CaCO_3$, from step 1:

0.1 mole $CaCO_3 \leftrightarrow$ 0.2 mole HCl

Moles of HCl required = 0.2

Moles of HCl available = 0.1

There is not enough HCl available, to react with 0.1 mole of $CaCO_3$. This means that some of the $CaCO_3$ will be left over, when the HCl is used up.

Answer: $CaCO_3$ is the reactant which is in excess.

Balance Equation Practice

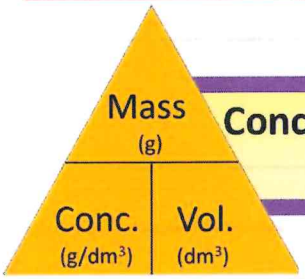
$Al_{(s)} + H_2SO_{4(aq)} \rightarrow Al_2(SO_4)_{3(aq)} + H_{2(g)}$

$Mg_{(s)} + HNO_{3(aq)} \rightarrow Mg(NO_3)_{2(aq)} + H_{2(g)}$

$Li_{(s)} + H_2O_{(l)} \rightarrow LiOH_{(aq)} + H_{2(g)}$

Quantitative chemistry Revision

The concentration of a solution is measured in **grams per cubic decimetre**, g/dm^3. The greater the concentration, the more dissolved particles there are in the solution: Equal volumes of different solutions that have the same concentration contain the same number of particles of dissolved solute. For example, a solution at 2 g/dm^3 is twice as concentrated as a solution at 1g/dm^3.



Conc. = mass of solute in grams / Volume in dm^3

Converting from cm^3 to dm^3 **cm^3 / 1000 = dm^3**

cm^3	dm^3
100	
50	
75	
90	
10	

Use the equation to work out the concentration of the following solutions (show your working)

a) 10g of magnesium chloride in 1dm^3 of solution

b) 1.5g of potassium iodide in 150cm^3 of solution

c) 2.3g of lithium chloride in 500cm^3 of solution

Calculate the concentrations of each of the following solutions in units of g/dm3:

a) 10.0 g of sodium chloride dissolved in 2.00 dm3 of water (1 mark)

b) 2.5 g of glucose dissolved in 0.5 dm3 of water (1 mark)

c) 3.8 g of copper sulfate dissolved in 250 cm3 of water (2 marks)

d) 25.6 g of potassium chloride dissolved in 1500 cm3 of water. (2 marks)

Use the equation to work out the mass required to make the following solutions (show your working)

a) 0.5dm^3 of a 2g/dm^3 solution of silver nitrate

b) 250cm^3 of a 1.5g/dm^3 solution of sodium chloride

c) 10cm^3 of a 0.4g/dm^3 solution of sodium carbonate

Quantitative chemistry Revision

Moles

Because saying 'relative formula (or atomic!) mass in grams' is a bit clumsy, we simply say 'moles' instead. This means that 1 mole of Carbon Dioxide is 44 grams, or 44g.

To calculate how many moles of a substance there is divide the amount of it by the mass of 1 mole of the substance

1. NaOH
   23 + 16 + 1 = 40g is one mole of NaOH

2. We have 100g in our reaction so...
   $\frac{100}{40} = \frac{2.5 \text{ moles}}{}$

What mass of carbon dioxide is formed when 12 g of carbon is burned in oxygen?

The Avogadro number

One mole of atoms contains 6×10^{23} atoms, no matter what **element** it is. This is a very large number: it is 6 with 23 zeros after it. It is known as the **Avogadro number**.

This number is used in chemistry because if you could count out this many carbon atoms, the total mass of carbon you would have is 12 g. On the other hand, weighing out 12 g of carbon allows you to know how many atoms you have.

How many moles in:

46g of NaCl:

_____

36g of H_2O

_____

15g of HCl

_____

How to calculate reactant mass

We can use masses in a reaction to help us calculate the amount of reactant and product.

1. Write out the equation for the reaction. Make sure it is balanced.
2. Work out the relative masses of the substances needed in the calculation. Remember to multiply by the number of molecules that are present.
3. Convert the relative masses into the units in the question.
4. Find the ratio by dividing both numbers by the smallest relative mass.
5. Find the mass of the unknown by multiplying the mass of the known by the ratio of the unknown.

To calculate the mass of a single atom, first look up the atomic mass of carbon from the Periodic Table. This number, 12.01, is the mass in grams of one mole of carbon. One mole of carbon is 6.022 x 1023 atoms of carbon (Avogadro's number). This relation is then used to 'convert' a carbon atom to grams by the ratio:

- mass of 1 atom / 1 atom = mass of a mole of atoms / 6.022 x 1023 atoms
- Plug in the atomic mass of carbon to solve for the mass of 1 atom:
- mass of 1 atom = mass of a mole of atoms / 6.022 x 1023
- mass of 1 C atom = 12.01 g / 6.022 x 1023 C atoms
- mass of 1 C atom = 1.994 x 10-23 g

Quantitative chemistry Revision

No. of molecules = No. of mols x (6.02×10^{23})

Calculate the number of molecules in 1.5 mol of a substance.

Calculate the number of water molecules in 0.5 mol of water.
Number of water molecules = Avogadro constant x amount of substance in mol
$= 6.02 \times 10^{23} \times 0.5$
$= 3.01 \times 10^{23}$

In chemistry, yield, also referred to as reaction yield, is the amount of product obtained in a chemical reaction. The absolute yield can be given as the weight in grams or in moles

1. Work out the maximum mass of a product that could be made using it's chemical formula
2. Divide the actual mass of the product made by it's maximum mass
3. Multiply by 100

Yield = Theoretical mass x 100
Actual mass

In a manufacturing process, 12 tonnes of product are predicted but only 10 tonnes are obtained. What is the percentage yield?

Percentage yield
In practice, it is not always possible to get the calculated amount of product in a reaction:

- reversible reactions may not go to completion
- some product may be lost when it is removed from the reaction mixture
- some of the reactants may react in an unexpected way

If the reaction of 0.112 grams of H2 and 0.896 grams of O produces 0.745 grams of H2O, what is the percent yield?

Key word	Definition
percentage yield	
theoretical yield	
actual yield	

In the neutralisation of sulfuric acid with sodium hydroxide, the theoretical yield from 6.9g of sulfuric acid is 10g. In a synthesis, the actual yield is 7.2g. What is the percentage yield for this synthesis?

The atom economy (atom utilisation) is a measure of the amount of starting materials that end up as useful products. It is important for sustainable development and for economic reasons to use reactions with high atom economy.

Quantitative chemistry Revision

4.8g of magnesium are reacted with 32g of bromine to form magnesium bromide, calculate the empirical formula.

1: Get the mass of each element, (you may have to calculate it or use a percentage as a mass).

Mg-4.8g, Br-32g

2: Convert the mass of each element into moles of each element using

Moles of Mg = 4.8/24 = 0.2 moles
Moles of Br = 32/80 = 0.4 moles

3: Find the simplest ratio of the moles of each element by dividing the number of moles of each by the smallest number of moles.

Mole ratio of Mg = 0.2/0.2 = 1
Mole ratio of Br = 0.4/0.2 = 2

4: Use the mole ratio to write the empirical formula.

So the formula of magnesium bromide is $MgBr_2$

Methane, in which 2.4g of carbon combine with 0.8g of hydrogen gas, calculate the empirical formula.

Copper oxide, where 32g of copper react with 4g of oxygen, calculate the empirical formula.

Sodium Hydride, in which 6.9g of sodium combine with 0.3g of hydrogen, calculate the empirical formula.

Carbon fluoride, where 24g of carbon react with 152g of fluorine, calculate the empirical formula.

The particles in gases are able to move freely, so determining their volume can be difficult. The scientist Amedeo Avogadro (1776-1856) stated that one mole of any substance has 6.02×10^{23} particles. This is known as the Avogadro constant. We use this to work out the number of moles of any substance by using this equation:

number of moles = mass (grams) ÷ relative atomic (or formula) mass

Physics Paper 1 Revision Workbook

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Energy Revision Workbook

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Energy Revision

Work done

Work and energy are measured in the same unit, the joule (J). When an object is moved by a force, energy is transferred and work is done. But work is not a form of energy - it is one of the ways in which energy can be transferred.

work done = force x distance moved

Example

A cyclist peddles a bicycle with a force of 1,000 N moving it 250 m.

work done = force x distance moved

= 1,000 x 250

= **250,000 J = 250 kJ**

What is the work done when a force of 10N acts over a distance of 100m?

What is the work done when a force of 50N acts over a distance of 10m?

What is the work done when a force of 2N acts over a distance of 30m?

energy efficiency = useful output energy / total input energy

Useful Energy j	Total energy j	Efficiency %
95	120	
30	40	
62	75	

Complete the table below

Energy store	Description
	The energy stored when repelling poles have been pushed closer together or when attracting poles have been pulled further apart.
	The total kinetic and potential energy of the particles in an object, in most cases this is the vibrations - also known as the kinetic energy - of particles. In hotter objects, the particles have more internal energy and vibrate faster.
	The energy stored in chemical bonds, such as those between molecules.
	The energy of a moving object.
	The energy stored when repelling charges have been moved closer together or when attracting charges have been pulled further apart.
	The energy stored when an object is stretched or squashed.
	The energy of an object at height.

Efficiency

You should know that energy can be 'wasted' during energy transfers, and you should be able to calculate the efficiency of a device.

'Wasted' energy

Energy cannot be created or destroyed. It can only be transferred from one form to another or moved. Energy that is 'wasted', like the heat energy from an electric lamp, does not disappear. Instead, it is transferred into the surroundings and spreads out so much that it becomes very difficult to do anything useful with it.

Example

This filament bulb is supplied with 100 J of electrical energy, which it converts to 45 J of light energy. What is it's efficiency?

Efficiency = Useful / Total x 100

= 45 J / 100 J x 100

= 45%

Energy Revision

Highlight key words or phrases

Energy flow diagrams

Diagrams can be used to show how energy is transferred from one store to another. Two examples are the transfer diagram and the Sankey diagram.

In transfer diagrams the boxes show the energy stores and the arrows show the energy transfers.

Sankey diagrams

Sankey diagrams start off as one arrow that splits into two or more points. This shows how all of the energy in a system is transferred into different stores.

Sankey diagrams are really useful when the amount of energy in each of the energy sources is known. The width of the arrow is drawn to scale to show the amount of energy.

Kinetic energy

All moving objects have kinetic energy. The amount of kinetic energy they have depends on:

- speed
- mass

A person has more kinetic energy when running than walking.

If a car and a lorry are driving at the same speed on the motorway the lorry has more kinetic energy than the car.

$$KE = \frac{1}{2} \times mass \times velocity^2$$

Example

A car with a mass of 1,500 kg travels at a velocity of 20 m/s. What is the KE?

kinetic energy = ½ x mass x velocity²

= ½ x 1,500 x 20^2

= **300,000 J = 300 kJ**

A year 11 pupil with a mass of 55kg swinging back on their chair and falling off it at a speed of 0.6m/s.

Total input energy: 100j

Useful energy: 80j

Wasted energy: 20j

Complete the two Sankey diagrams below

Total input energy: 150j

Useful energy: __j

Wasted energy: 50j

Total input energy: 80j

Useful energy: 70j

Wasted energy: ___j

A runner with a mass of 62kg running at a speed of 0.8m/s.

A tennis ball travelling at a speed of 46m/s with a mass of 58kg.

A tennis ball travelling at a speed of 46m/s with a mass of 58kg.

Energy Revision

The spring constant

The spring constant k is different for different objects and materials.

When an elastic object - such as a spring - is stretched, the increased length is called its extension. The extension of an elastic object is directly proportional to the force applied to it:

This equation works as long as the elastic limit (the limit of proportionality) is not exceeded. If a spring is stretched too much, for example, it will not return to its original length when the load is removed.

What force is needed to stretch a spring with a spring constant of 5N/m, 0.9m?

What force is needed to stretch a spring with a spring constant of 2N/m, 0.1m?

What force is needed to stretch a spring with a spring constant of 3N/m, 0.2m?

How much elastic potential energy does a spring store when it is compressed by 0.2 m if it has a spring constant of 5 N/m?

How much gravitational potential energy does a 500 g book gain when it is lifted up 1.5 m onto a shelf?

Force applied to a spring = Spring constant X extension

Example

What is the force applied to a spring with a spring constant of 10N/m when it's stretched 0.5m?

Force applied to a spring = Spring constant X extension

Force =10N/m x 0.5m

= 5N

Elastic Potential Energy

Elastic potential energy is Potential energy stored as a result of deformation of an elastic object, such as the stretching of a spring. It is equal to the work done to stretch the spring, which depends upon the spring constant k as well as the distance stretched.

$$Ee = \frac{1}{2} \times Ke^2$$

Example

Robert stretches a spring with a spring constant of 3 N/m until it is extended by 50 cm. What is the elastic potential energy stored by the spring?

- $Ee = \frac{1}{2} \times Ke^2$
- $Ee = \frac{1}{2} \times 3 \times 0.5^2$
- $Ee = \frac{1}{2} \times 3 \times 0.25$
- $Ee = 0.375j$

Gravitational potential energy (GPE)

On Earth we always have the force of gravity acting on us. When we're above the Earth's surface we have potential (stored) energy. This is called gravitational potential energy. The amount of gravitational potential energy an object on Earth has depends on its:

- mass
- height above the ground

GPE = mass x gravitational field strength x height

Energy Revision

Example

An apple with a mass of 200 g falls 3 m from its branch to the ground. What is the GPE?

GPE = mass x gravitational field strength x change in height

= 0.2 x 10 x 3

= 6 J

A car has a mass of 1000 kg, it drives up a 50 m tall hill. How much GPE does it gain?

A boy has a mass of 55 kg. He climbs 12 m up a tree. What is his gain in GPE?

An owl has a mass of 4 kg. It dives to catch a mouse losing 800 J of GPE. How high was the bird to begin with?

Evaluate the use of concrete in storage heaters:

- Why is concrete used?
- What are the problems associated with the use of concrete?
- Why aren't other materials with a higher or lower specific heat capacity used?

Specific heat capacity

Temperature and heat are not the same thing:

- temperature is a measure of how hot something is
- heat is a measure of the thermal energy contained in an object.

Temperature is measured in °C, and heat is measured in J. When heat energy is transferred to an object, its temperature increase depends upon the:

- the mass of the object
- the substance the object is made from
- the amount energy transferred to the object.

For a particular object, the more heat energy transferred to it, the greater its temperature increase.

Calculating specific heat capacity

Here is the equation relating energy to specific heat capacity:

$E = m \times c \times \theta$

- E is the energy transferred in joules, J
- m is the mass of the substances in kg
- c is the specific heat capacity in J / kg °C
- θ ('theta') is the temperature change in degrees Celsius, °C

Example

How much energy is needed to increase the temperature of 500 g of lead from 20ºC to 45ºC? The specific heat capacity of lead is 128 J/kg ºC.

- mass of lead = 500 ÷ 1000 = 0.5 kg
- temperature change = 45 – 20 = 25ºC
- energy needed = 0.5 × 128 × 25 = **1600 J** (1.6 kJ)

How much energy must be transferred to raise the temperature of 2 kg of water from 20°C to 30°C?

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Power

Power is a measure of how quickly energy is transferred. The unit of power is the watt, W. The more energy that is transferred in a certain time, the greater the power. A 100 W light bulb transfers more electrical energy each second than a 60 W light bulb. You also need to remember that energy transferred is the same as work done.

Power = Energy transferred / time

Conduction

Heat energy can move through a substance by conduction. Metals are good conductors of heat, but non-metals and gases are usually poor conductors of heat. Poor conductors of heat are called insulators. Heat energy is conducted from the hot end of an object to the cold end.

The electrons in piece of metal can leave their atoms and move about in the metal as free electrons. The parts of the metal atoms left behind are now charged metal ions. The ions are packed closely together and they vibrate continually. The hotter the metal, the more kinetic energy these vibrations have. This kinetic energy is transferred from hot parts of the metal to cooler parts by the free electrons. These move through the structure of the metal, colliding with ions as they go.

Draw a diagram to show how conduction happens

Example

How much power is needed when 75J of energy is transferred in 25s?

Power = Energy transferred / time

Power = 75J / 25s

= 3W

How much power is needed when 45J of energy is transferred in 5s?

How much power is needed when 35J of energy is transferred in 7s?

How much power is needed when 55J of energy is transferred in 11s?

Highlight key words or phrases

Energy dissipation

No system is perfect. Whenever there is a change in a system, energy is transferred and some of that energy is dissipated.

Dissipation is a term that is often used to describe ways in which energy is wasted. Any energy that is not transferred to useful energy stores is said to be wasted because it is lost to the surroundings. Electrical cables warming up are a good example of this. It is not useful to have hot wires behind a television as energy is dissipated to the surrounding air.

In a mechanical system, energy is dissipated when two surfaces rub together. Work is done against friction which causes heating of the two surfaces - so the internal (thermal) energy of the surfaces increases. Adding lubricant between the surfaces reduces this friction and so less heat is wasted, like on a conveyor belt for example.

In an electrical context, new types of components can be more energy-efficient. For example, using LED light bulbs as opposed to filament lamps causes less energy to be wasted.

Energy Revision

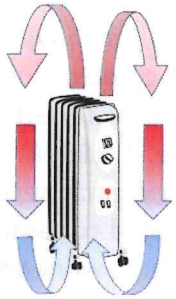
Convection

Liquids and gases are fluids. The particles in these fluids can move from place to place. Convection occurs when particles with a lot of heat energy in a liquid or gas move and take the place of particles with less heat energy. Heat energy is transferred from hot places to cooler places by convection.

Liquids and gases expand when they are heated. This is because the particles in liquids and gases move faster when they are heated than they do when they are cold. As a result, the particles take up more volume. This is because the gap between particles widens, while the particles themselves stay the same size.

The liquid or gas in hot areas is less dense than the liquid or gas in cold areas, so it rises into the cold areas. The denser cold liquid or gas falls into the warm areas. In this way, convection currents that transfer heat from place to place are set up.

The diagram below shows a convection heater



Explain in detail how a convection heater warms a room.

A student is asked to investigate the amount of infra-red radiation emitted by different surfaces. Some of the equipment they were provided with is shown below:

- Leslie cube kettle
- infrared detector
- heat proof mat.

Describe how they could carry out this investigation

Highlight key words or phrases

Radiation

All objects give out and take in thermal radiation, which is also called infrared radiation. The hotter an object is, the more infrared radiation it emits.

Infrared radiation is a type of electromagnetic radiation that involves waves. No particles are involved, unlike in the processes of conduction and convection, so radiation can even work through the vacuum of space. This is why we can still feel the heat of the Sun, although it is 150 million km away from the Earth. Some surfaces are better than others at reflecting and absorbing infrared radiation.

Energy Revision

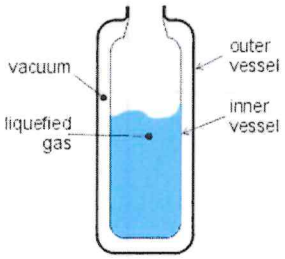
Highlight key words or phrases

Ways to reduce heat loss

There are several different ways to reduce heat loss:

- Simple ways to reduce heat loss include fitting carpets, curtains and draught excluders. It is even possible to fit reflective foil in the walls or on them.
- Heat loss through windows can be reduced by using double glazing. These special windows have air or a vacuum between two panes of glass. If the double glazing has a vacuum there will be no conduction or convection. If the double glazing is made with air between the glass then convection is minimised because there is little room for the air to move. Air is a poor conductor so there will be very little heat loss by conduction.
- Heat loss through walls can be reduced using cavity wall insulation. This involves blowing insulating material into the gap between the brick and the inside wall. Insulating materials are bad conductors and so this reduces the heat loss by conduction. The material also prevents air circulating inside the cavity, therefore reducing heat loss by convection.
- Heat loss through the roof can be reduced by laying loft insulation. This works in a similar way to cavity wall insulation.

A student has a vacuum flask and a glass bottle. They can both hold the same volume of liquid. The student heats some water to 80□C and pours 100ml of the water into each of the containers.



Dewar vessel

Describe the energy transfer which takes place between each container and the surroundings and explain why the water in the vacuum flask stays hotter.

Explain why a cavity wall has a better U-value than a brick wall

U-values measure the effectiveness of a material as an insulator in buildings. Solar panels use heat energy from the Sun to provide hot water or to heat buildings. The specific heat capacity of a substance allows us to calculate the amount of energy needed to heat it up. U-values measure how effective a material is an insulator. The lower the U-value is, the better the material is as a heat insulator.

Energy Revision

Complete the table below

Type of energy	How it works	Problems with it
fossil fuels (coal, oil and gas)		
nuclear fuel		
bio-fuel		
wind		
hydro-electricity		
geothermal		
the tides		
the Sun		
water waves.		