



OCR AAQ Applied Science

Summer Independent Learning

Y11-12

Part 1 – Compulsory content (pages 2 -25)

There are 3 sections to the compulsory content (**Biology**, **Physics** and **Chemistry**)

For each section.

1. Watch the videos and complete the notes – you may consider adding flashcards / condensed notes, so you can use them to test yourself (metacognition)
2. Complete all of the questions

This will be assessed in your initial assessment

Part 2 – Highly recommended content (pages 25-31)

There are 3 sections to the highly recommended content (**Biology**, **Physics** and **Chemistry**)

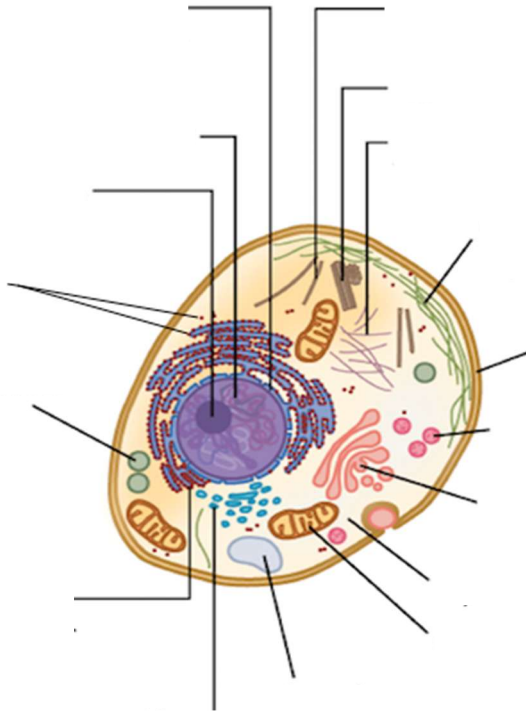
Part 1 – Compulsory Content Pg. 2-25

BIOLOGY

Cells and Microscopy

Q1. Label the cells below

EUKARYOTIC CELL



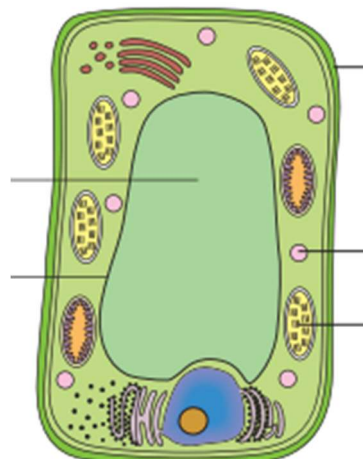
REVIEW

Use the resources below to support you with the questions

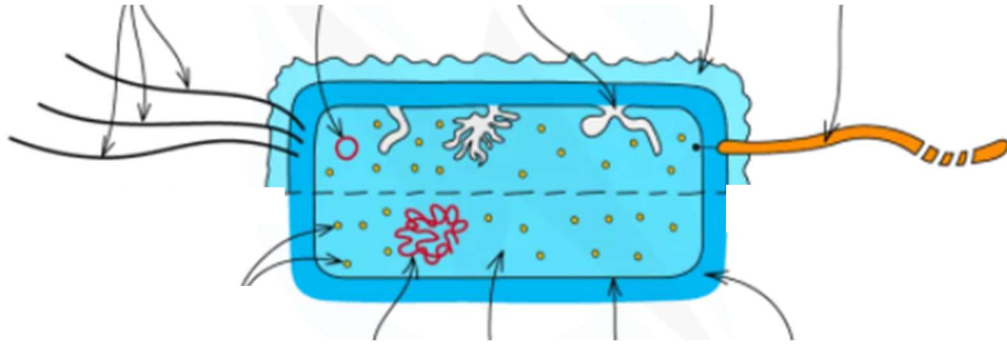


<https://www.savemyexams.co.uk/gcse-biology-aqa-new/revision-notes/>

PLANT CELL



PROKARYOTIC CELL



Microscopy

Q3. When a cell was viewed with a light microscope the image of the cell nucleus had a diameter of 12mm. The cell had been observed at a magnification of X 200. What was the actual size of the nucleus in μm ?

Q4. A red blood cell has a diameter of $8\ \mu\text{m}$. A photograph of a red blood cell was taken using an optical microscope with a magnification of X 1000. What will the diameter of the cell be on the photograph in mm?

Q5. A chloroplast has a diameter of $2\ \mu\text{m}$. The image of a chloroplast observed using an optical microscope had a diameter of 20mm. What was the magnification of the microscope used?

Q6. If a measurement is given in mm how can it be converted to μm ?

Q7. If a measurement is given in μm how can it be converted to mm?

Enzymes

Protein structure

Watch the videos:

From time stamps 7:20 – 10:50



<https://www.youtube.com/watch?v=QFq9o72QaI8&list=PL0Mjub5NT755dp8xUfC-yoXlbPTcjVM1i&index=7>

<https://pmt.physicsandmathstutor.com/download/Biology/A-level/Notes/AQA/1-Biological-Molecules/Summary%20Notes.pdf>

What is the general structure of an amino acid?

How do two amino acids form a dipeptide?

Describe the following protein structures:

Primary Structure

Secondary Structure

Tertiary Structure

Quaternary Structure

Enzymes

<https://www.bbc.co.uk/bitesize/guides/z88hcj6/revision/1>



Enzyme definitions.

This section revises many of the key terms for GCSE to do with enzyme structure and function. A GCSE level question follows to assess your understanding. Whilst most of the definitions are from the GCSE specification you may find that some are unfamiliar to you.

Define these key words.

Enzyme:

Active site:

Substrate:

Activation energy:

Denature:

Q1. (a) Enzymes are used in body cells.

(i) What is an enzyme?

Draw a ring around the correct answer.

antibody	biological catalyst	hormone
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(1)

(ii) All enzymes are made of the same type of substance.

What is this substance?

Draw a ring around the correct answer.

carbohydrate	fat	protein
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(1)

(iii) Where is the enzyme amylase produced in the human body?

Draw a ring around the correct answer.

liver	salivary glands	stomach
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(1)

(b) Enzymes are sometimes used in industry.

Draw **one** line from each enzyme to the correct industrial use of that enzyme.

Enzyme	Industrial use
Carbohydrase	Changes starch into sugars
Isomerase	Removes grease stains from clothes
Protease	Pre-digests proteins in some baby foods
	Changes glucose syrup into fructose syrup

Interpreting enzyme graphs.

This section requires you to explain how different conditions affect enzyme activity.

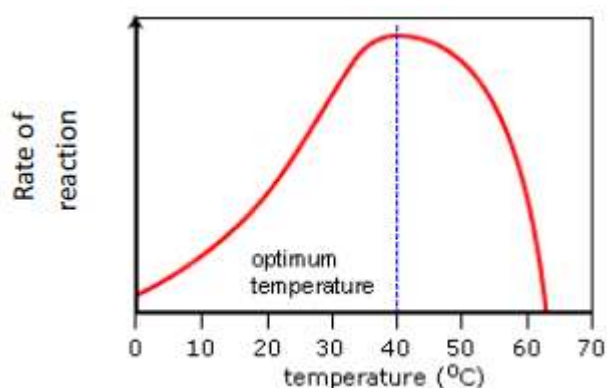
Using the following link from our YouTube channel, watch the video and annotate each of the graphs.

You need to **explain** the shape of each graph in terms of enzyme activity.

<https://www.youtube.com/watch?v=Pk3Lb2UHVcA&list=PL0Mjub5NT755dp8xUfC-yoXlbPTcjVM1i&index=9&t=0s>



Q1. Change in temperature.



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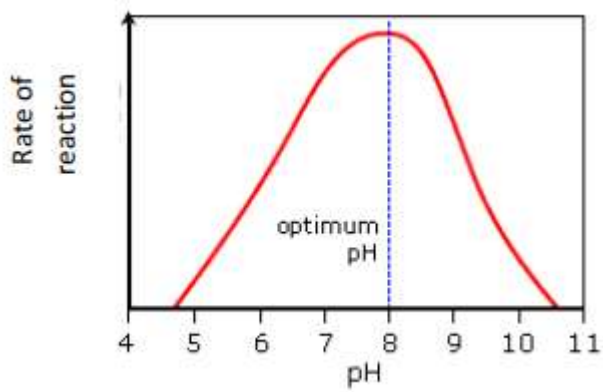
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Q2. Change in pH.



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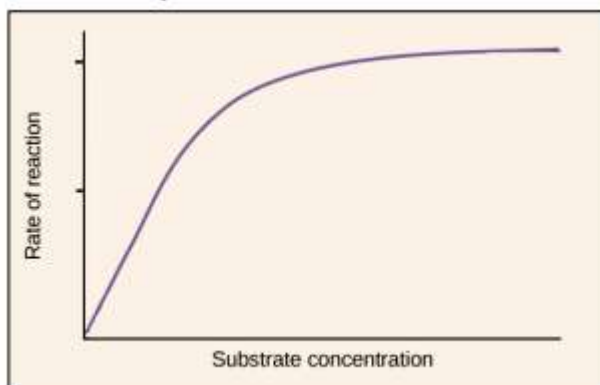
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Q3. Change in substrate concentration.



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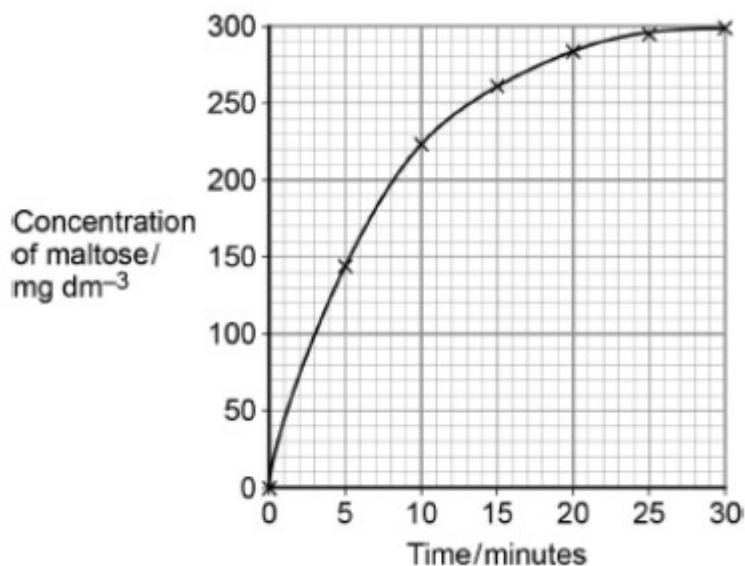
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Q4. A scientist investigated the hydrolysis of starch. He added amylase to a suspension of starch and measured the concentration of maltose in the reaction mixture at regular intervals.

His results are shown in the graph below.



Explain the results shown in the graph.

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.....

..... (2)

Biochemical tests – memorise these, will be tested first week

Use the information below to complete the table

<https://www.bbc.co.uk/bitesize/guides/zxcsrcd/revision/5>

<https://myedspace.co.uk/myresources/a-level/biology/aqa/revision-notes/biochemical-tests>

Substance testing for	Chemicals used and method on how to test	What a positive result looks like (substance present)	What a negative result looks like (substance NOT present)	Any hazards and risks
Starch				
Protein				
Lipids				
Reducing sugars				
Non-reducing sugars				

PHYSICS – Circuits

GCSE bitesize

<https://www.bbc.co.uk/bitesize/guides/zgvq4qt/revision/1>



Intro to circuits

<https://www.youtube.com/watch?v=R3hdaLpq2AA>



$V=IR$

<https://www.youtube.com/watch?v=hRojfU77c38>



Power = work done / time

<https://www.youtube.com/watch?v=kCJUzdCBOK0&list=PLidqglGKox7UVC-8WC9djoeBzwxPeXph7&index=7>



Draw the symbol for each circuit component:

Lamp	Cell	Resistor
Opened switch	Battery	Thermistor
Closed switch	Diode	Variable resistor
Ammeter	LED (light-emitting diode)	LDR (light-dependent resistor)
Voltmeter	Fuse	

Q1.

Figure 1 shows a person using an electric lawn mower.

Figure 1



- (a) The lawn mower is connected to the mains electricity supply.

What is the frequency of the mains electricity supply in the UK?

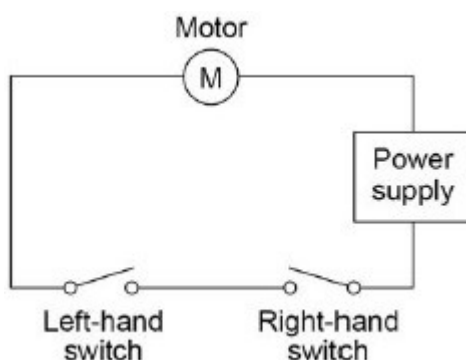
Frequency = _____ Unit _____

(2)

The lawn mower has a switch on each side of the handle.

Figure 2 shows the circuit diagram for the lawn mower.

Figure 2



- (b) The motor in the lawn mower can only be turned on when the person using it holds the handle of the lawn mower with both hands.

Explain why.

(2)

- (c) The power input to the motor is 1.8 kW

The resistance of the motor is 32Ω

Calculate the current in the motor.

Current = _____ A
(3)

- (d) The useful power output from the motor is 1.5 kW

Calculate the time it takes for the motor to transfer 450 000 J of useful energy.

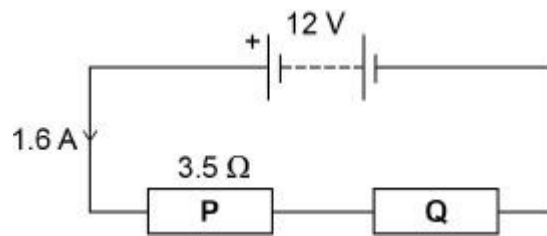
Time = _____ seconds
(3)
(Total 10 marks)

Q2.

- (a) Draw a diagram to show how 1.5 V cells should be connected together to give a potential difference of 4.5 V.

Use the correct circuit symbol for a cell. (2)

A student built the circuit shown in the diagram below.



- (b) Calculate the total resistance of the circuit in the diagram above.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

Total resistance = _____ Ω

(2)

- (c) The resistance of **P** is 3.5 Ω.

Calculate the resistance of **Q**.

Resistance of **Q** = _____ Ω

(1)

- (d) The student connects the two resistors in the diagram above in parallel.

What happens to the total resistance of the circuit?

Tick **one** box.

It decreases

☐

It increases

☐

It does not change

☐

(1)

Give a reason for your answer.

(1)
(Total 7 marks)

CHEMISTRY

Answer all the questions. There are links to websites which you may find helpful.
You will be given a test on these concepts at the start of the term.

This unit covers some of the key science concepts in biology, chemistry and physics.

This section looks at some of the chemistry concepts you have covered at GCSE and will cover in more depth in Unit F180.

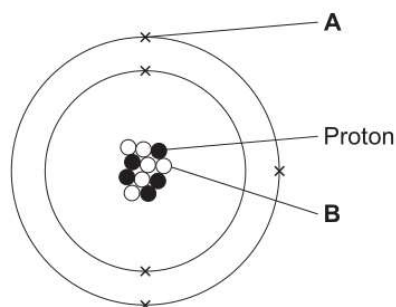
Periodicity and properties of elements

☐ Atomic Structure

<https://www.bbc.co.uk/bitesize/guides/zwn8b82/revision/3> (pages 3,4 and 5)
https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html

Q1. Figure 1 shows an atom of element **G**.

Figure 1



Draw a ring around the correct answer to complete each sentence.

(a) Label **A** shows

an electron an ion a nucleus (1)

(b) Label **B** shows

an isotope a molecule a neutron (1)

(c) The atomic number of element **G** is

(d) The mass number of element **G** is

5 6 10 11 16 (1)

☐ Periodic Table

<https://www.bbc.co.uk/bitesize/guides/ztv797h/revision/2> (pages 2-8)
<https://www.rsc.org/periodic-table/>

Q2. The Periodic table below contains **six** errors. Highlight these.

(6)

metals	non-metals	group	period
Noble gases	Alkaline-Earth metals	Halogens	Alkali metals



Element **X** has two different isotopes, both of which contain 17 protons. The least abundant isotope contains 20 neutrons. The second isotope is three times more abundant and contains 2 more neutrons. All the atoms contain 2 electrons in the first shell, 8 electrons in the second shell and 7 electrons in the third.

(2)

.....6

Key

A_r
Symbol
name

(c) Is element **X** a metal or non-metal? (4)

(d) Identify an element, in the same group as **X**, which has a lower boiling point than **X**.
..... (1)

□ Chemical reactions and equations

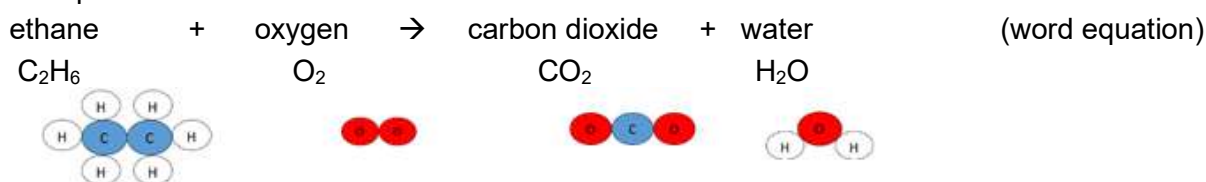
<https://www.bbc.co.uk/bitesize/guides/zy4pmsg/revision/1> (pages 1-6)

<https://www.bbc.co.uk/bitesize/guides/z2bfxf/r/revision/1> (pages 1,2)

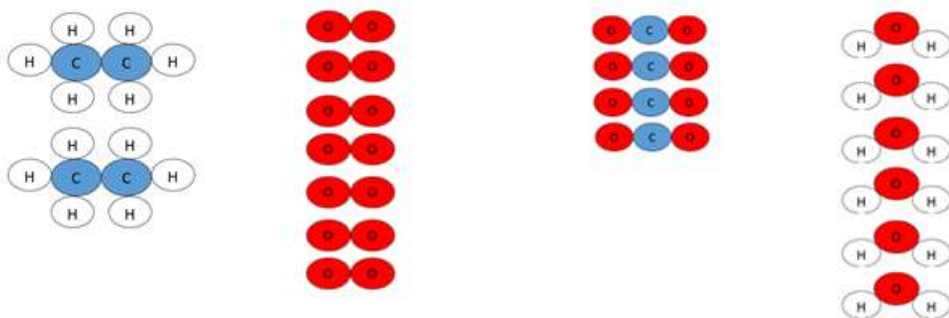
Equations are used to show chemical reactions.

Reactants are written on the left of the arrow and products are written on the right.

For example:



Atoms cannot be created or destroyed. They are simply rearranged. Therefore, the equation with formulae needs balancing. (You can only add more of the same molecules. You cannot change the formula of any.)



The relative formula mass of a molecule/compound (M_r) can be calculated by adding the A_r of all the atoms it contains. The A_r value for all elements can be found in the Periodic Table.

A_r of C is 12.0, A_r of H is 1.0 and A_r of O is 16.0

M_r of C_2H_6 = $(2 \times 12.0) + (6 \times 1.0) = 30.0$

M_r of O_2 = $(2 \times 16.0) = 32.0$

M_r of CO_2 = $12.0 + (2 \times 16.0) = 44.0$

M_r of H_2O = $(2 \times 1.0) + 16.0 = 18.0$

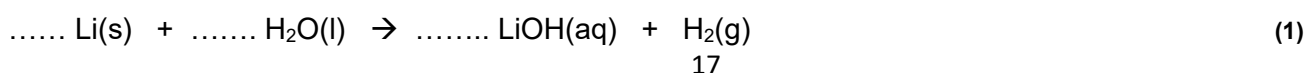
The total mass of the reactants = the total mass of the products

Mass of reactants = $(2 \times M_r C_2H_6) + (7 \times M_r O_2) = (2 \times 30.0) + (7 \times 32.0) = 284.0$

Mass of products = $(4 \times M_r CO_2) + (6 \times M_r H_2O) = (4 \times 44.0) + (6 \times 18.0) = 284.0$

Q5. Lithium reacts with water to form lithium hydroxide and hydrogen.

(a) Balance the symbol equation for this reaction



(b) (i) Complete the table below for this reaction

(8)

	Reactant or product	State	M_r
Lithium			
Water	reactant	liquid	18.0
Lithium hydroxide			
Hydrogen			

(ii) Calculate the total mass of the reactants. Are these the same as the total mass of the products?
Show your workings.

.....

..... (2)

❑ Bonding

Chemical reactions involve the breaking and making of bonds. This involves electrons being transferred or shared between atoms.

The total number of electrons at the end of the reaction must be the same as at the start.

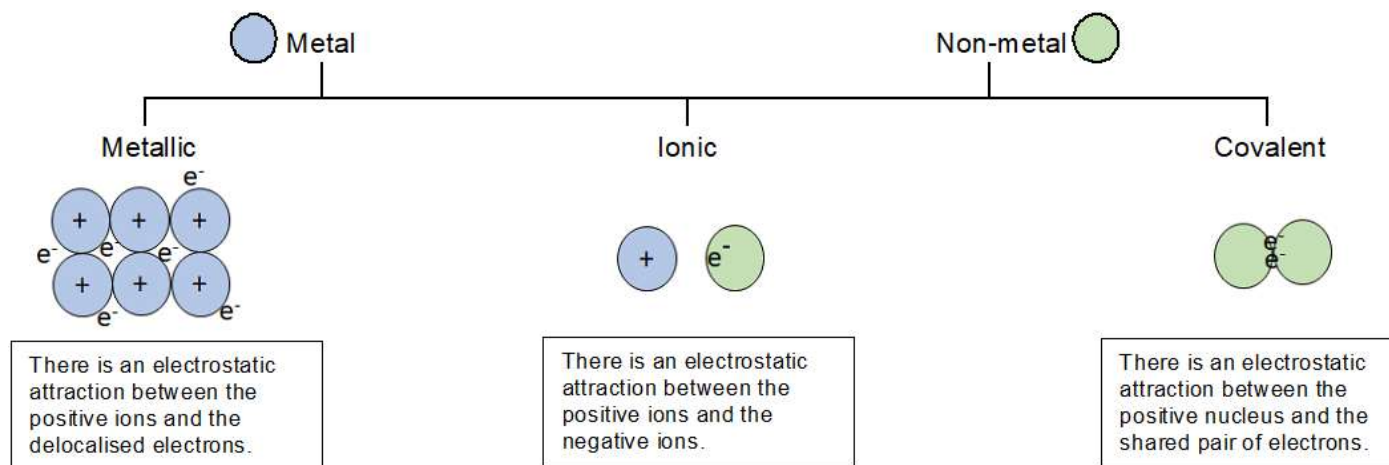
Metal atoms **lose** electrons and form **positively charged ions**.

Non-metal atoms **gain** electrons and form **negatively charged ions**

OR by **sharing** them (in pairs) with another non-metal atom

<https://www.bbc.co.uk/bitesize/topics/z33rwx> (ionic compounds, small molecules, metals and alloys)

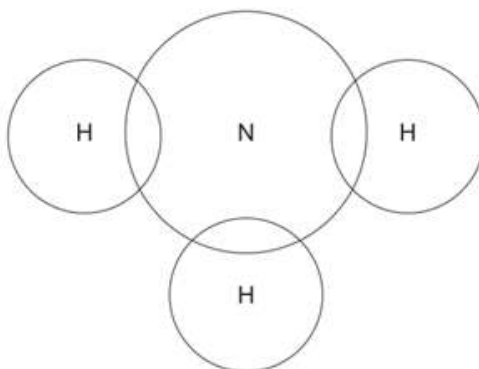
How do you know which type of bonding is present in an element or compound? Consider the type of element(s) it contains:



Q6. The electronic structure of a potassium atom is 2,8,8,1

Draw a diagram to show the electronic structure of a potassium ion. Show the charge on the ion.

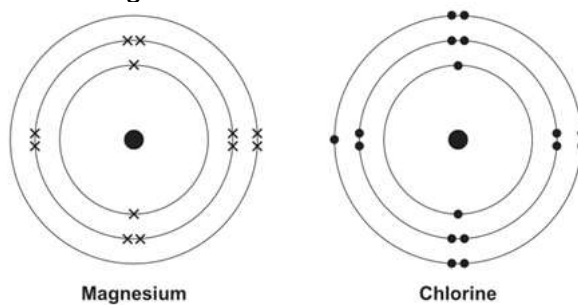
Q7. Complete the dot and cross diagram to show the electrons in the outer shells of ammonia, NH₃. Use the periodic table to help you.



(2)

(2)

Q8. The diagrams shown an atom of magnesium and an atom of chlorine.



Describe, in terms of electrons, how magnesium atoms and chlorine atoms change into ions to produce Magnesium chloride, MgCl_2 .
You may draw labelled diagrams.

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..... (4)

Practical Scientific Procedures and Techniques

❑ Laboratory Safety

- Watch the video on safety in the laboratory:
<https://www.youtube.com/watch?v=RhlOYhOvCsQ>

Use this to complete a list of safety rules to follow when completing any experiment.

1.
2.
3.
4.
5.
6.
7.
8.

(8)



You will be using a number of different chemicals and apparatus when completing your experiments.

- Follow the instructions provided to complete the table below on hazard symbols

i) Match the old hazard symbol to the new symbol.

ii) Match the new hazard symbol to the hazard name.

<https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/acs-secondary-safety-guidelines.pdf> (page 22 and 23)

iii) List the precautions which should be taken (in addition to wearing a labcoat and safety glasses) when handling chemicals with these hazards to minimise the chance of an accident occurring.

<https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/acs-secondary-safety-guidelines.pdf> (pages 38-40)

Old	New	Name	Precautions
		harmful / irritant	
		oxidising agent	
		flammable	
		harmful to the environment	
		corrosive	
		toxic	
			

(19)

❑ Practical techniques

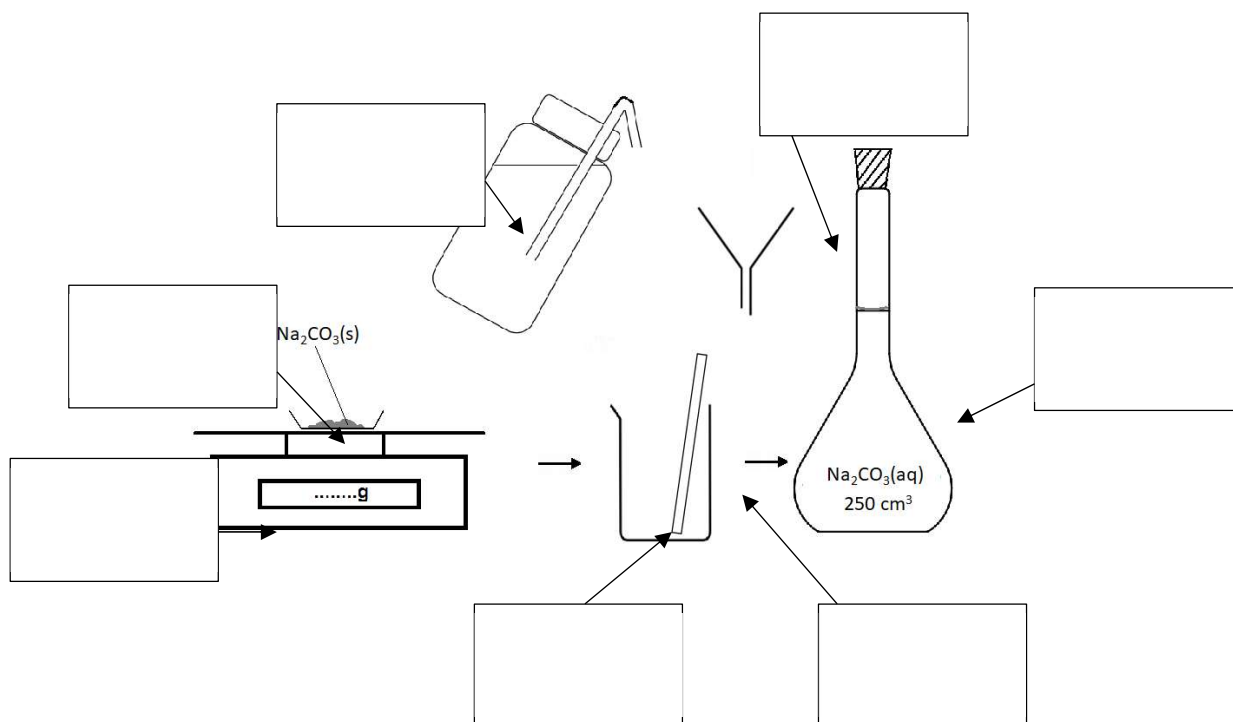
One of the practical techniques you will need to complete is the preparation of a standard solution and performing a titration to test the solution you have prepared.

- Watch these videos to help you answer the questions

<https://www.youtube.com/watch?v=xBKyjXUkJy0>
<https://www.youtube.com/watch?v=rLc148UCT2w>
https://www.youtube.com/watch?v=gzvzvDv_BnA

Q1. (a) What is a standard solution?(1)

(b) The diagram below shows the apparatus used to make a standard solution of sodium carbonate. Complete the labels. (7)



(c) The standard solution prepared can be used to find the concentration of a solution of hydrochloric acid.

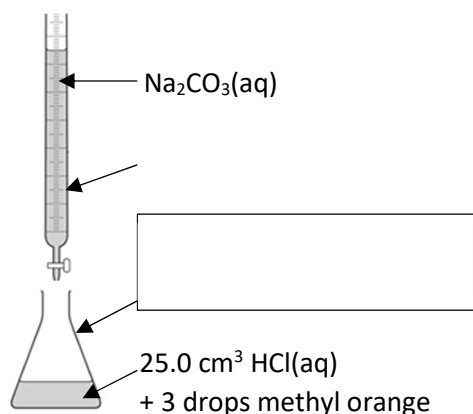
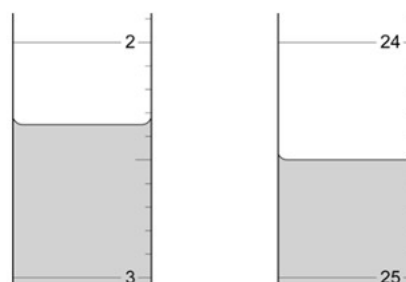


Figure 2.



- Complete the label to show name of the apparatus in which the acid is placed. (1)
- What is the name given to this procedure? (1)
- Figure 2.** shows the level of the sodium carbonate solution in the burette at the start and the end of one titration. Use these to work out the volume of sodium carbonate added in the titration. Give your answer to 2 d.p:

Volume $\text{Na}_2\text{CO}_3(\text{aq})$ added = cm^3 (1)

❑ Obtaining and analysing results obtained in an experiment

It is important to keep a record of all data whilst carrying out practical work. It is good practice to draw a table before starting the experiment and then enter results straight into the table.

Tables should have clear headings with units.

Time / min	Temperature / °C
0	27.6
1	27.4
2	27.2

The independent variable is the left-hand column in a table, with the following columns showing the dependent variables. All measurements should be written to the same number of decimal places (matching the precision of the measuring instrument).

<https://www.bbc.co.uk/bitesize/guides/zcxp6yc/revision/1>

<https://www.bbc.co.uk/bitesize/guides/zcxp6yc/revision/6>

Q2. A student was told to complete a practical to investigate how temperature affects the rate of a reaction. The student carried out the reaction at five different temperatures and recorded the time taken for each.

The student then calculated the rate of reaction, in s^{-1} for each experiment using the equation:

$$\text{rate of reaction} = \frac{1}{\text{time}}$$

The student's results and calculations are shown below:

at 24.5°C the experiment took 340 seconds

$$1/340 = 0.0029 \text{ s}^{-1}$$

at 39.0°C it took 256 sec

$$1/256 = 0.0039 \text{ s}^{-1}$$

at 58.0°C the experiment took 124 s

$$1/124 = 0.0081 \text{ s}^{-1}$$

80.5°C 62 s

$$1/62 = 0.0161$$

51°C 186 s

$$1/186 = 0.0054$$

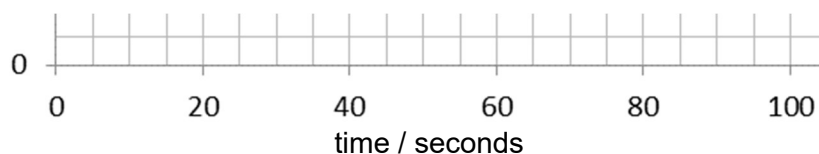
(a) What is the independent variable in this experiment? Circle the correct answer

rate of reaction time temperature (1)

(b) Tabulate the student's data in an appropriate manner. (4)

..... /	 /	 /

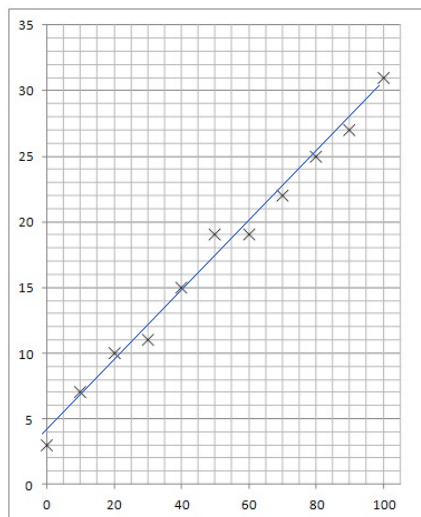
Drawing a graph of the results obtained usually makes it easier to interpret the data and draw conclusions. The independent variable is shown on the x-axis and the dependent variable is shown on the y-axis. Axes should always be labelled with the quantity being measured and the units, as shown here:



Data points should be marked with a cross, x.

When choosing the scales consider:

- the maximum and minimum values of each variable.
- whether 0,0 should be included as a data point.
- how to draw the axes without using difficult scale markings (e.g. multiples of 3, 7, etc)
- the data points should cover at **least half** of the grid supplied for the graph.



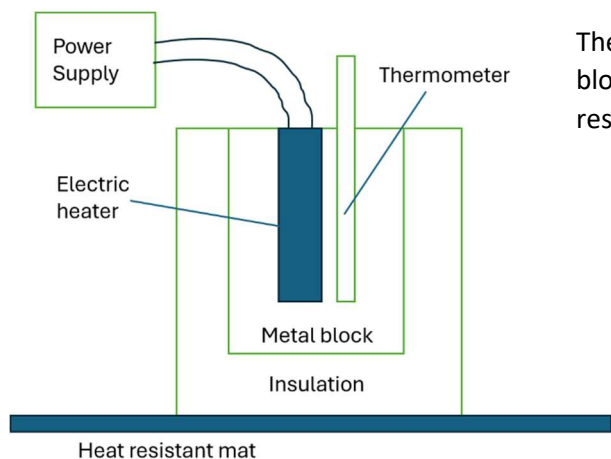
Consider the following when deciding where to draw a line of best fit:

- the line can be straight or curved
- the line should pass through, or very close to, the majority of plotted points (ignoring any anomalous points)
- for points not on the line make sure that there are as many points on one side of the line as the other
- the line should be continuous and drawn with a sharp pencil (use a rule for a straight line)
- the line will go through the origin (0,0) if a value of 0 for the independent variable would produce a value of 0 for the dependent variable

Q3. A student investigated how the temperature of a metal block changed with time.

An electric heater was used to increase the temperature of the block.

The heater was placed in a hole drilled in the block as shown in **Figure 1**.



The student measured the temperature of the metal block every 60 seconds. **Table 3.** shows the student's results.

Table 3.

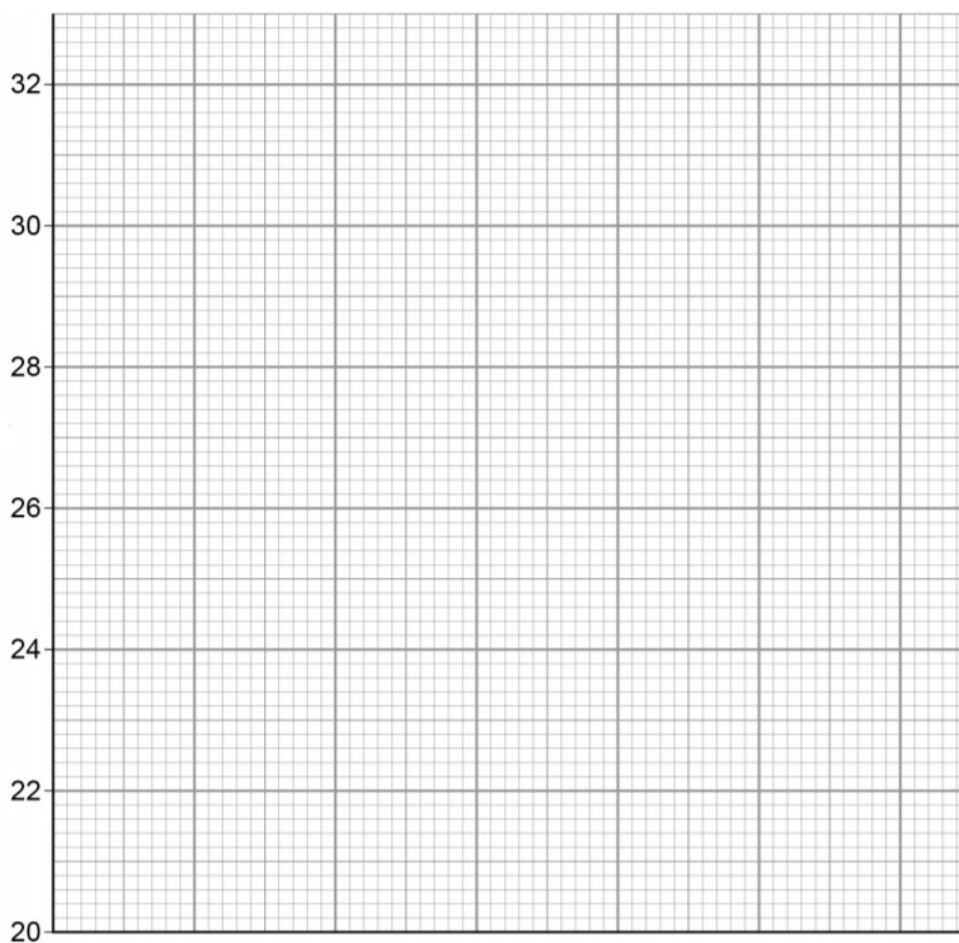
Time in s	Temperature in °C
0	20.0
60	24.5
120	29.0
180	31.0
240	31.5

(a) Complete the graph of the data from **Table 3.** on **Figure 2**.

- Choose a suitable scale for the x-axis.
- Label the x-axis and label the y-axis.
- Plot the student's results.
- Draw a line of best fit.

(5)

Figure 2.



Part 2 – Highly recommended

BIOLOGY –

Use the resources below to support you in answering the questions



Cell Structure and
Function

Cell Structure and Function

Q1. Complete the table below with the functions of each structure in the eukaryotic cell

Structure	Function
Plasma Membrane	
Cytoplasm	
Nucleus	
Nucleolus	
Rough Endoplasmic Reticulum	
Smooth Endoplasmic Reticulum	

Golgi Apparatus	
Vesicles	
Lysosomes	
Ribosomes	
Mitochondria	
Centrioles	

PHYSICS – planning an investigation

<https://www.savemyexams.com/gcse/physics/aqa/18/revision-notes/2-electricity/2-1-current-potential-difference-and-resistance/2-1-10-required-practical-investigating-iv-characteristics/>

Plan an investigation on the effect of potential difference on current

Independent variable:

Dependent variable:

Equipment:

Numbered method, including circuit diagram of how to set up the circuit:

Risk assessment:

Hazard	Risk	Precaution

CHEMISTRY –

Make notes from the following resources, then have a go at completing the questions

Titration and mole calculations

<https://www.bbc.co.uk/bitesize/guides/zx98pbk/revision/3>

<https://www.youtube.com/watch?v=wPGVQu3UXpw>

<https://www.youtube.com/watch?v=ovx-Sro4NXM>



Q1. This question is about acids and alkalis.

(a) Dilute hydrochloric acid is a strong acid.

Explain why an acid can be described as both strong and dilute.

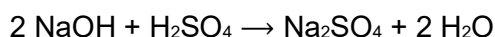
(2)

A student titrated 25.0 cm³ portions of dilute sulfuric acid with a 0.105 mol/dm³ sodium hydroxide solution.

(c) The table below shows the student's results.

	Titration 1	Titration 2	Titration 3	Titration 4	Titration 5
Volume of sodium hydroxide solution in cm ³	23.50	21.10	22.10	22.15	22.15

The equation for the reaction is:



Calculate the concentration of the sulfuric acid in mol/dm³

Use only the student's concordant results.

Concordant results are those within 0.10 cm³ of each other.

Concentration of sulfuric acid = _____ mol/dm³

(5)

- (d) Explain why the student should use a pipette to measure the dilute sulfuric acid and a burette to measure the sodium hydroxide solution.

(2)

- (e) Calculate the mass of sodium hydroxide in 30.0 cm³ of a 0.105 mol/dm³ solution.

Relative formula mass (M_r): NaOH = 40

Mass of sodium hydroxide = _____ g

(2)

(Total 12 marks)

Q2. A student investigated the reactions of copper carbonate and copper oxide with dilute hydrochloric acid.

In both reactions one of the products is copper chloride.

- (a) Describe how a sample of copper chloride crystals could be made from copper carbonate and dilute hydrochloric acid.

(4)

- (b) A student wanted to make 11.0 g of copper chloride.

The equation for the reaction is:



Relative atomic masses, A_r : H = 1; C = 12; O = 16; Cl = 35.5; Cu = 63.5

Calculate the mass of copper carbonate the student should react with dilute hydrochloric acid to make 11.0 g of copper chloride.

Mass of copper carbonate = _____ g

(4)

- (c) The percentage yield of copper chloride was 79.1 %.

Calculate the mass of copper chloride the student actually produced.

Actual mass of copper chloride produced = _____ g

(2)