Year 10 CORE

Cycle 3 Assessments

Revision Support

In this booklet, you will find **tips for parents**, **knowledge organisers** and **'what I need to know'** checklists for core subjects. Your options teachers will give you KOs for those subjects.

Use these to support your preparation for assessments. These begin on **Monday 10th June 2019** and will take place in lesson time.

Five simple revision tips for parents

Exam season is fast approaching and you're probably feeling the pressure of trying to help your child prepare. We've compiled some revision tips to help you banish the stress of exam prep.

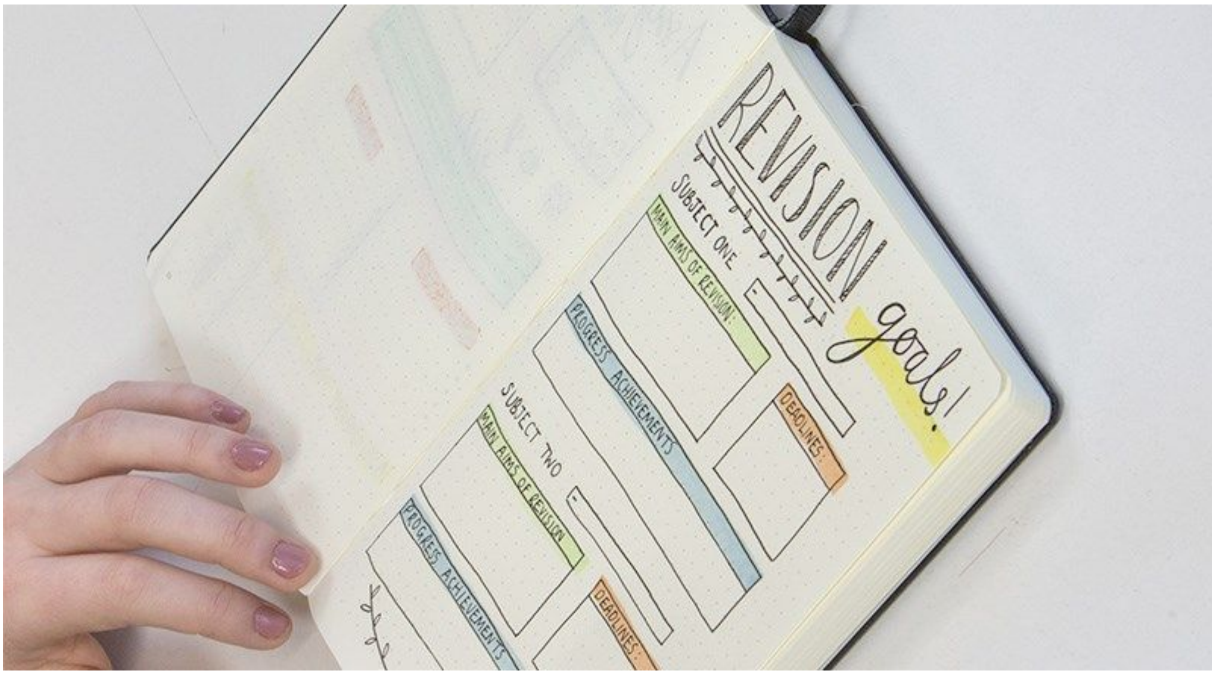
1- Establish effective study habits

Help your child create a study plan early on (this will make you aware of their exam dates too), making sure it is realistic and achievable to avoid de-motivation. Planning in advance will also help avoid ineffective cramming sessions further down the line. Encourage them to use a weekly planner so they are accountable for their work. Don't micro-manage. Provide extra support if they need or ask for it.

2- Take a break!

Don't try and force them to work for hours at a time. Their concentration span is limited and it will hinder the success of their revision if they are trying to do mammoth sessions. Suggest the use of a timer as well as regularly changing revision subject, to avoid getting stuck in a rut. Check out our Pomodoro video as it's a really simple way for students to manage their time effectively:

https://youtu.be/RlidoiSrpB0



3- Practise past papers

Past papers encourage your child to think contextually, rather than just trying to memorise an entire text book. You can help by creating a realistic, timed, exam scenario when they are completing practice papers .This will encourage them to get used to working under pressure and develop exam strategies, helping them feel less anxious on the day.

4- Watch for signs of frustration

It's important that your child is in the right frame of mind for revising. If they are struggling over something in particular, it may be best to park it for the night, reassess the next day and break it down into manageable chunks. Look out for stress and worry over exams that have been and gone. Be sure to ask them how their exam went, then shift their focus to what's coming up next and encourage them to say in a positive mind-set. It is important to remember the role of a healthy diet, plenty of water and exercise in keeping a healthy outlook on exams.

5- Ask for help

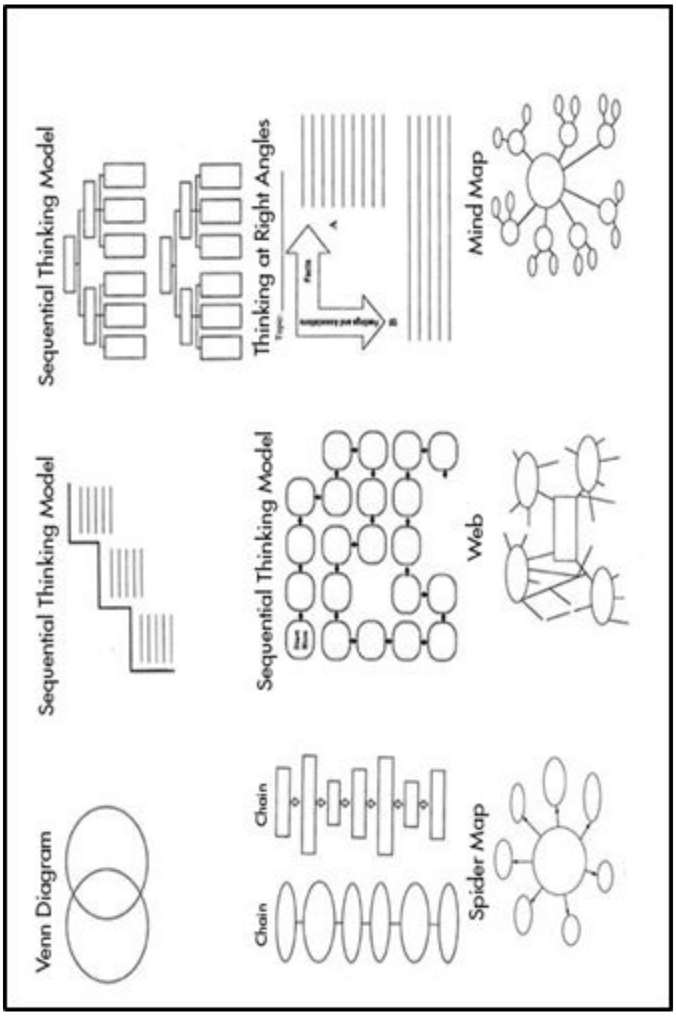
If you are working closely with your child to help them study, but feel the work is beyond your own skill set, it may be worth seeing if there is another family member who can assist. Or, if you feel this may be a long term issue and your child needs extra support, it may be worth hiring a private tutor to help improve your child's understanding of the subject. Alternatively there is lots of free support online, offering revision help for a huge range of subjects. Don't forget- teachers are just at the end of a phonecall and are ALWAYS happy to help!

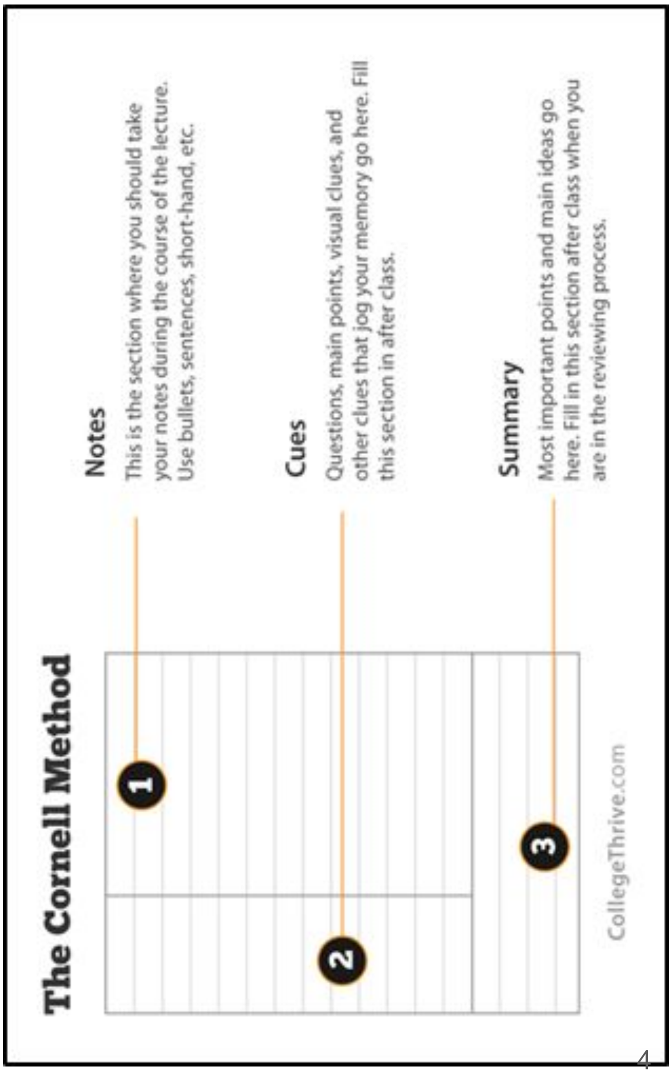
TOP TIPS

Use these knowledge organisers to revise for your assessment. Try:

- practice questions;
- getting someone to quiz you;
- making flashcards to use when quizzing;
- graphic organisers (see right);
- the Cornell method (see right);
- talk for a minute on the given term/topic – no pauses, no hesitations. Slips or repetitions or micro pauses lose a 'life' – three strikes and you're out!

- Ask someone at home to use the 'what I need to know' checklists to test you on what you have learned.





Weekly Revision Timetable

Name: ____________________

Day	9:00 – 10:00	10:00 – 11:00	11:00 – 12:00	12:00 – 1:00	1:00 – 2:00	2:00 – 3:00	3:00 – 4:00	4:00- 5:00	5:00 – 6:00	6:00 – 7:00	7:00 – 8:00	8:00 – 9:00	9:00 – 10:00
Monday													
Tuesday													
Wednesday													
Thursday													
Friday													
Saturday													
Sunday													

School Day

******Remember: make sure you give yourself breaks and allow time to relax and do the things your want to do and enjoy doing.***

Year 10

English

Year 10 English Revision

What I Must Know			
I know the plot of the play in chronological order.			
I understand context and how it relates the play.			
I understand how characters develop throughout the play.			
I can identify themes and trace them throughout the play.			
I can identify and explain dramatic techniques used in the play.			

AQA English Literature - An Inspector Calls - Knowledge Organiser

Context:

- The play was written in 1945 but set in 1912, this leads to lots of dramatic irony.
- The play is set before WW1 which shows that Birling's optimistic claims about war being unlikely are completely wrong. It was written at a time when many people would be recovering from the traumatic impact of WW2.
- Set at a time of great divisions between the upper and lower classes.
- Women were seen as subservient and inferior to men – rich women had to marry well and poor women were seen as cheap labour. After WW2, women had a much more valued place in society.
- In 1945 there was a great desire for change in society and J. B. Priestley wanted to make the most of this.

Setting:

- The play is set in the fictional town of 'Brumley', an industrial town in the north of England.
- All of the action takes place in the dining room of the Birling household. They are a well off family and live in a comfortable house suited to their wealth and status.
- The lighting should be 'pink and intimate' at the start of the play but when the Inspector arrives it should become 'brighter and harder' which reflects the changing mood in the play.

ACT 1

The Birling family are celebrating Sheila and Gerald's engagement. Mr Arthur Birling, Sheila's father, is particular pleased since the marriage means closer links with Crofts Limited. When the women leave the room, Mr Birling lectures his son, Eric and Gerald about the importance of every man looking out for himself if he wants to get on in life. The doorbell rings unexpectedly during Mr Birling's speech to Eric and Gerald and Inspector Goole arrives.

Inspector Goole says that he is investigating the death of a young woman who committed suicide, Eva Smith.

Mr Birling is shown a photograph of Eva, after initially denying recognising the woman in the photo, he remembers firing her in 1910 for organising a strike over workers pay. Birling feels justified for his actions and does not believe he committed any wrongdoing.

The investigation moves to Sheila. Sheila recalls also having Eva sacked about her manner when served by her in an upmarket department store. Sheila regrets her actions and feels hugely guilty and responsible for Eva's death.

The Inspector reveals that Eva Smith changed her name to Daisy Renton. Gerald acts guilty and Sheila notices his worry, she confronts Gerald when the Inspector leaves the room. Gerald reveals to Sheila he had an affair with Daisy Renton.

ACT 2

Gerald explains to The Inspector that he had an affair with Eva, but hasn't seen her since he ended their relationship back in Autumn 1911.

Sheila gives her engagement ring back to Gerald.

The Inspector turns his attention to Mrs Sybil Birling, she confesses that she also had contact with Eva, but Eva gave herself a different name to Mrs Birling.

Eva approached a charity chaired by Mrs Birling to ask for help. Eva was desperate and pregnant but help was refused by Mrs Birling because she was offended by the girl calling herself 'Mrs Birling'. She tells Eva that the baby's father should be made entirely responsible.

She also tells Inspector Goole that the father should be held entirely responsible and should be made an example of.

ACT 3

Eric is revealed as the father. He stole money from Mr Birling's office to provide money to Eva. Eric is angry at his mother when he learns that she has refused to help Eva.

The Inspector tells them that they are all partly to blame for Eva's death and warns them of the consequences of people not being responsible for each other, *"If men will not learn that lesson, when they will be taught it in fire and blood and anguish"*.

After Inspector Goole leaves, the family begin to suspect that he was not a genuine police inspector. A phone call to the Chief Constable confirms this. Next, they phone the infirmary to be informed that no suicide case has been brought in.

Mr Birling, Mrs Birling and Gerald congratulate themselves that it was all a hoax and they continue can continue as before. This attitude upsets Sheila and Eric.

The phone rings. Mr Birling announces to the family that a girl has just died on her way to the infirmary, a police inspector is coming to question them.

MR BIRLING

- Worked his way up in the world and is **proud** of his achievements..
- Aware of people who are his social superiors.
- He is **optimistic** for the future and confident that there will not be a war. As the audience knows there *will* be a war, we begin to doubt Mr Birling's judgement.
- He is extremely **selfish**.
- At the end of the play, he knows he has lost the chance of his knighthood and his reputation but he is unable to admit his responsibility for his part in Eva's death.

MRS BIRLING

- She is a **snob**, very aware of the differences between social classes.
- She has the least respect for the Inspector of all the characters.
- She sees Sheila and Eric still as "children" and speaks patronisingly to them.
- She **tries to deny things** that she doesn't want to believe.
- At the end of the play, like her husband, she refuses to believe that she did anything wrong and doesn't accept responsibility for her part in Eva's death.

Sheila

- Even though she seems very playful at the opening, we know that she has had suspicions about Gerald which maybe suggests she is not as naïve as she seems.
- She feels full of **guilt** for her jealous actions and blames herself.
- She is very **perceptive**: she realises that Gerald knew Daisy Renton from his reaction.
- She is **curious.**
- She is **angry** with her parents in Act 3 for trying to "pretend that nothing much has happened."
- At the end of the play, Sheila is much **wiser.**

ERIC

- Eric seems **embarrassed and awkward** right from the start.
- It soon becomes clear that he is a **hardened drinker**.
- He feels **guilt and frustration** with himself over his relationship with the girl.
- He had some **sense of responsibility**, though, because although he got a woman pregnant, he was concerned enough to give her money.
- He is appalled by his parents' inability to admit their own responsibility.
- At the end of the play, like Sheila, he is fully aware of his social responsibility.

GERALD

- He is an **aristocrat**.
- He is not as willing as Sheila to admit his part in the girl's death to the Inspector and initially pretends that he never knew her.
- He did have some genuine feeling for Daisy Renton.
- Despite this, in Act 3 he tries to prove that the Inspector is a fake - because that would get him off the hook.
- At the end of the play, he has not changed. He has not gained a new sense of social responsibility, which is why Sheila (who has) is unsure whether to take back the engagement ring.

THE INSPECTOR

- He works very **systematically**.
- He is a figure of **authority.** He deals with each member of the family very firmly.
- He seems to **know and understand** an extraordinary amount.
- All this **mystery** suggests that the Inspector is not a 'real' person. So, what is he?
    - Is he a ghost? Goole reminds us of 'ghoul'.
    - Is he the voice of Priestley?
    - Is he the voice of our consciences?

OLDER Vs YOUNGER GENERATION

- The play implicitly draws out a significant contrast between the older and younger generations of Birlings.
- While Arthur and Sybil refuse to accept responsibility for their actions toward Eva Smith (Arthur, in particular, is only concerned for his reputation and his potential knighthood), Eric and especially Sheila are shaken by the Inspector's message and their role in Eva Smith's suicide.
- The younger generation is taking more responsibility, perhaps because they are more emotional and idealistic, but perhaps because Priestley is suggesting a more communally responsible socialist future for Britain.
- Gerald Croft is caught in the middle, being neither very young nor old. In the end he sides with the older generation, perhaps because his aristocratic roots influence him to want to keep the status quo and protect his own interests.

Example Paragraphs

During the celebration of Shelia and Gerald's engagement Mr Birling gives a speech about how the "Titanic is unsinkable and the Germans don't want war". Priestly purposefully uses dramatic irony to depict the Edwardian upper class society as highly ignorant. This is as the "Titanic" did sink on her maiden voyage and "war' did break out two years after the play was set. The fact that the play is set in 1918 and written in 1945 is significant as it allows the audience to acknowledge the mistakes made in the past and learn from them. The play would has resonated with the post WW2 audience as they had just endured two World Wars and there was a clear need for change.

The Inspector makes a dramatic entrance in act one, signalled by the "sharp ring of the front door bell". He literally interrupts Mr Birling's monologue, which shuns collective responsibility, and advocates an individualistic approach to society. Birling is mid utterance, selfishly claiming that "community" is merely "nonsense" and that "a man has to mind his own business and look after himself and his own" when the audience hears the door bell. The interruption is heightened by the fact that the ring is a "sharp" one. Perhaps the person calling is going to sharply disagree with Birling's attitude; perhaps he is going to shed a new light on society's obsession with individual success as opposed to collective responsibility. Priestley uses the dramatic device of the carefully timed door bell as an indicator that we should not take Birling's advice seriously; that a challenge is going to be made to his morally questionable attitude.

DRAMATIC TECHNIQUES

Lighting – a metaphor for truth and signals the uneasy atmosphere the Inspector creates when it changes to become 'brighter and harder' after his arrival. The Inspector also brings people into the 'light' to show them the photo of Eva Smith.
Sound effects – the 'sharp' ring of the doorbell cuts off Mr Birling as he making a very selfish speech at the start of the play. It indicates that the Inspector will be a 'sharp' intrusion into their way of life. At the end of the play, there is the 'sharp' ring of the telephone which cuts off Mr Birling as he celebrating getting away with it.
Exits and entrances – a feature of the 'Well Made Play'. Exits and entrances are timed perfectly to increase dramatic tension e.g. Sheila arrives just as the focus of the investigation shifts to her, Sheila and Gerald are left alone on stage as Sheila realises that Gerald has been unfaithful to her.
Cliff-hanger – at the end of each Act there is a cliff-hanger to create dramatic tension and suspense which is another feature of the 'Well Made Play'.
Dramatic irony – where the audience know more than the characters. This is used with Mr Birling in Act 1 when he makes a series of incorrect predictions. It shows him to be a pompous and arrogant character who is not to be trusted.
Retrospective irony – when events take on a greater significance at the end of the play e.g. Eric's outburst in Act 1 is an early sign of him drinking too much and Eric's reference to Sheila's 'nasty temper' becomes more significant when we realise her role in Eva Smith's death.

SOCIAL RESPONSIBILITY

- The words **responsible** and **responsibility** are used by most *characters* in the play at some point.
- Each member of the family has a different attitude to responsibility.
- The Inspector wanted each member of the family to share the responsibility of Eva's death: he tells them, "each of you helped to kill her."
- In his final speech, the Inspector is talking about a collective responsibility, everyone is society is linked, in the same way that the characters are linked to Eva Smith.
- "We do not live alone," the Inspector says in his final speech, "we are members of one body." This perhaps is the most important and central theme of the play: that we have a duty to other people, regardless of social status, wealth, class, or anything else.
- There is, Priestley observes, such a thing as society, and he argues that it is important that people be aware of the effects of their actions on others. The Birlings initially do not think at all about how they might have affected Eva Smith, but they are forced to confront their likely responsibility over the course of the play.

Social Class

- Taking the play from a socialist perspective inevitably focuses on issues of social class.
- Class is a large factor, indirectly, in the events of the play and Eva Smith's death. Mrs. Birling, Priestley notes, is her husband's social superior, just as Gerald will be Sheila's social superior if they do get married. Priestley also subtly notes that Gerald's mother, Lady Croft, disapproves of Gerald's marrying Sheila for precisely this reason.
- Finally, everyone's treatment of Eva might be put down (either in part or altogether) to the fact that she is a girl, as Mrs. Birling puts it, "of that class." Priestley clearly was interested in the class system and how it determines the decisions that people make. In the play he is trying to show that the upper classes are unaware and perhaps don't care that their easy lives rest upon the hard work of the lower classes.

Sex

- As a working class woman, Eva Smith was really the 'bottom of the pile' in society.
- Women had very little rights or opportunities in society. They were not allowed to vote and even the best an upper class woman could hope for would be to marry well.
- A job was crucial to lower class women like Eva. If they lost their job there was very little support out there and many were forced into prostitution.

Year 10

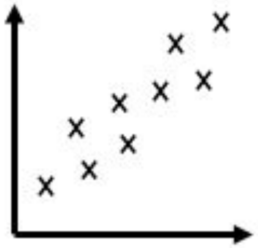
Mathematics

Year 10 Maths Revision

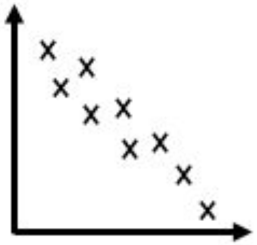
What I must know			
Knowledge of scatter graphs and correlation (What types - describe)			
Knowledge of cumulative frequency, box plots and histograms			
Knowledge of averages (including frequency tables)			
Knowledge of powers, roots & Indices			
Knowledge of standard form			
How to work out Linear & Geomteric sequences			
Be confident with Trigonometry problems			
Be using Hegarty Maths for Homework and Revision			

Scatter Graphs

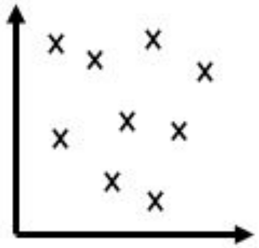
Shows the **relationship** or **correlation** between **two variables**



Positive correlation
As one value goes up, the other value goes up

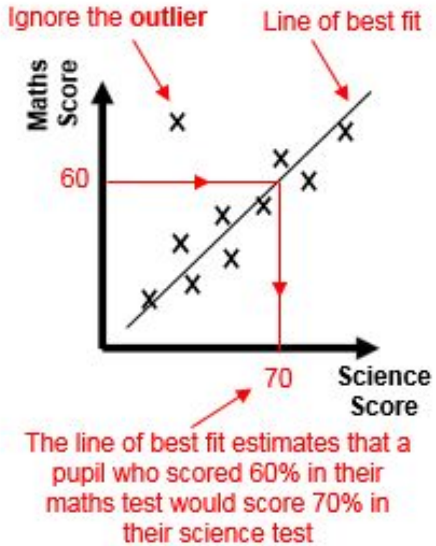


Negative correlation
As one value goes up, the other value goes down



No correlation
There is no obvious relationship

- A **line of best fit** can be used to make **predictions** for other results.
- The line of best fit follows the general correlation of the points, with roughly half the points above the line, and half the points below the line.
- The line of best fit should ignore any **outliers** (points that do not fit the general correlation).
- If the correlation is **strong**, all the points will closely follow the line of best fit
- If the correlation is **weak**, the points will still follow the general pattern, but the points will be further away from the line of best fit.



Averages from a List of Values

$$\underline{\text{MEAN}} = \frac{\text{Total of values}}{\text{Number of items in list}}$$

RANGE = **Highest value – Lowest value**

MODE = **Most common**
- **Bi-modal** data has **two modes**
- Some data sets will have **no mode**

MEDIAN = Middle value
- Data **must** be in size order first.
- If there are two middle values, then the median is half-way between the two.

Averages from a Frequency Table

Number of pets (p)	Frequency (f)	p x f
0	5	0
1	7	7
2	11	22
3	2	6
4	0	0
Total	**25**	**35**

MODE = **Category with the most entries**
(i.e. the category with the highest frequency)
Highest frequency is 11 for "2 pets", so MODE = 2

RANGE = **Difference between highest category value and lowest category value**
Highest number of pets = 3 (nobody has 4 pets)
Lowest number of pets = 0
RANGE = 3 – 0 = 3

MEDIAN = **Category that contains the middle value**
Location = $\frac{n+1}{2} = \frac{25+1}{2}$ = 13th value in table.
Add down frequency column – when location value has been exceeded, median is in this category.
MEDIAN = 2 pets

MEAN:
1) Multiply each category by its frequency – this is column "p x f" in table
2) Add these values together – sum of "p x f" column is 0 + 7 + 22 + 6 + 0 = 35
3) Divide by the total frequency – MEAN = 35 ÷ 25 = 1.4 pets

Averages from a Grouped Frequency Table

Weight (w kg)	Frequency (f)	Midpoint (m)	m x f
$0 \le w < 10$	3	5	15
$10 \le w < 20$	9	15	135
$20 \le w < 30$	6	25	150
$30 \le w < 40$	2	35	70
Total	**20**	-	**370**

MODAL CLASS = **Class with the most entries / highest frequency**
Highest frequency is 9, so
MODAL CLASS = $10 \le w < 20$

RANGE = **Difference between highest class boundary and lowest class boundary**
Highest class boundary = 40kg
Lowest class boundary = 0kg
RANGE = 40 – 0 = 40kg

MEDIAN CLASS = **Class that contains the middle value**
Location = $\frac{n+1}{2} = \frac{20+1}{2}$ = 10.5th value in table. (i.e. half way between 10th and 11th value).
Add down frequency column – when location value is exceeded, median is in this class.
MEDIAN CLASS = $10 \le w < 20$

ESTIMATE THE MEAN:
1) Find the midpoint of each class frequency – this is column "m" in table
2) Multiply each midpoint by its frequency – this is column "m x f" in table
3) Add these values together – sum of "m x f" column is 15 + 135 + 150 + 70 = 370
4) Divide by the total frequency – ESTIMATED MEAN = 370 ÷ 20 = 18.5kg

Cumulative Frequency

Shows the total frequency so far. Can be used to estimate the key values for a grouped data set.

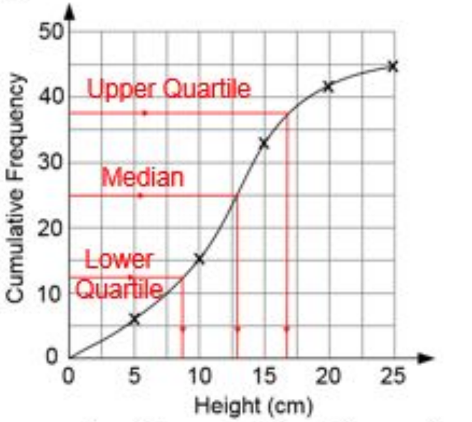
Height (cm)	Freq.	Cumulative Frequency
$0 < h \le 5$	7	0 + 7 = 7
$5 < h \le 10$	8	7 + 8 = 15
$10 < h \le 15$	18	15 + 18 = 33
$15 < h \le 20$	9	33 + 9 = 42
$20 < h \le 25$	3	42 + 3 = 45

Step 1: Complete the "Cumulative Frequency" column with the running total.

Step 2: Plot data classes along the x-axis, and cumulative frequency along the y-axis.

Step 3: Plot each point at the **upper boundary** for each class.

Step 4: Join the points with a **smooth curve**.



Read along and down the graph for the key values

LQ = ¼ of the way up the side ≈ $8cm$

Median = ½ way up the side ≈ $13cm$

UQ = ¾ of the way up the side ≈ $17cm$

Histograms

Used for **continuous data** that has been **grouped into classes**. Similar to a bar chart, but the bars can have **different widths**. It is the **area** of each bar that tells you the **frequency** for each class.

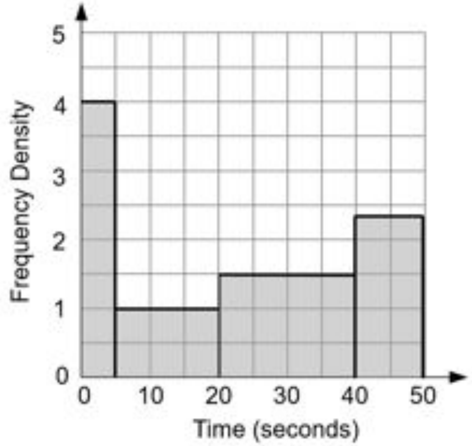
Step 1: Calculate the **frequency density** using the formula

$$Frequency\ Density = \text{Frequency} \div Class\ Width$$

Step 2: Plot the data classes along the horizontal axis, and frequency density on the vertical axis

Step 3: Draw bars at correct heights with no gaps.

Time (sec)	Freq.	Frequency Density
$0 \le w < 5$	20	20 ÷ 5 = 4
$5 \le w < 20$	15	15 ÷ 15 = 1
$20 \le w < 40$	30	30 ÷ 20 = 1.5
$40 \le w < 50$	23	23 ÷ 10 = 2.3



Box Plots

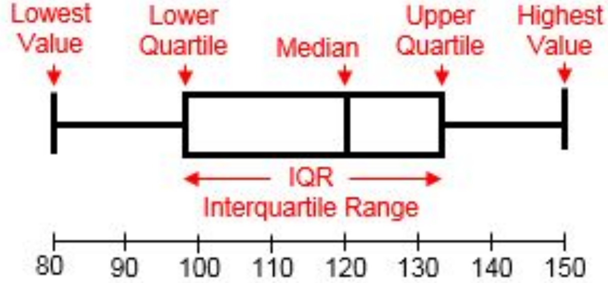
Shows the spread of a data set.

For a data set with n values

Lower Quartile (LQ) 25% : $(n+1)/4$

Median 50% : $(n+1)/2$

Upper Quartile (UQ) 75% : $3(n+1)/4$



Interquartile Range (IQR) = Middle 50% of values = Upper Quartile – Lower Quartile

Standard Form

Useful for writing very big or very small numbers in a shortened way.

Must always be in the format: $A \times 10^n$

This number is **always between 1 and 10** (it can be equal to 1, but must be less than 10)

An integer value – it is **the number of places that the decimal point moves**

n **is positive for big numbers:** $73800 = 7.38 \times 10^4$

Move the decimal point until 73800 becomes 7.38

The decimal point has moved **four places.** 73800 is a big number, so the power of 10 is +4

n **is negative for small numbers** $0.0425 = 4.25 \times 10^{-2}$

Move the decimal point until 0.0425 becomes 4.25

The decimal point has moved **two places.** 0.0425 is a small number, so the power of 10 is –2

To **multiply or divide** numbers in standard form:

1) Multiply or divide the front numbers
2) Use the laws of indices to simplify the powers of 10
3) Convert your answer to standard form

$(8 \times 10^7) \times (2 \times 10^{-3})$

$= (8 \times 2) \times (10^7 \times 10^{-3})$

$= 16 \times 10^4$

$= 1.6 \times 10^5$

To **add or subtract** numbers in standard form:

1) Make sure both numbers have the same power of 10
2) Add or subtract the front numbers
3) Convert your answer to standard form

$(9.4 \times 10^5) + (6.2 \times 10^3)$

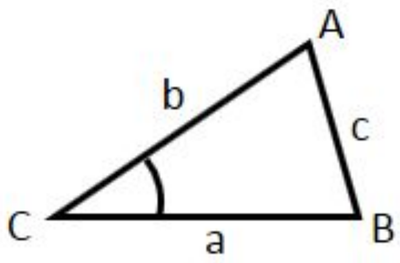
$= (940 \times 10^3) + (6.2 \times 10^3)$

$= 946.2 \times 10^3$

$= 9.462 \times 10^5$

Area of a Triangle and Sine Rule

For any triangle with vertices A, B and C and sides a, b and c:



Area of Triangle $= \frac{1}{2} \times a \times b \times Sin\ C$

$$\frac{Sin\ A}{a} = \frac{Sin\ B}{b} = \frac{Sin\ C}{c}$$

$$\frac{a}{Sin\ A} = \frac{b}{Sin\ B} = \frac{c}{Sin\ C}$$

Laws of Indices

For any values of a and b, and any integer values of m and n

$a^m \times a^n = a^{m+n}$ $\quad a^1 = a$

$a^m \div a^n = a^{m-n}$ $\quad a^0 = 1$

$(a^m)^n = a^{m \times n}$

$(ab)^n = a^n b^n$

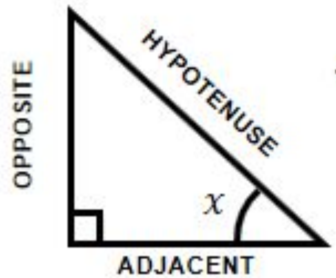
$a^{-n} = \frac{1}{a^n}$

$a^{1/n} = \sqrt[n]{a}$

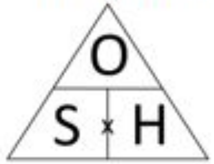
$a^{m/n} = (\sqrt[n]{a})^m = \sqrt[n]{(a^m)}$

Trigonometry Ratios

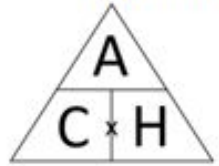
Applies to any right-angled triangle. Always start by labelling the **Hypotenuse** (opposite the right-angle), **Opposite side** and **Adjacent side** (in relation to the angle involved in the question), then pick the formula that involves the two sides in the question.



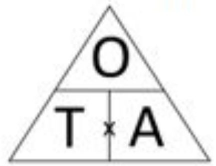
$Sin\ x = \frac{Opposite}{Hypotenuse}$



$Cos\ x = \frac{Adjacent}{Hypotenuse}$



$Tan\ x = \frac{Opposite}{Adjacent}$



Sequences

A **sequence** is just a list of numbers or patterns which follow a **particular rule**.

Numbers in a sequence are called **terms**.
A **term-to-term rule** tells you how to use the **previous term** in the sequence to create the **next term.**
The **n-th term rule** tells you how to create the 1st, 2nd, 3rd term etc. by **substituting** different values of n into the rule.

Linear sequence:
Terms **increase (or decrease) by the same amount** each time.
Can create the next term in the sequence by adding (or subtracting) the **common difference** to the previous term.

Example: 2 , 5 , 8 , 11 , 14 , ...

Find the common difference: +3 +3 +3 +3 → 3n is in the nth term rule

Subtract 3n from terms in sequence:

Sequence:	2 , 5 , 8 , 11 , 14 , ...
3n:	3 , 6 , 9 , 12 , 15 , ...
Seq. – 3n :	–1 , –1 , –1 , –1 , –1 , ...

→ Need to –1 to get correct sequence

Put both parts together: **nth term = 3n – 1**

Geometric sequence:
The next term is created by **multiplying the previous term by some constant value**.

Example: 1 , 3 , 9 , 27 , 81 , ...
x 3 x 3 x 3 x 3 → Rule is "Multiply previous term by 3"

Fibonacci sequence:
The next term is created by **adding together the two previous terms**.

Example: 1 , 1 , 2 , 3 , 5 , 8 , 13 , ...
+ 1 + 1 + 2 + 3 + 5

Quadratic sequence:
The n-th term rule has an **n² term** in it.
The first difference between the terms changes as you go through the sequence.
The second difference between the terms remains the same.

Example: 2 , 4 , 8 , 14 , 22 , ...

Find the first difference: +2 +4 +6 +8

Find the second difference: +2 +2 +2

Half this difference gives the coefficient of n²: 2 ÷ 2 = 1 → n²

Subtract n² from terms in sequence:

Sequence:	2 , 4 , 8 , 14 , 22 , ...
n²:	1 , 4 , 9 , 16 , 25 , ...
Seq. - n²:	1 , 0 , –1 , –2 , –3 , ...

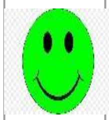
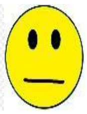
Find the rule for the n-th term of this linear sequence: –1 –1 –1 → nth term: – n + 2

Add this to the n² term for the final answer: **nth term = n² – n + 2**

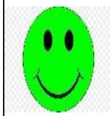
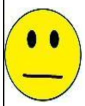
Year 10

Science

Year 10 Maths Revision

What I must know			
Knowledge of scatter graphs and correlation (What types - describe)			
Knowledge of averages (including frequency tables)			
Knowledge of powers, roots & Indices			
How to work out Linear & Geomteric sequences			
Be confident with Trigonometry problems			

Year 10 Science Revision

What I must know Prior Learning: Chemistry Prior Learning: Biology New Learning Physics			
Label: The reactivity series of metals.			
Energy change in exothermic reactions			
Energy profile (level) diagrams			
Explain the role of white blood cells in protecting us against pathogens.			
Interpret graphs about vaccinations and antibody production			
Draw particle diagrams: The three states of matter – solid, liquid, gas			
Internal energy relating to solids, liquids and gases			
Calculating density			
Half life of radioactive substances			
Properties of alpha, beta and gamma radiation			
Vector quantities and forces			

Biology Knowledge Organiser
B6 - Preventing and treating disease

REVISION FROM CYCLE 1

Human defence systems

Pathogens are all over the place, so humans have evolved defence systems to deal with them. We have **non-specific defences**, which keep pathogens from entering the body (although, of course, they can fail to do this – otherwise you'd never get sick!). If pathogens do get in, we have the **immune system**, which destroys the pathogen inside the body.

Non-specific defences:

- The **skin**! Our main barrier against pathogens getting in. The vast majority of pathogens cannot get through the skin at all – they have to enter somewhere else. Also, the skin scabs over to provide a quick barrier if there is a cut or wound.
- The **nose** has hairs and mucus to trap microorganisms so they don't get any further than the nose. If you don't blow your nose, the mucus ends up in the back of the throat and you swallow it – this is harmless, because the stomach acid kills any microorganisms in there.
- The **trachea** and **bronchi** also contain mucus. This traps microorganisms that are breathed in, and the mucus, again, can be swallowed harmlessly.
- The **stomach** produces hydrochloric acid (at pH 2), which kills most microorganisms that are swallowed.

The immune system responds if pathogens enter the body properly – i.e. if they get into the bloodstream. The most important cells in the immune system are the white blood cells. They help defend against pathogens by:

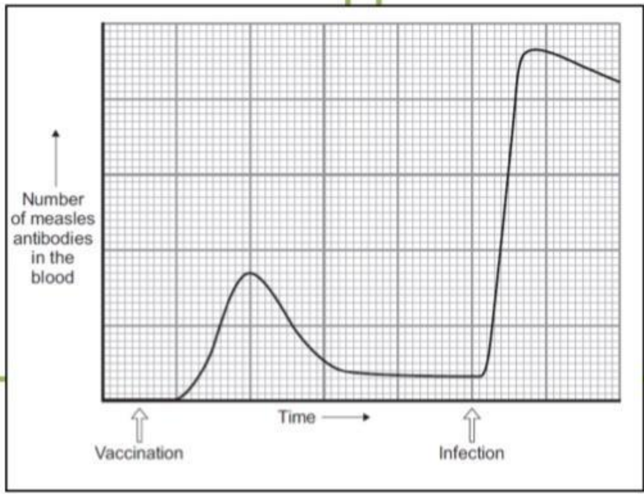
- **Phagocytosis**. This is the *engulfing* and *digesting* of pathogens by white blood cells, destroying the pathogens.
- **Antibody production**. White blood cells produce chemicals called antibodies that bind to pathogens and destroy them. These are *specific*, meaning only one particular antibody type will bind to one particular pathogen.
- **Antitoxin production**. Some pathogens, especially bacteria, produce poisonous toxins. These are neutralised by antitoxins – another sort of chemical produced by white blood cells. Again, antitoxins are specific to specific toxins.

Key Terms	Definitions
Defence systems	Structures and mechanisms we have to prevent pathogens entering the body, and to fight them off if they do enter. Includes non-specific defences (act on any pathogen) and specific defences (target the particular pathogen you've been infected by).
Mucus	A sticky substance produced by many epithelial (surface-covering) tissues in the body, to trap dust particles and microorganisms so they can't enter the body.
Antibody	Chemical produced by white blood cells that destroys specific pathogens.
Antitoxin	Chemical produced by white blood cells that neutralises specific toxins.

Vaccination

Vaccination is great on two fronts: it stops the vaccinated individual from getting ill AND it helps prevent the spread of communicable diseases. If a large proportion of the population is vaccinated, it is very unlikely that an *unvaccinated* person would be exposed to the pathogen, so everyone is protected.

1. A vaccine contains a small quantity of a **dead or inactive** form of a **pathogen** (usually a virus, such as the measles virus – see graph).
2. Delivering a vaccine stimulates a **primary** immune response. White blood cells produce antibodies to destroy the pathogen, but this is slow.



3. Specialised white blood cells (memory cells) remain in the blood afterwards.
4. This means that if an infection by the real pathogen takes place in the future, there is a **secondary** immune response by the white blood cells, which is *quicker* than the primary immune response.
5. The secondary immune response starts faster (see graph), involves the production of far more antibodies (a *stronger* response) and the level of antibodies stays higher for longer.
6. This means the pathogen is destroyed before you even realise you are ill.

REVISION FROM CYCLE 2

Chemistry Knowledge Organiser
C7 - Energy changes

Energy in Reactions

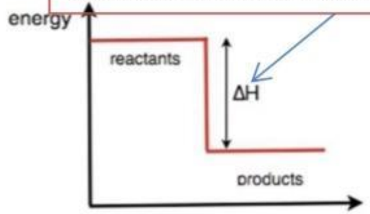
Energy is conserved in chemical reactions. The amount of energy in the **universe at the end** of a chemical reaction **is the same as before the reaction** takes place. In a chemical reaction, bond breaking and bond making occur. To break a chemical bond you need to overcome the force of attraction in the bond, this process requires energy therefore it is **endothermic.** The process of bond formation is **exothermic,** energy is released when bonds form. In a chemical reaction the difference between the energy required to break the bonds and the energy gained from making the bonds will decide whether a reaction is exothermic or endothermic.
Chemical reactions can therefore be divided into exothermic and endothermic chemical reactions.

	What happens?	Why?	Example
Exothermic	Heat energy is transferred to the surroundings.	The energy required to break chemical bonds is less than the energy gained from making chemical bonds. Therefore the excess is given off as heat to the surroundings.	Combustion reaction, reactions used in hand warmers
Endothermic	Heat energy is taken in from the surroundings	The energy required to break chemical bonds is more than the energy gained from making chemical bonds. Therefore heat is taken in from the surroundings.	The reaction of citric acid and sodium hydrogencarbonate, the reactions used in ice packs

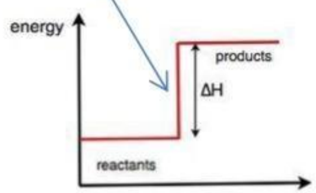
Reaction Profiles

Reminder from topic 15: Chemical reactions can occur only when reacting particles collide with each other and with sufficient energy. The minimum amount of energy that particles must have to react is called the **activation energy**. **Reaction profiles** can be used to show the relative energies of reactants and products, the activation energy and the overall energy change of a reaction.

This is the reaction profile of an **exothermic reaction,** the energy of the products is lower than that of the reactants. The difference in energy is released as heat to the surroundings.



This is the reaction profile of an **endothermic reaction,** the energy of the products is higher than that of the reactants. The difference in energy is taken in from the surroundings.

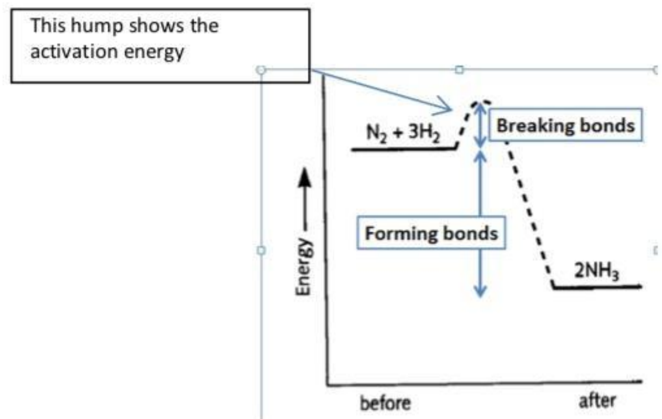


Key Terms	Definitions
Reaction Profile	A graph which shows the energies of the products and reactants in a chemical reaction
Exothermic	A reaction that gives out heat to the surroundings
Endothermic	A reaction that takes heat in from the surroundings

Reaction Profiles- In more detail

The profile below shows the reaction which makes ammonia from nitrogen and hydrogen. The equation is given below:

$N_2 + 3H_2 \rightarrow 2\ NH_3$



There are some key features to highlight on this graph ,firstly the curved section represents the **activation energy** for this reaction, this hump shows how much energy is required to break the bonds in the reactants. To overcome the activation energy we often need to heat our reactants. The products are lower in energy than the reactants, this means it is an **exothermic reaction.** As the excess energy is given out to the surroundings. as heat **energy.**

Calculating bond energies -higher tier.

The difference between the sum of the energy needed to break bonds in the reactants and the sum of the energy released when bonds in the products are formed is the overall energy change of the reaction.
For example consider the reaction:

$N_2 + 3H_2 \rightarrow 2\ NH_3$

To work out the overall energy change you will need to subtract, the energy gained from forming the bonds in ammonia, from the energy required to break the nitrogen and hydrogen bonds. This will give you the overall energy change, if the value is negative then the reaction is exothermic, if the value is positive the reaction is endothermic

Physics Knowledge Organiser

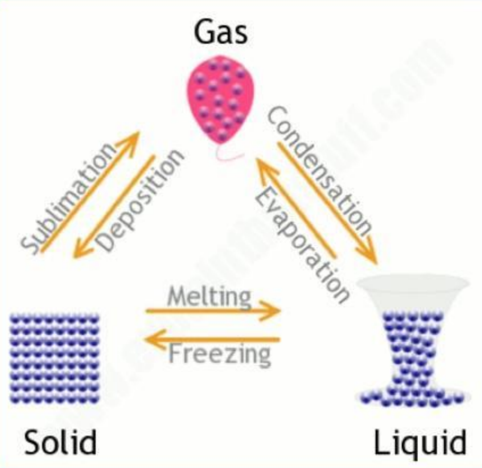
P6 - Particle model of matter

States of matter and changes of state

Study the diagram. The particle model is used to explain differences between solids, liquids and gases, and to explain how changes from one state to another happen. Make sure you know how to draw the particles arrangement in each state, and know all the names for each state change shown on the diagram.

In a solid, the particles are **fixed in position** and only vibrate – they can't flow around. In a liquid, the particles are still **very close together** but they can **flow** past each other. In a gas, the particles move **randomly** and there is **empty space** between them.

In changes of state, no new substance is produced and there is no change in the **mass** of the substance. This is because no particles are created or destroyed.



Density and the particle model

The particle model explains why 1 kg of a gas will have a **much** larger volume than 1 kg of a solid. This is because there is empty space between the particles in a gas, whereas in a solid, they are tightly packed together. Looking at the equation below, you should see that in this example the *m* is the same (1 kg), but the volume for the gas is much larger. Since we divide by volume, this must mean that the **density** of the gas is much smaller than the density of the solid.

Density of regular and irregular shaped objects

To calculate the density of a regular shaped object we can use a ruler to measure length and then calculate the volume. We find the mass of the object by using a mass balance then calculate the density using the equation.

To calculate the density of an irregular shaped object we use a displacement can. The can is filled with water just above the spout. The irregular shaped object is placed in the can and the water level rises. The displaced water will come out of the spout and can be collected in a measuring cylinder. The volume of this displaced water is the volume of the irregular shape. The density equation can then be used to find the density of the object.

Key Terms	Definitions
Model	Models are used all the time in science. A model represents the real world and can explain many things about the universe. However, models are never perfect and there are limits to what they can explain. That doesn't stop them being extremely useful though!
Particle model	The model that represents molecules or atoms as small, hard spheres. The important things to think about when using the particle model are the **arrangement** of the particles in each state of matter and the **kinetic energy** of the particles.
State of matter	The physical arrangement of particles determines the state of a particular substance: solid, liquid or gas. Changing from one state of matter to another is a physical process, NOT a chemical process. No new substance is produced, and if you reverse the state change, you have a substance with exactly the same properties as the stuff you started with.
Density	The quantity that defines how much material (i.e. mass) is in a certain volume. See equation. If you have two objects the same size but different densities, the more dense object will feel heavier in your hand as there is more mass in the same volume.
Melt/freeze	The change of state from solid to liquid/liquid to solid.
Evaporate/ condense	Change of state from liquid to gas/ gas to liquid.
Boil	Like evaporation, boiling is a change of state from liquid to gas. However, boiling involves heating of the liquid so it boils, rather than particles on the surface of the liquid becoming gas (like in evaporation).

Equation	Meanings of terms in equation
$\rho = \frac{m}{V}$ *	*ρ = density (kilograms per metre cubed, kg/m^3)* *m = mass (kg)* *V = volume (metres cubed, m^3)*

Physics Knowledge Organiser

P7 – Atomic structure

Types of nuclear radiation

As you've seen, the rate of decay is measured in Bq, or can be measured as the count rate in Bq. What it actually 'counts' is the amount of radiation hitting the detector each second. The radiation emitted from the nucleus thanks to radioactive decay can be:

- An **alpha particle** (symbol: α). An alpha particle is made of two protons and two neutrons (making it identical to the nucleus of helium atoms). Since there are four subatomic particles in one alpha particle, it has a mass number of 4. Since there are two protons in an alpha particle, it has a proton number of 2.
- A **beta particle** (symbol: β). A beta particle is a high speed electron. Beta particles are emitted during a type of radioactive decay where a neutron turns into a proton. This process also makes an electron, and electrons aren't 'allowed' in nuclei, so it gets fired out.
- A **gamma ray** (symbol: γ). Yes, the same wave as in the electromagnetic spectrum. It has a very high frequency and very short wavelength.
- A **neutron** (symbol: n). An uncharged particle – you know all about them already.

Alpha, beta and gamma

As well as being different in form, alpha, beta and gamma are also different in terms of how they behave after emission from a nucleus.

Type of nuclear radiation	Range in air	Penetrating power	Ionising power
Alpha	A few centimet-res	Not very penetrating at all: absorbed by a thin sheet of paper.	Strongly ionising (as alpha particles are large and have a +2 charge)
Beta	A few metres	Fairly penetrating: completely absorbed by a sheet of aluminium 5mm thick.	Moderately ionising (as not as big as alpha particles and their charge is smaller, -1)
Gamma	Enormous distances	Penetrates most materials. Absorbed only by several metres of concrete or a thick sheet of lead.	Only weakly ionising.

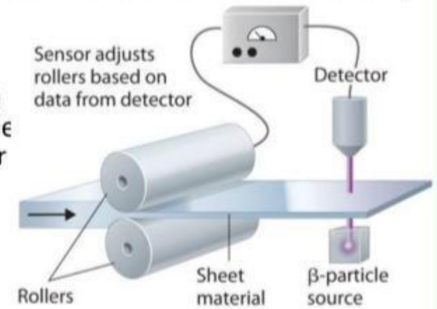
Key Terms	Definitions
Emission	Releasing or giving out. Nuclear radiation is **emitted** during radioactive decay.
Penetration	Passing through a material. Different types of nuclear radiation can penetrate different materials, and are absorbed by certain materials.
Ionisation	The process of making an ion by 'knocking off' electrons. Ionising radiation causes this, and can break up molecules into ions which go on to react with other chemicals. This is very dangerous in living organisms.

Using nuclear radiation

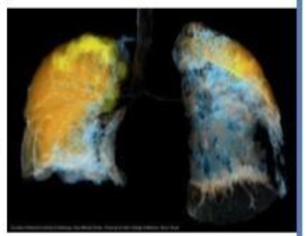
Nuclear radiation can be very useful. Here are some examples: notice that the type of nuclear radiation used depends on exactly what you need it for, so it links to the properties in the table opposite.

Radiotherapy: this is a treatment for cancer, using gamma rays. Gamma rays easily penetrate body tissues, so they can reach a tumour e.g. in the brain. The gamma rays can kill the cancer cells. However, since gamma rays are dangerous to healthy tissue, they use beams of gamma rays from many angles to the tumour, so healthy cells between source and tumour are not affected too badly.

Monitoring thickness of paper in a factory: As the diagram shows, a beta source is used. This is because beta will pass through materials such as paper. The detector on the other side of the sheet will measure a lower count rate if the sheet gets too thick, and a higher count rate if it gets too thin. The rollers can be automatically adjusted to fix this.



Medical diagnosis: sources of radiation can be taken into the body and the nuclear radiation monitored from the outside to give information about body function.



Obviously, alpha is NOT suitable for this as it won't penetrate body tissues to get to the detector! For example, a radioactive xenon isotope can be inhaled to check lung function. On the image, the left lung isn't getting much air to the bottom parts.

Physics Knowledge Organiser

P7 – Atomic structure

Nuclear equations

To show what happens to an atom when it radioactively decays, we use nuclear equations. In these equations, we represent alpha and beta particles as shown in the key terms table.

Recalling what an alpha particle actually is (2 protons and 2 neutrons), it is clear that a nucleus going through alpha decay loses 4 subatomic particles (so the mass number has to **decrease** by *four*). Two of those are *protons*, so the *atomic number* must decrease by 2. Here's an example:

$$^{219}_{86}\text{radon} \longrightarrow {}^{215}_{84}\text{polonium} + {}^{4}_{2}\text{He}$$

This shows that a radon nucleus decays to produce a polonium nucleus and an alpha particle.

Beta decay results in a beta particle, and happens because a neutron turns into a proton and an electron. The electron is ejected from the nucleus. Since neutrons and protons have the same mass, the mass number does not change. However, there is an *extra proton*, so the atomic number must increase by one (therefore the charge of the nucleus increases by 1). Here's an example:

$$^{14}_{6}\text{carbon} \longrightarrow {}^{14}_{7}\text{nitrogen} + {}^{0}_{-1}\text{e}$$

This shows that the carbon nucleus decays to produce a nitrogen nucleus and a beta particle.

NB: emission of a gamma ray DOES NOT cause any change to the mass or atomic number.

Radioactive contamination

It is vital to realise that being exposed to nuclear radiation DOES NOT make something radioactive! (Despite what comic books show.) We say the exposed material/object is **irradiated**, and it is dangerous for living cells, as you know.

So, **radioactive contamination** is NOT being exposed to nuclear radiation. It means getting unwanted radioactive materials onto other materials. For instance, spilling a powdered radioactive source onto clothes. This is dangerous because the radioactive material keeps on emitting nuclear radiation through nuclear decay, so it can keep on irradiating the thing its on.

The hazards due to irradiation or contamination mean that *precautions* must be taken. For instance, the radioactive materials (e.g. uranium) used in nuclear power plant is only transferred, stored and used in containers that nuclear radiation can't penetrate. There is ongoing research by scientists into the effects of nuclear radiation on human health. Like all scientific findings, this research should be **published** and receive **peer review** – where other scientists check the methods and analysis performed, to make sure it is right!

Key Terms	Definitions
Mass number	The total number of subatomic particles in the nucleus of an atom (protons + neutrons).
Atomic number	The number of protons in the nucleus of an atom. In other words, the number of positive (+1) charges in the nucleus.
Alpha particle	Can be represented with the symbol: ${}^{4}_{2}\text{He}$
Beta particle	Can be represented with the symbol: ${}^{0}_{-1}\text{e}$
Half-life	The half-life of a radioactive isotope is the average time it takes for the number of radioactive nuclei to halve. It can be also be measured as the time it takes for the count rate of the sample to decrease to half its starting count rate.

Half life

Radioactive decay is **random** – so you don't know which nucleus will decay next. However, with a large number of radioactive nuclei, the time it takes for HALF of them to decay *is* predicable. This differs depending on the particular isotope involved. This length of time is called a **half-life** (see definitions too). Plotting the number of radioactive nuclei OR the count rate against time makes half-life easy to find. Read off the time it takes for the number on the y-axis to decrease by a half. So, in this example, we can see that the half-life of carbon-14 is 5.5 thousand years, whereas the half-life of plutonium-239 is 24 thousand years.

The y-axis could also show count rate (Bq) – the shape of the graph would be identical