newcollaborative Learning Trust

*Opening doors to a brighter future*

# 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

**REVIEW**

**Use the resources below to support you with the questions**

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

Q1. Label the cells below

**EUKARYOTIC CELL**

Use the website to quiz yourself on the structure of a cell.

https://www.purposegames.com/game/DgmVURuXTDK

Write your scores below:

Attempt 1:

Attempt 2:

Attempt 3:

**PLANT CELL**

Use the website to quiz yourself on the structure of a cell.

https://www.purposegames.com/game/2bde3fa5

Write your scores below:

Attempt 1:

Attempt 2:

Attempt 3:

**PROKARYOTIC CELL**

Use the website to quiz yourself on the structure of a cell.

https://www.purposegames.com/game/label-the-parts-of-a-prokaryotic-cell

Write your scores below:

Attempt 1:

Attempt 2:

Attempt 3:

## 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 µm. 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 µm. 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 7:20 – 10:50**

https://www.youtube.com/watch?v=QFq9o72Qal8&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** |

**(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** |

**(1)**

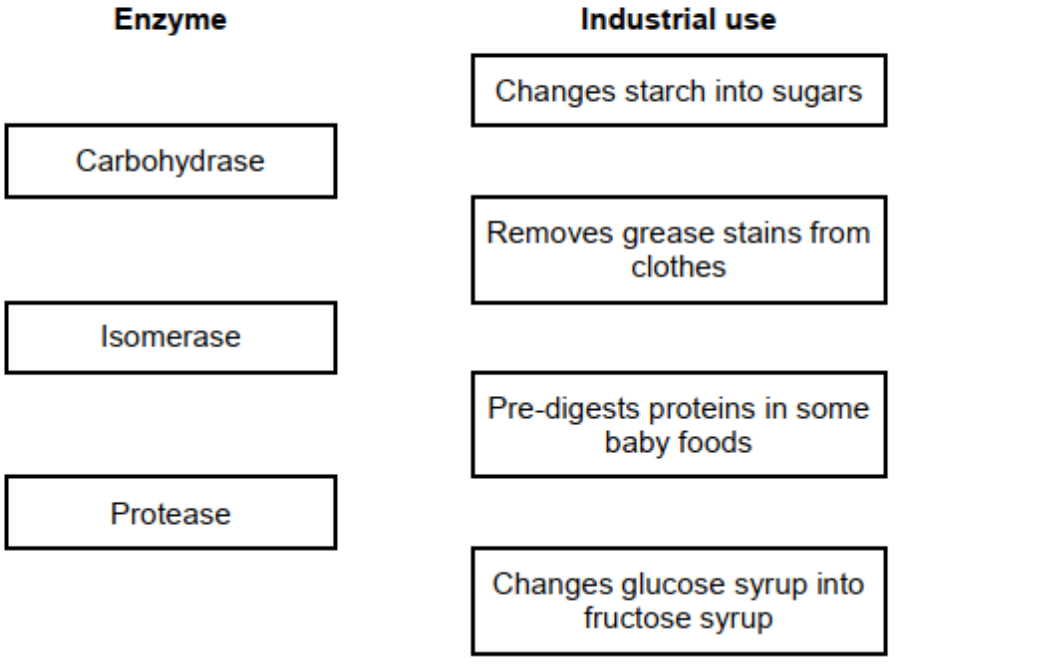
(iii) Where is the enzyme amylase produced in the human body?
Draw a ring around the correct answer.

| | | |
|---|---|---|
| **liver** | **salivary glands** | **stomach** |

**(1)**

(b) Enzymes are sometimes used in industry.

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



**Interpreting enzyme graphs.**

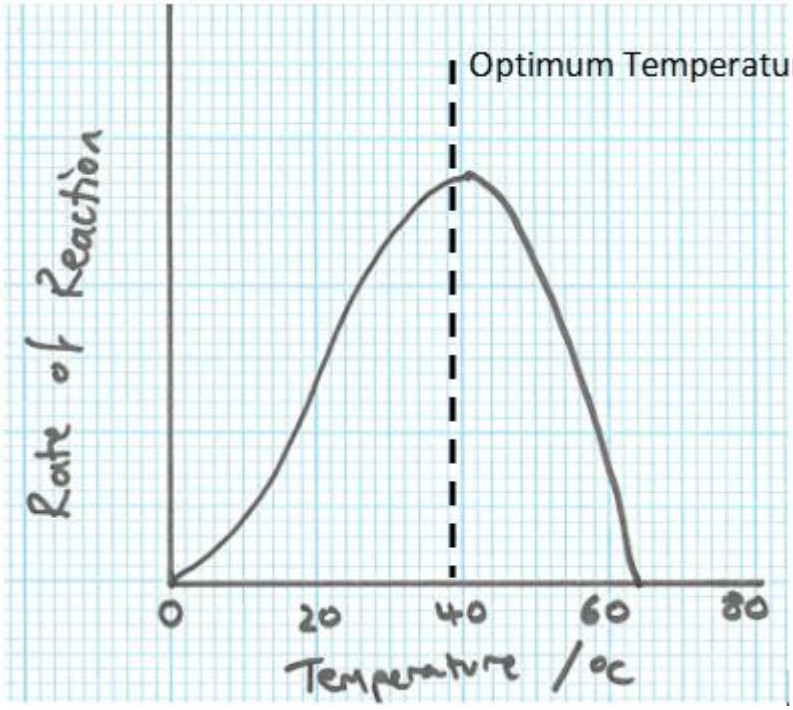
This section requires you to explain how different conditions affect enzyme activity.

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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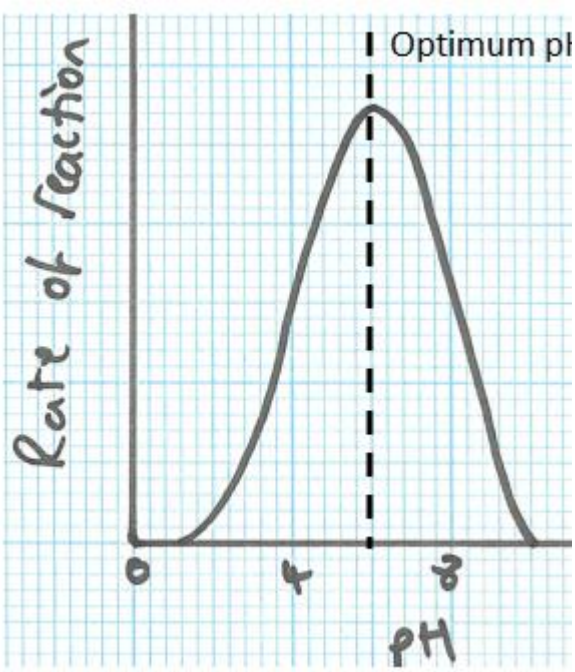
**Q2. Change in pH.**

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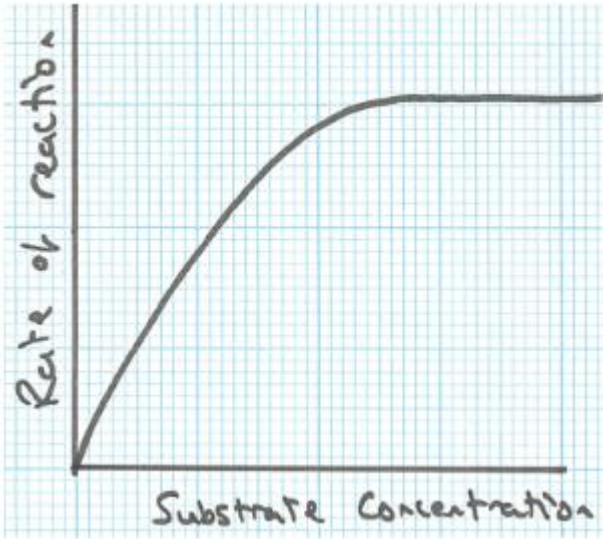
**Q3. Change in substrate concentration.**

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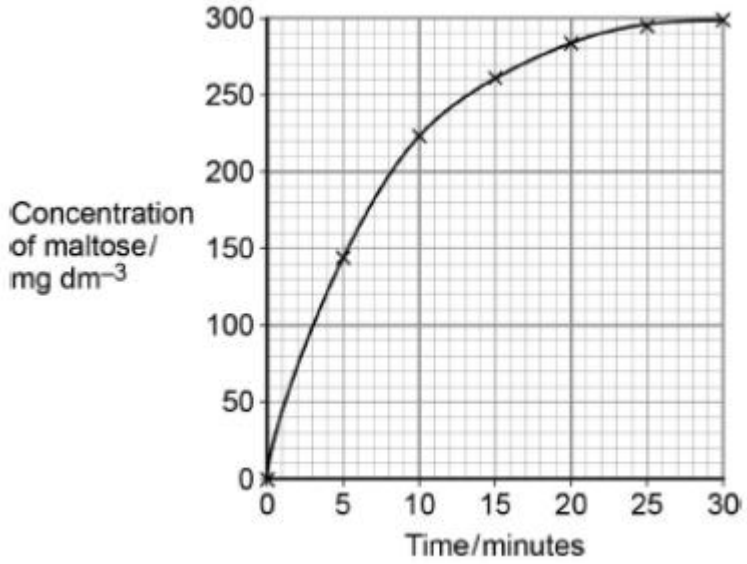
**Q4**. A scientist investigated the hydrolysis of starch. He added amylase to a suspension of starch and measured the concentration of maltose in the reaction mixture at regular intervals.

His results are shown in the graph below.




Explain the results shown in the graph.

……
……
……
……
……
……
…… **(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/zxcrsrd/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 NOTpresent) | 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=PLidqqIGKox7UVC-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.**

A person uses an electric lawn mower.

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

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

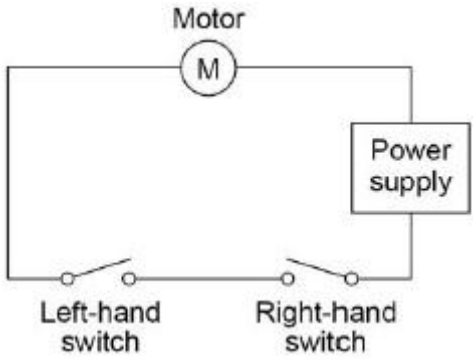
Frequency = _____ Unit _____

**(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 32 Ω

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)**

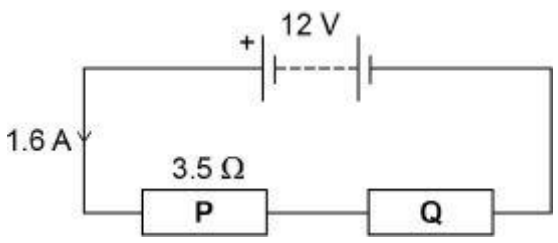
**(Total 10 marks)**

**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.

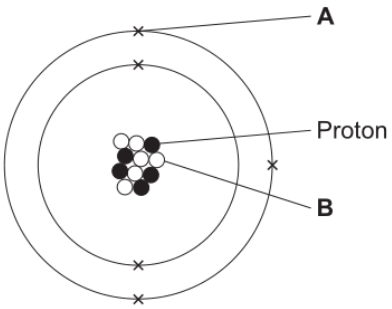
## Periodicity and properties of elements

### ❑ 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/

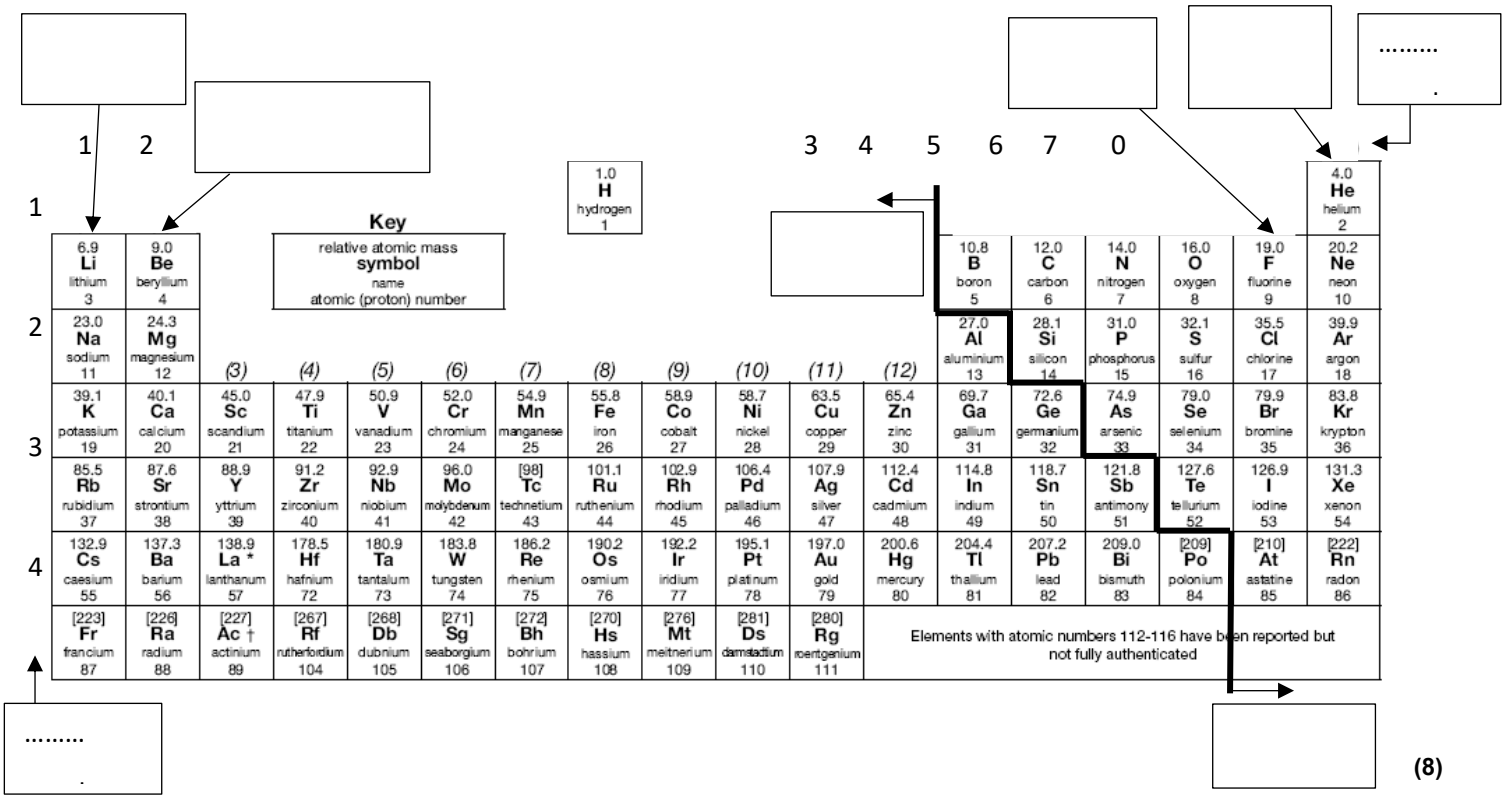
**Q2.** The Periodic table below contains **six** errors. Highlight these.

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | H | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | | | B | C | N | O | Fl | Ne |
| Na | Mg | | | | | | | | | | | Al | Si | P | S | CL | Ar |
| K | Ca | Sc | Ti | V | Cr | Mn | fe | CO | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | pD | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| Fr | Ra | Ac | Rf | Db | Sg | Bh | Hs | Mt | Ds | Rg | | | | | | | |

**(6)**

**Q3.** Complete the labels on the diagram below using the following terms:

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




**(8)**

**Q4.** Read the information below on element **X** carefully. Use this to help you answer the questions which follow.

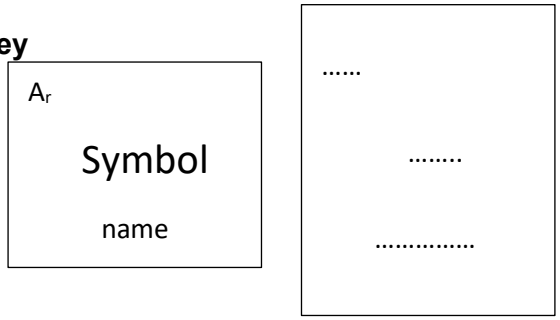
> Element **X** has two different isotopes, both of which contain 17 protons. The least abundant isotope contains 20 neutrons. The second isotope is three time more abundant and contains 2 more neutrons. All the atoms contain 2 electrons in the first shell, 8 electrons in the second shell and 7 electrons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

**(a)** Where in the Periodic Table is element **X** found:

Group: …… Period: …….. **(2)**

**(b)** Use the Periodic Table in **Q3.** the **key** and your answer to **Q4.(a)** to complete **Figure 2.** for element **X**

**Key**




**(4)**

**(c)** Is element **X** a metal or non-metal? …….. **(1)**

**(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/z2bfxfr/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:

ethane + oxygen → carbon dioxide + water (word equation)

$C_2H_6$ $O_2$ $CO_2$ $H_2O$

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.)

$2C_2H_6$ + $7O_2$ → $4CO_2$ + $6H_2O$ (balanced equation)

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 x 12.0) + (6 x 1.0) = 30.0 $M_r$ of $O_2$ = (2 x 16.0) = 32.0

$M_r$ of $CO_2$ = 12.0 + (2 x 16.0) = 44.0 $M_r$ of $H_2O$ = (2 x 1.0) + 16.0 = 18.0

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

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

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

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

**(a)** Balance the symbol equation for this reaction

…… Li(s) + ……. $H_2O$(l) → …….. LiOH(aq) + $H_2$(g) **(1)**

**(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.

……

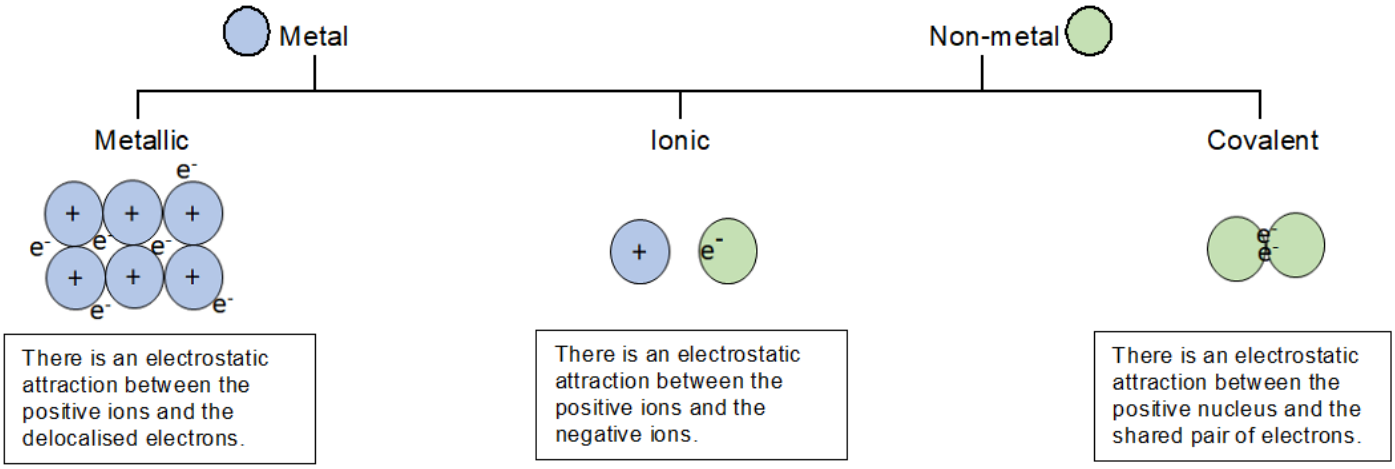
…… **(2)**

## ❑ 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/z33rrwx (ionic compounds, small molecules, metals and alloys)

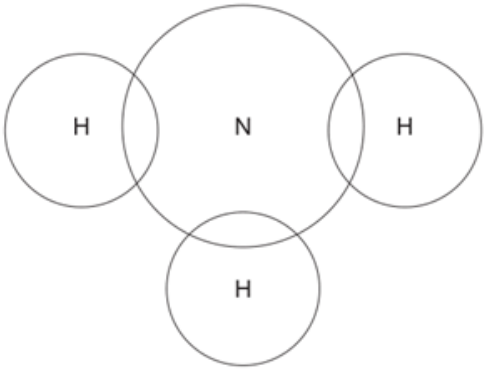
How do you know which type of bonding is present in an element or compound? Consider the type of element(s) it contains:




**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.

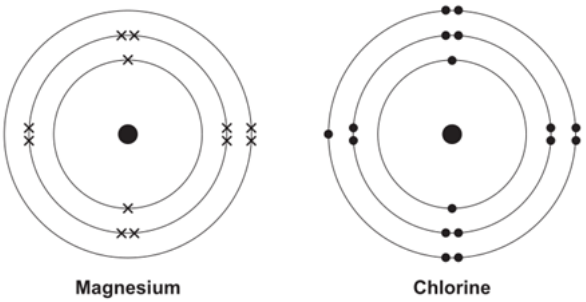
**(2)**

**Q7.** Complete the dot and cross diagram to show the electrons in the outer shells of ammonia, $NH_3$.
Use the periodic table to help you.




**(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.

……..

……..

……..

……..

……..

……..

……..

…… **(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

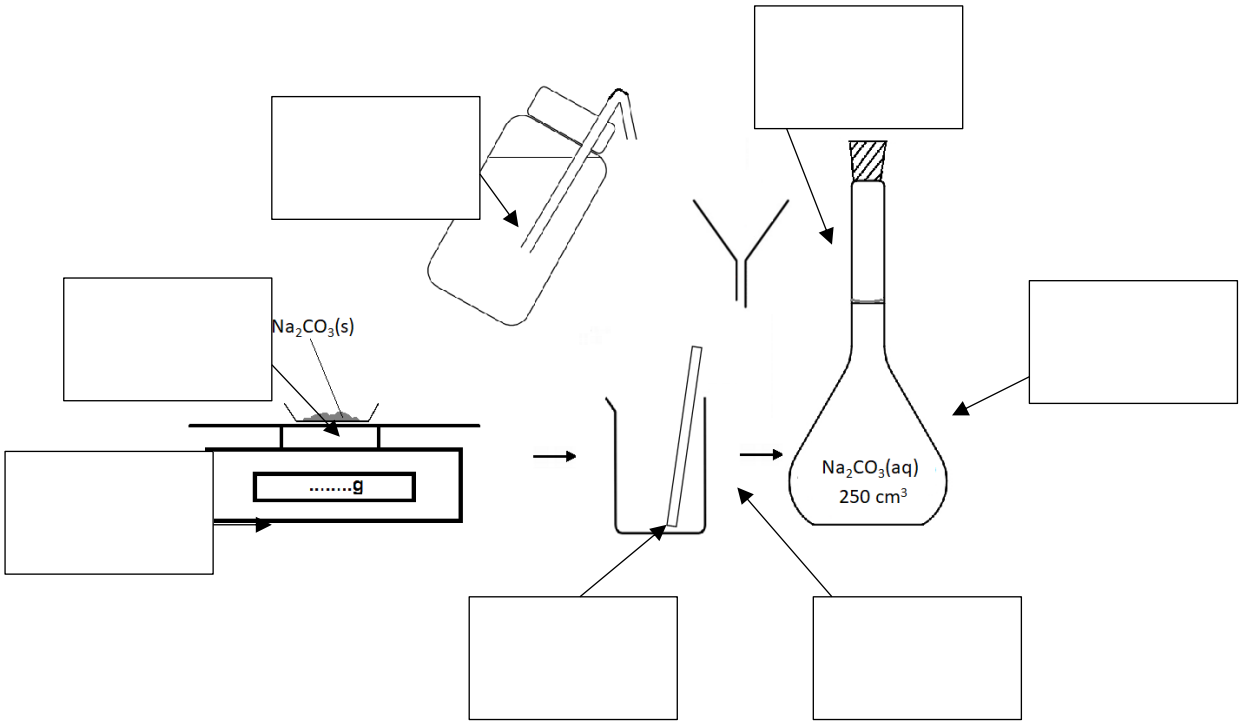
One of the practical techniques you will need to complete is the preparation of a standard solution and performing a titration to test the solution you have prepared.

- Watch these videos to help you answer the questions
  https://www.youtube.com/watch?v=xBKyjXUhJy0
  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.

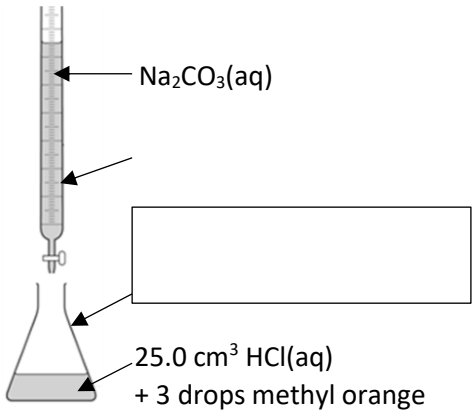
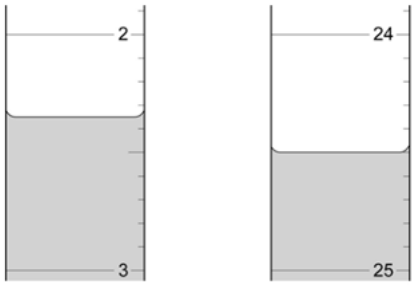



**Figure 2.**




**(i)** Complete the label to show name of the apparatus in which the acid is placed. **(1)**

**(ii)** What is the name given to this procedure? …… **(1)**

**(iii)** **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 $Na_2CO_3(aq)$ 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 $s^{-1}$ |
| at 39.0 °C it took 256 sec | 1/256 = 0.0039 $s^{-1}$ |
| at 58.0 °C the experiment took 124 s | 1/124 = 0.0081 $s^{-1}$ |
| 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)**

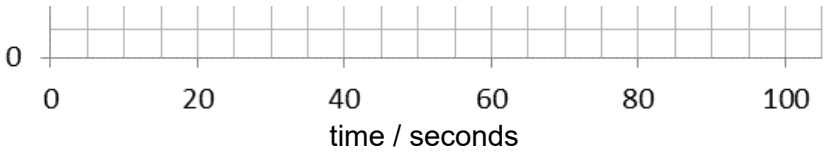
| ……. / ….. | …….. / ……. | ……. / …… |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

https://www.bbc.co.uk/bitesize/guides/z8fq6yc/revision/8

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.

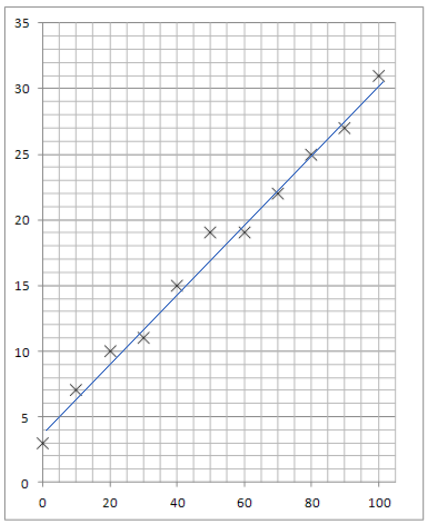
Axes should always be labelled with the quantity being measured and the units.




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:

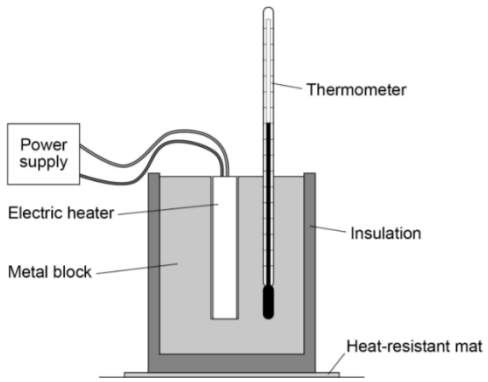
- the line can be straight or curved
- the line should pass through, or very close to, the majority of plotted points (ignoring any anomalous points)
- for points not on the line make sure that there are as many points on one side of the line as the other
- the line should be continuous and drawn with 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 place in a hole drilled in the block as shown in **Figure 1.**

**Figure 9**




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

**Table 3.**

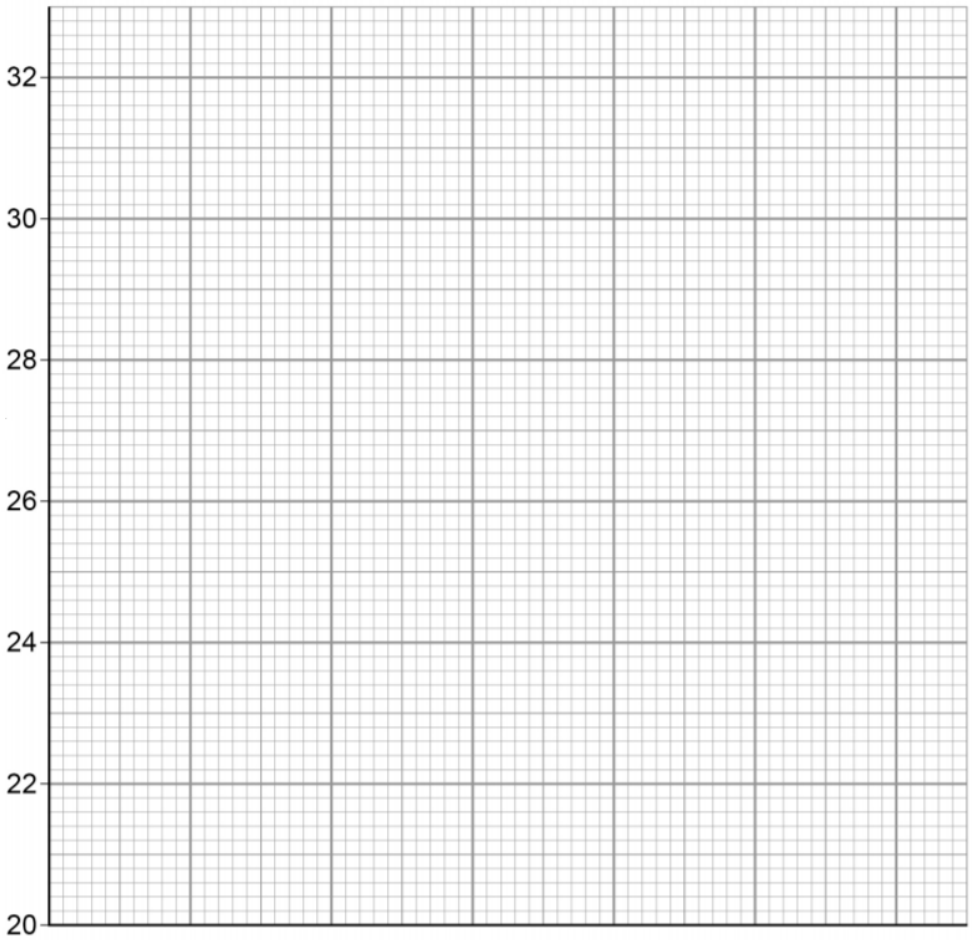
| Time in s | Temperature in °C |
|---|---|
| 0 | 20.0 |
| 60 | 24.5 |
| 120 | 29.0 |
| 180 | 31.0 |
| 240 | 31.5 |

**(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

## Titrations 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 $cm^3$ portions of dilute sulfuric acid with a 0.105 $mol/dm^3$ 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:

$$2\ NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2\ H_2O$$

Calculate the concentration of the sulfuric acid in mol/dm$^3$

**Use only the student's concordant results.**

Concordant results are those within 0.10 cm$^3$ of each other.

Concentration of sulfuric acid = _____ mol/dm$^3$

**(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 cm$^3$ of a 0.105 mol/dm$^3$ 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:

$$CuCO_3 + 2HCl \rightarrow CuCl_2 + H_2O + CO_2$$

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)**

# MARK SCHEME

# 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.

3. Watch the videos and complete the notes – you may consider adding flashcards / condensed notes, so you can use them to test yourself (metacognition)
4. 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

**REVIEW**

**Use the resources below to support you with the questions**

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

Q1. Label the cells below

**EUKARYOTIC CELL**

**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?

**60µm**

Q4. A red blood cell has a diameter of 8 µm. 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?

**8mm**

Q5. A chloroplast has a diameter of 2 µm. The image of a chloroplast observed using an optical microscope had a diameter of 20mm. What was the magnification of the microscope used?

**X 10,000**

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

**Multiply by 1000**

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

**Divide by 1000**

# Enzymes

## Protein structure

**What is the general structure of an amino acid?**

**How do two amino acids form a dipeptide?**

**2 amino acids join via condensation reactions. Held together by a peptide bond**

Primary structure: The sequence/order of amino acids that makes up the polypeptides of a protein.

Secondary structure: The way in which the chain of amino acids in a protein is folded. This forms alpha helix and Beta sheets. Structure held in place by hydrogen bonds

Tertiary structure: The further folding and coiling of the secondary structure to give the protein its 3D shape. Held in place by hydrogen, ionic and disulphide bonds. The tertiary structure is important e.g. the shape of an enzymes active site must be complementary shape to the substrate so they can fit.

Quaternary structure: Made of more than 1 polypeptide

**Enzymes**

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

**Enzyme definitions.**

Enzyme: A protein that acts as a biological catalysts lowering the activation energy of a reaction to alter its speed.

Active site: The shape specific region of an enzyme that is complimentary to the substrate.

Substrate: A substance that is acted on by an enzyme. It is complimentary to the enzymes active site.

Activation energy: The energy required to bring about a reaction.

Denature: Permanent change in a proteins 3D shape due to unravelling of the amino acid chain.

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

(i) What is an enzyme?

Draw a ring around the correct answer.

| | | |
|---|---|---|
| **antibody** | **biological catalyst** | **hormone** |

**(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** |

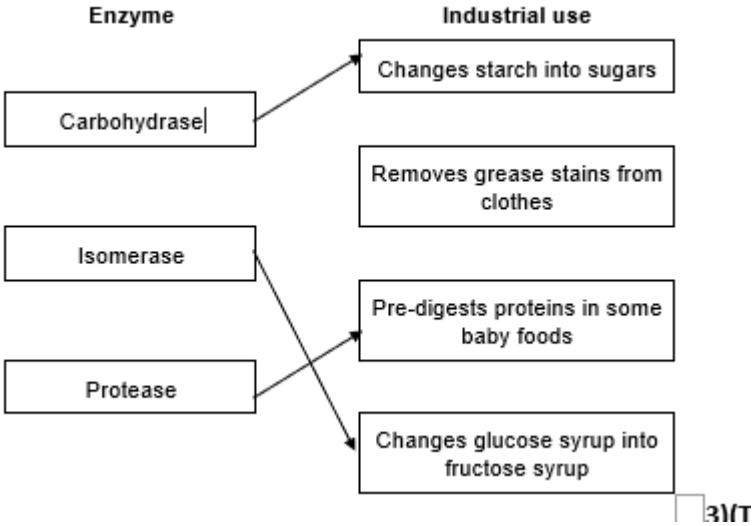
**(1)**

(iii) Where is the enzyme amylase produced in the human body?
Draw a ring around the correct answer.

| | | |
|---|---|---|
| **liver** | **salivary glands** | **stomach** |

**(1)**

**(b)**




**Interpreting enzyme graphs.**

**Q1. Change in temperature.**

As temperature increase the enzyme & substrate gain more kinetic energy. There are more frequent successful collision, this increases the rate of reaction to its optimum at $40^{O}C$. After this the increase in temperature causes H bonds to break. This means both the tertiary structure changes and the enzymes active site is no longer complimentary to the substrate. The enzyme is denatured and the rate of reaction drops. No enzyme-substrate complexes can form.

**Q2. Change in pH.**

Any change in pH (higher or lower than the optimum pH for the specific enzyme) causes H bonds to break. This means both the tertiary structures changes and the enzymes active

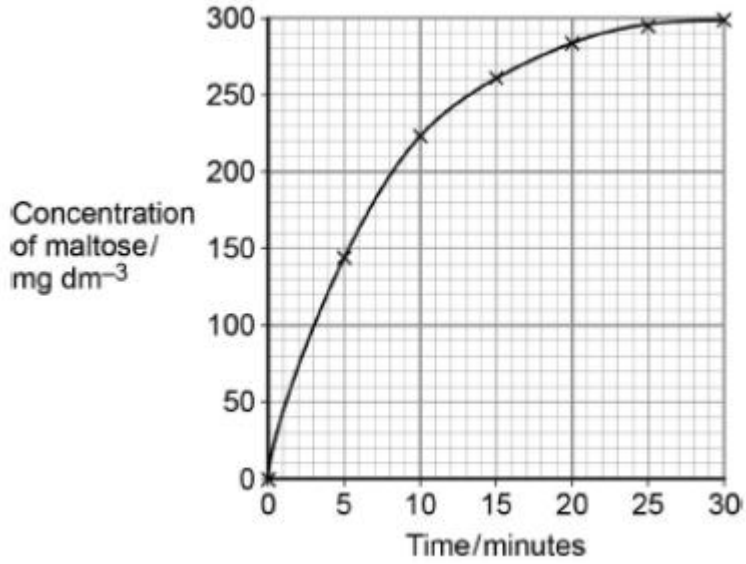
site is no longer complimentary to the substrate. The enzyme is denatured and the rate of reaction drops. No enzyme substrate complexes can form.

**Q3. Change in substrate concentration.**

An increase in substrate increases rate of reaction as there is an increased chance in enzymes substrate complexes forming. At a certain substrate concentration, the rate of reaction plateaus. This is due to the enzymes actives sites becoming saturated with substrate.

**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.

1. (Rate of) increase in concentration of maltose slows as substrate/starch is used up

**OR**

High initial rate as plenty of starch/substrate/more E-S complexes;
*Reject ref. to amylase being used up*

2. No increase after 25 minutes/at end/levels off because no substrate/starch left;
*Accept 'little'*
*Ignore references to substrate a limiting factor*

# Biochemical tests – memorise these, will be tested first week

**Use the information below to complete the table**

https://www.bbc.co.uk/bitesize/guides/zxcrsrd/revision/5

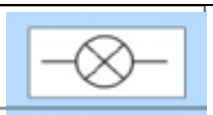
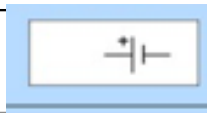
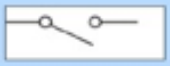
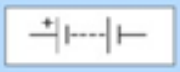
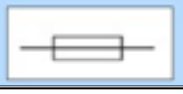
https://myedspace.co.uk/myresources/a-level/biology/aqa/revision-notes/biochemical-tests

| 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** | **Iodine** | • Add a few drops of iodine solution to the sample<br>• No heating required | Blue-black colour | Remains orange-brown |
| **Protein** | Protein | • Add Biuret reagent (or sodium hydroxide + copper sulfate)<br>• Mix gently | Lilac/purple colour | Remains blue |

| | | | | |
|---|---|---|---|---|
| **Lipids** | Lipids | • Add ethanol and shake<br>• Add water (emulsion test) | White/cloudy emulsion forms | Solution remains clear |
| **Reducing sugars** | Reducing sugars | • Add Benedict's solution<br>• Heat in water bath (80–100°C for ~5 minutes) | Green → yellow → orange → brick-red precipitate (depending on concentration) | Remains blue |
| **Non-reducing sugars** | Non-reducing sugars | • Boil with dilute hydrochloric acid<br>• Neutralise with sodium hydrogencarbonate<br>• Then carry out Benedict's test | Same as reducing sugars: orange/brick-red precipitate | Remains blue after Benedict's test |

# PHYSICS – Circuits

**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.

(a) 50

1

Hz / hertz

*allow Hertz*

1

(b) (both) switches need to be closed / on

1

to complete the <u>series</u> circuit
**or**
to allow charge to flow
**or**
so there is a current in the circuit

1

(c)

*an answer of 7.5 (A) scores **3** marks*

*an answer of 0.237(A) scores **2** marks*

$1800 = I^2 \times 32$

*this mark may be awarded if P is incorrectly or not converted*

**1**

$I^2 = \frac{1800}{32}$

**or**

$I^2 = 56.25$

*this mark may be awarded if P is incorrectly or not converted*

**1**

$I = 7.5$ (A)

*this answer only*

**1**

(d)

*an answer of 300 (s) scores **3** marks*

*an answer of 300 000 (s) scores **2** marks*

$1500 = \frac{450\ 000}{t}$

*this mark may be awarded if P is incorrectly or not converted*

**1**

$t = \frac{450\ 000}{1500}$

*this mark may be awarded if P is incorrectly or not converted*

**1**

$t = 300$ (s)

*this answer only*

**1**

**[10]**

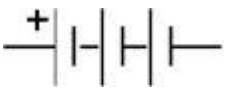
## Q2.

(a) correct circuit symbol

**1**

3 cells joined in series in correct orientation

e.g.




*ignore absence of + symbol*

**1**

(b) $R = \frac{12}{1.6}$

1

R = 7.5 (Ω)

1

*an answer of 7.5 (Ω) scores **2** marks*

(c) 4.0 (Ω)

*allow their answer to part **(b)** − 3.5 correctly calculated*

1

(d) it decreases

1

the current would be higher (for the same p.d.)

*reason only scores if correct box is chosen*

**or**

more than one path for charge to flow

*allow current for charge*

**or**

total resistance is always less than the smallest individual resistance

1

**[7]**

# 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 1.

**Periodicity and properties of elements**

❑ **Atomic Structure**

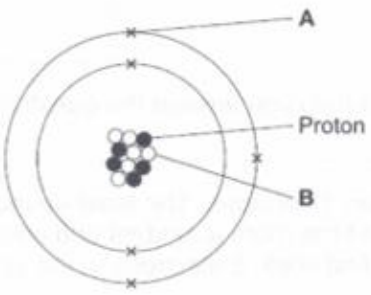
https://www.bbc.co.uk/bitesize/guides/zwn8b82/revision/3 (pages 3,4 and 5)
https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html

❑ **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

**5** **6** **10** **11** **16** = number of protons **(1)**

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

**5** **6** **10** **11** **16** 5 protons + 6 neutrons **(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)**

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

**Q3.** Complete the labels on the diagram below using the following terms:

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | | | B | C | N | O | Fl | Ne |
| Na | Mg | | | | | | | | | | | Al | Si | P | S | CL | Ar |
| K | Ca | Sc | Ti | V | Cr | Mn | fe | CO | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | pD | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| Fr | Ra | Ac | Rf | Db | Sg | Bh | Hs | Mt | Ds | Rg | | | | | | | |

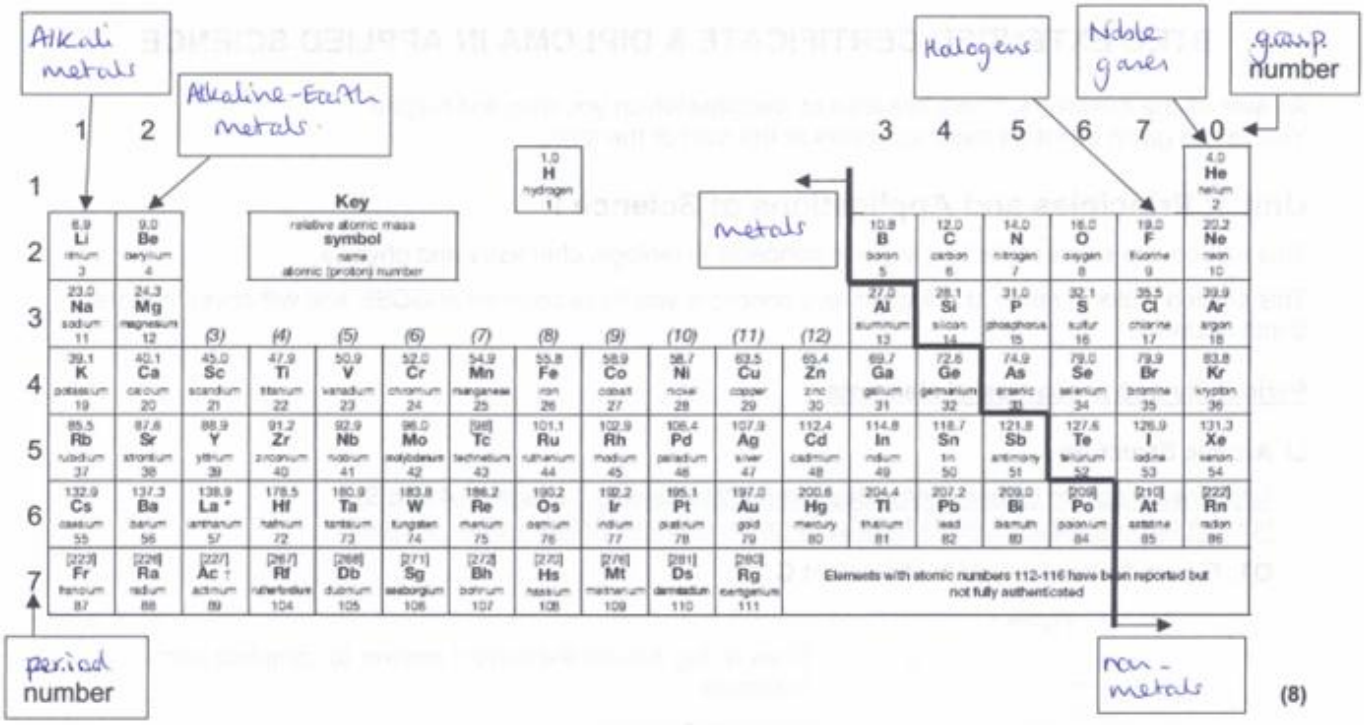
CAPITAL then lower case

**(6)**

**(8)**

**Q3.** Complete the labels on the diagram below using the following terms:

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




**(8)**

**Q4.** Read the information below on element **X** carefully. Use this to help you answer the questions which follow.

> Element **X** has two different isotopes, both of which contain 17 protons. The least abundant isotope contains 20 neutrons. The second isotope is three time 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.

**(a)** Where in the Periodic Table is element **X** found:

Group: ....7.... Period: ....3.... **(2)**

**(b)** Use the Periodic Table in **Q3.** the **key** and your answer to **Q4.(a)** to complete **Figure 2.** for element **X**

**Key**

| | |
|---|---|
| $A_r$ | 35.5 |
| Symbol | Cl |
| name | chlorine |
| Z | 17 |

**(4)**

**(c)** Is element **X** a metal or non-metal? ....non-metal.... **(1)**

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

....Fluorine.... **(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/z2bfxfr/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:

ethane + oxygen → carbon dioxide + water (word equation)

$C_2H_6$ $O_2$ $CO_2$ $H_2O$

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.)

$2C_2H_6$ + $7O_2$ → $4CO_2$ + $6H_2O$ (balanced equation)

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 x 12.0) + (6 x 1.0) = 30.0

$M_r$ of $O_2$ = (2 x 16.0) = 32.0

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

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

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

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

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

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

**(a)** Balance the symbol equation for this reaction

...2.. Li(s) + ...2.. $H_2O$(l) → ...2.. LiOH(aq) + $H_2$(g) **(1)**

**(b) (i)** Complete the table below for this reaction **(8)**

| | Reactant or product | State | $M_r$ |
|---|---|---|---|
| Lithium | reactant | solid | |
| Water | reactant | liquid | 18.0 |
| Lithium hydroxide | product | aqueous (solution) | 23.9 |
| Hydrogen | product | gas | 2.0 |

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

...(2 x 6.9) + (2 x 18.0) = 49.8 ..total mass of reactants.....(1)..

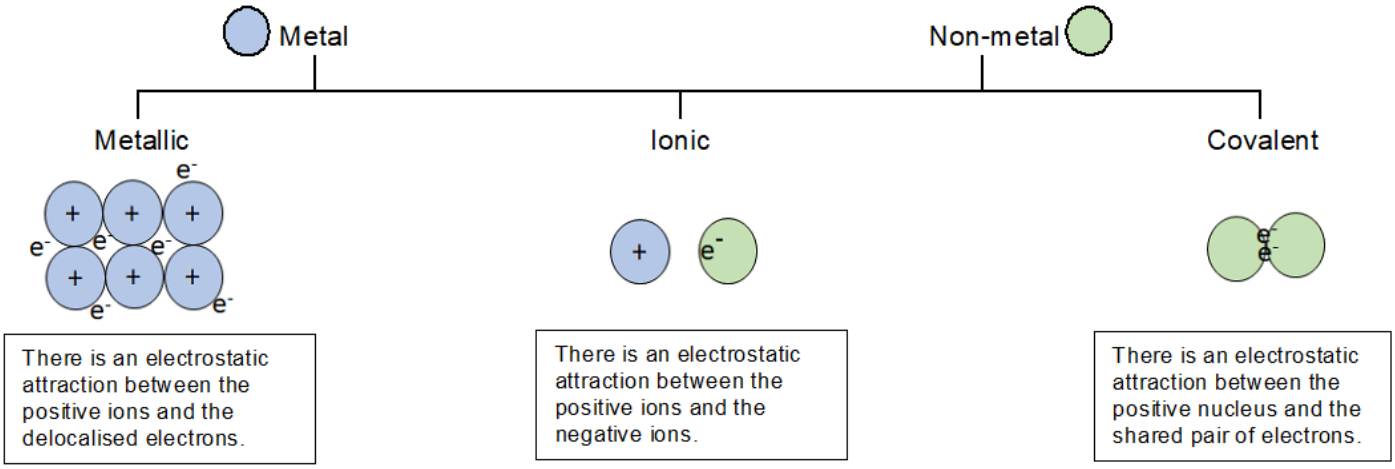
..(2 x 23.9) + 2.0 = 49.8 ..total mass of products ..is.. Yes, they are the same.(1) **(2)**

## ❑ 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

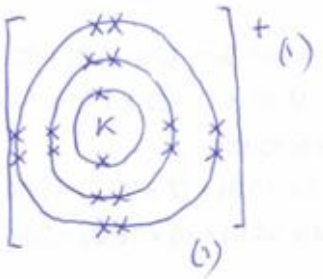
https://www.bbc.co.uk/bitesize/topics/z33rrwx (ionic compounds, small molecules, metals and alloys)

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



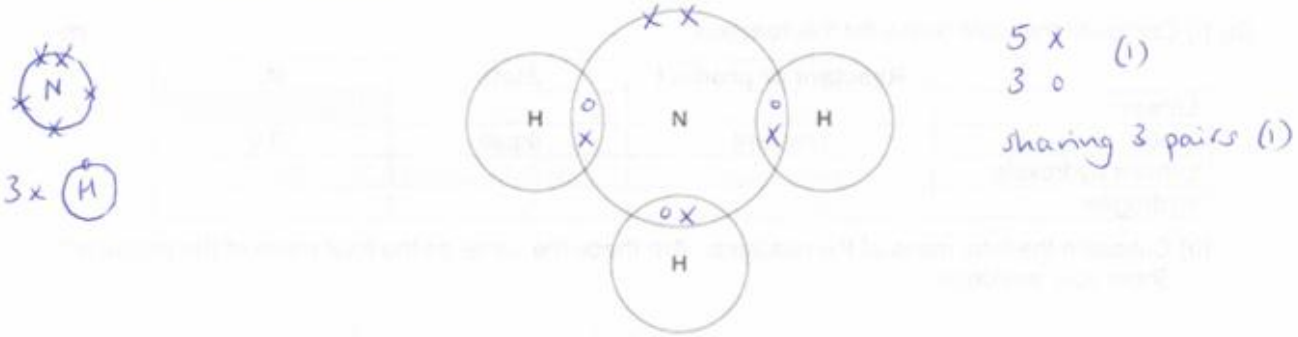

**Q6.** The electronic structure of a potassium atom is 2,8,8,1
Draw a diagram to show the electronic structure of a potassium ion. Show the charge on the ion.

last the 1 outer e⁻



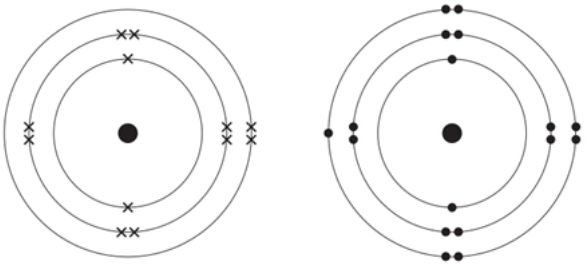

(2)

**Q7.** Complete the dot and cross diagram to show the electrons in the outer shells of ammonia, $NH_3$.
Use the periodic table to help you.



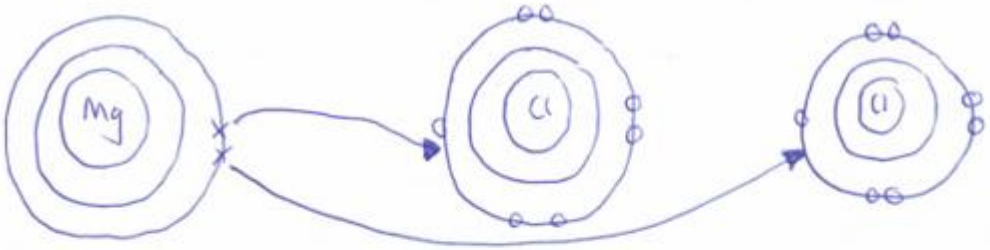

(2)

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



Magnesium 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.




One Mg atom loses 1 e⁻ (1) to one Cl atom (1)
It loses a 2nd e⁻ (1) to a 2nd Cl atom (1)
Mg forms the $Mg^{2+}$ ion and each Cl forms a $Cl^-$ ion

**(4)**

❑ **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.

❑ **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. Wear a lab coat (buttoned up)
2. Wear safety glasses / goggles
3. Tie back long hair (particularly when using a Bunsen burner)
4. Write a risk assessment (before you complete the practical)
5. Keep the lab tidy
6. Wipe up spillages
7. Do not eat (or drink or chewgum) in the lab
8. Wash your hands (particularly before you leave the lab)

(8)

You will be using

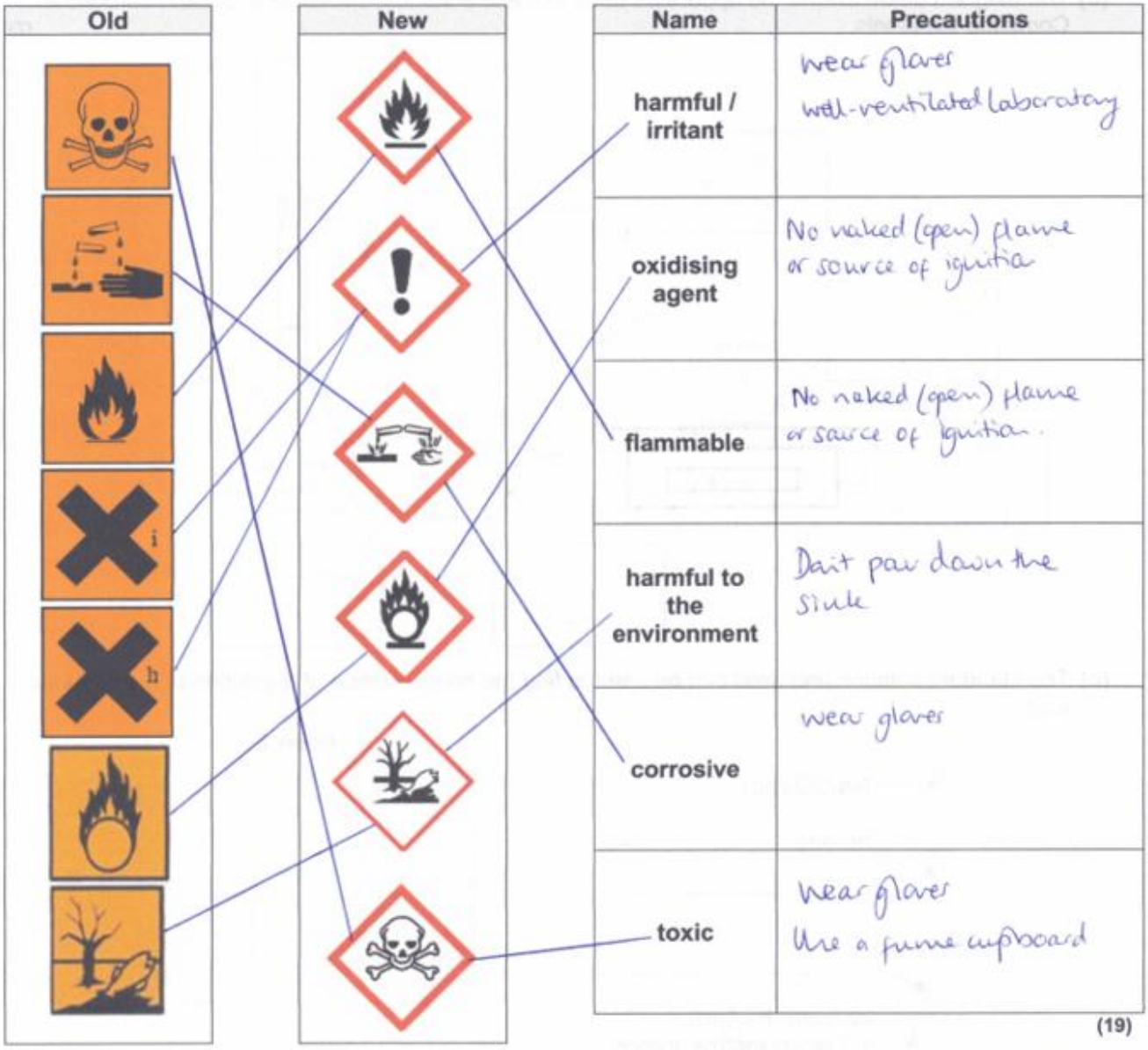
a number of different chemicals and apparatus when completing your experiments.

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

**iv)** Match the old hazard symbol to the new symbol.

**v)** 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)

**vi)** 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)




(19)

always wear labcoat + glaves.

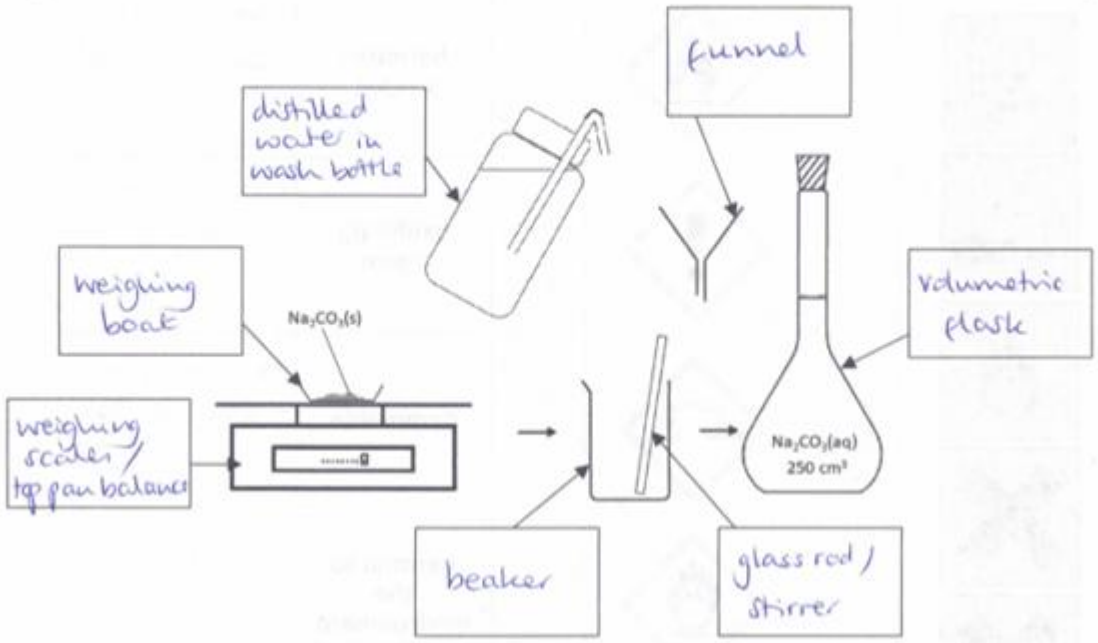
## ❑ Practical techniques

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=xBKyjXUhJy0
  https://www.youtube.com/watch?v=rLc148UCT2w
  https://www.youtube.com/watch?v=gzvzvDv_BnA

**Q1. (a)** What is a standard solution? ...It...is...a...solution...of...(accurately)...known...concentration.....(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.

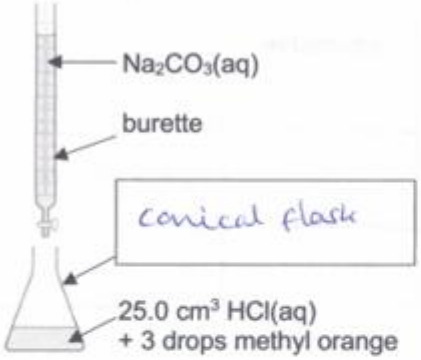



Figure 2.


**(i)** Complete the label to show name of the apparatus in which the acid is placed. **(1)**

**(ii)** What is the name given to this procedure? ....titration..... **(1)**

**(iii)** **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.

24.50 − 2.35

Volume $Na_2CO_3(aq)$ added = ....22.15..... $cm^3$ **(1)**

2 numbers after the decimal point

## ❑ 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 $s^{-1}$

at 39.0 °C it took 256 sec — 1/256 = 0.0039 $s^{-1}$

at 58.0 °C the experiment took 124 s — 1/124 = 0.0081 $s^{-1}$

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)**

| temperature...../ °C | .....time...../ ..s... | rate of reaction.../ ..$s^{-1}$ |
|---|---|---|
| 24.5 | 340 | 0.0029 |
| 39.0 | 256 | 0.0039 |
| 51.0 | 186 | 0.0054 |
| 58.0 | 124 | 0.0081 |
| 80.5 | 62 | 0.0161 |

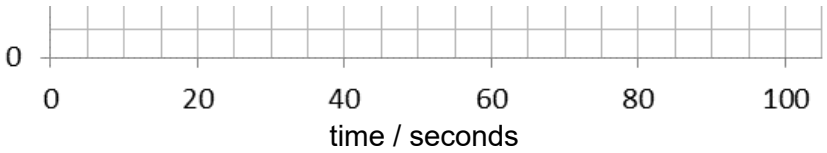
correct headings (1)
units with headings only (1)
all temperatures written to 1 d.p (1)
temperatures written in order of increasing size (1)

https://www.bbc.co.uk/bitesize/guides/z8fq6yc/revision/8

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.

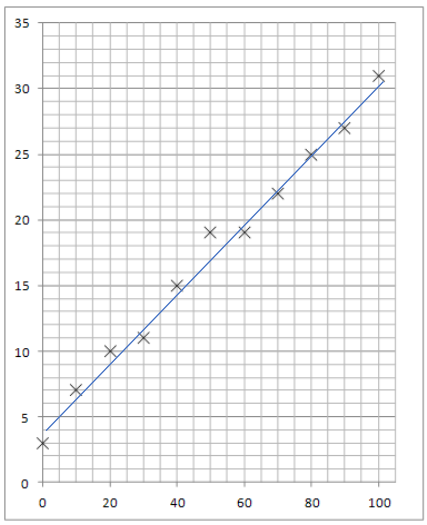
Axes should always be labelled with the quantity being measured and the units.




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:

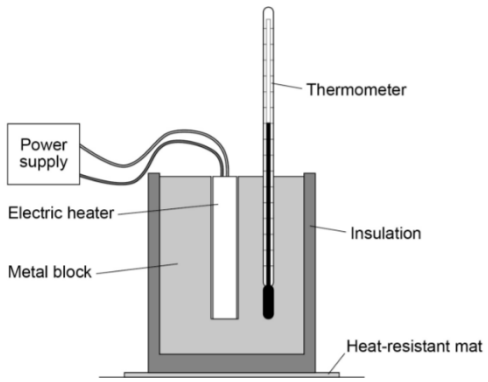
- the line can be straight or curved
- the line should pass through, or very close to, the majority of plotted points (ignoring any anomalous points)
- for points not on the line make sure that there are as many points on one side of the line as the other
- the line should be continuous and drawn with 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 place in a hole drilled in the block as shown in **Figure 1.**

**Figure 9**




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

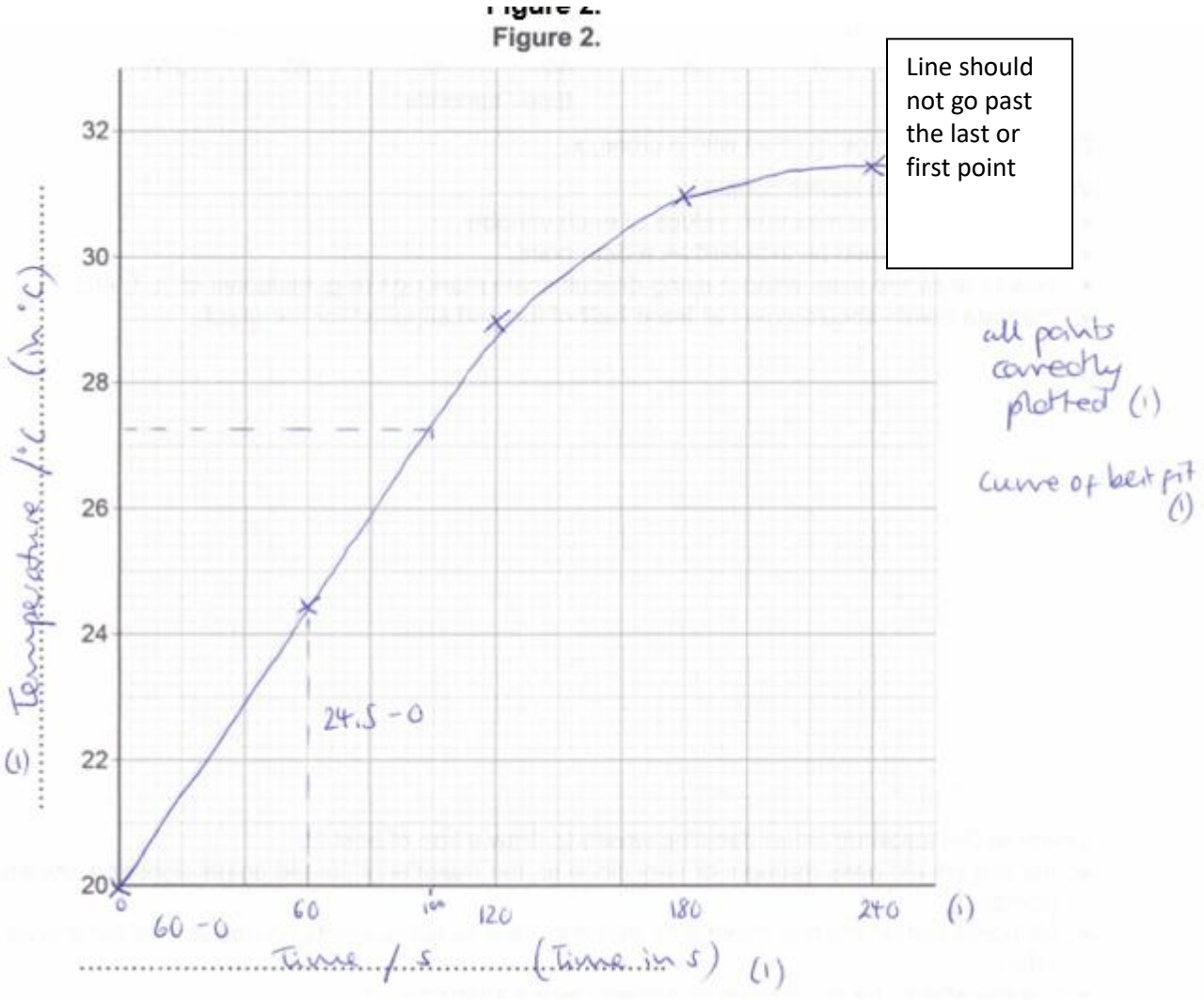
**Table 3.**

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

**(b)** 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 | **Controls what enters and leaves the cell; acts as a barrier to protect the cell.** |
| Cytoplasm | **A jelly-like substance where most chemical reactions happen in the cell.** |
| Nucleus | **Contains the cell's genetic material (DNA) and controls what the cell does.** |
| Nucleolus | **Found inside the nucleus; makes ribosomes, which are needed to build proteins.** |
| Rough Endoplasmic Reticulum | **Covered in ribosomes; helps make and transport proteins.** |
| Smooth Endoplasmic Reticulum | **Makes lipids (fats) and helps remove harmful substances from the cell.** |

| | |
|---|---|
| Golgi Apparatus | **Packages and modifies proteins and other molecules for transport around or out of the cell.** |
| Vesicles | **Small sacs that carry substances around the cell or to the cell membrane to be released.** |
| Lysosomes | **Contain enzymes that break down waste materials or damaged parts of the cell.** |
| Ribosomes | **Make proteins by joining together amino acids, using instructions from the DNA.** |
| Mitochondria | **Release energy from glucose through respiration, providing the cell with energy to work.** |
| Centrioles | **Help organise the movement of chromosomes during cell division (mainly in animal cells).** |

# 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/

**Independent variable:** Potential difference (voltage across the component)

**Dependent variable:** Current flowing through the circuit

**Equipment:**

DC power supply

Variable resistor (or adjustable power supply)

Ammeter

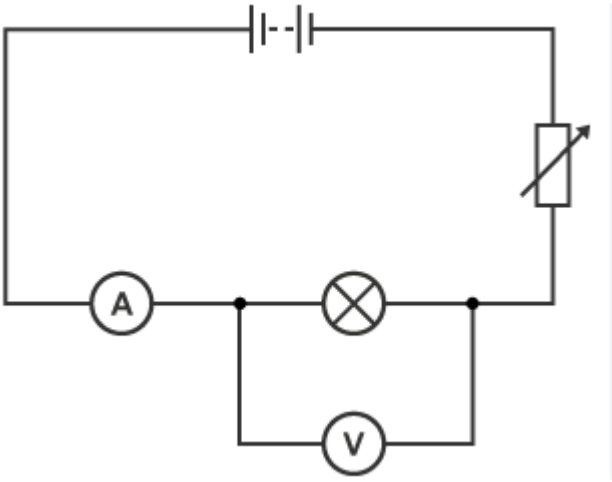
Voltmeter

Fixed resistor (or filament lamp)

Switch

Connecting wires

1. Set up the circuit as shown below (diagram must have ammeter in SERIES and voltmeter in PARALLEL)
2. Ensure the ammeter is connected in series with the resistor.
3. Connect the voltmeter in parallel across the resistor.
4. Close the switch to complete the circuit.
5. Adjust the variable resistor or power supply to set a low potential difference.
6. Record the voltmeter reading (V) and ammeter reading (I).
7. Increase the potential difference in small steps.
8. Record the current for each change.
9. Repeat measurements to improve reliability and calculate averages.
10. Plot a graph of current (I) against potential difference (V).




## Risk assessment:

| Hazard | Risk | Precaution |
|---|---|---|
| Electrical equipment | Electric shock | Use low voltage power supply only; check for damaged wires before use |
| Wires heating up | Burns | Do not touch components if they become hot; switch off between readings and allow components to cool down |
| Short circuit | Overheating, damage to equipment | Ensure correct connections; include resistor in circuit |
| Power supply | Overheating/fire risk | Do not exceed recommended voltage; switch off when not in use |
| Trailing wires | Tripping hazard | Keep workspace tidy and wires organised |
| Electrical equipment | Electric shock | Use low voltage power supply only; check for damaged wires before use |

# CHEMISTRY –

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

## Titrations 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.

(a) (strong because) completely ionised (in aqueous solution)

*ignore pH*

*allow dissociated for ionised*

*do **not** accept hydrogen is ionising*

*do **not** accept $H^+$ are ionised*

**1**

(dilute because) small amount of acid per unit volume

*ignore low concentration*

**1**

(c) (titre):
chooses titrations 3, 4, 5

**1**

average titre = 22.13 ($cm^3$)

*allow average titre = 22.13(3…) ($cm^3$)*

*allow a correctly calculated average from an incorrect choice of titrations*

**1**

(calculation):
(moles NaOH =

$$\frac{22.13}{1000} \times 0.105 = 0.002324)$$

*allow use of incorrect average titre from step 2*

**1**

(moles $H_2SO_4$ =
½ × 0.002324 =) 0.001162

*allow use of incorrect number of moles from step 3*

1

(concentration = $\frac{0.001162}{25} \times 1000$)

= 0.0465 (mol/dm$^3$)

*allow use of incorrect number of moles from step 4*

1

*alternative approach for step 3, step 4 and step 5*

$\frac{2}{1} = \frac{22.13 \times 0.105}{25.0 \times \text{conc. } H_2SO_4}$ *(1)*

*(concentration $H_2SO_4$ =)*

$\frac{22.13 \times 0.105}{25.0 \times 2}$

*= 0.0465 (mol/dm$^3$) (1)*

*an answer of 0.046473* ***or*** *0.04648 correctly rounded to at least 2 sig figs scores marking points 3, 4 and 5*

*an answer of 0.092946* ***or*** *0.09296* ***or*** *0.185892* ***or*** *0.18592 correctly rounded to at least 2 sig figs scores marking points 3 and 5*

*an incorrect answer for one step does* ***not*** *prevent allocation of marks for subsequent steps*

(d) pipette measures a fixed volume (accurately)

1

(but) burette measures variable volume

*allow can measure drop by drop*

1

(e) $(\text{moles} =) \frac{30}{1000} \times 0.105$

**or** 0.00315 (mol)

**or**

(mass per dm$^3$ =) 0.105 × 40

**or** 4.2 (g)

1

$(\text{mass} = \frac{30}{1000} \times 0.105 \times 40)$

= 0.126 (g)

1

*an answer of 0.126 (g) scores* ***2*** *marks*

*an answer of 126(g) scores* ***1*** *mark*

*an incorrect answer for one step does* ***not*** *prevent allocation of marks for subsequent steps*

**[12]**

## Q2.

(a) add excess copper carbonate (to dilute hydrochloric acid)

*accept alternatives to excess, such as 'until no more reacts'*

**1**

filter (to remove excess copper carbonate)

*reject heat until dry*

**1**

heat filtrate to evaporate some water **or** heat to point of crystallisation

*accept leave to evaporate or leave in evaporating basin*

**1**

leave to cool (so crystals form)

*until crystals form*

**1**

*must be in correct order to gain **4** marks*

(b) $M_r$ $CuCl_2$ = 134.5

*correct answer scores **4** marks*

**1**

moles copper chloride = (mass / $M_r$ = 11 / 134.5) = 0.0817843866

**1**

$M_r$ $CuCO_3$= 123.5

**1**

Mass $CuCO_3$ (=moles × $M_2$= 0.08178 × 123.5) = 10.1(00)

**1**

*accept 10.1 with no working shown for **4** marks*

(c) $\frac{79.1}{100} \times 11.0$

**or**

11.0 × 0.791

**1**

8.70 (g)

**1**

*accept 8.70(g) with no working shown for **2** marks*