Year 10 Biology- Term 3: Respiration and Nervous System

Key Words

Respiration:

- **Aerobic respiration: A form of respiration that uses oxygen to release energy from molecules like glucose.**
- **Anaerobic respiration: A form of respiration that releases energy from molecules like glucose without using oxygen.**
- **Cellular respiration: An exothermic reaction which is continuously occurring in living cells.**
- **Limiting factor: A factor that limits the rate of a reaction when there is not enough of it.**
- **Metabolism: The sum of all the reactions in a cell or the body.**
- **Oxygen debt: The amount of extra oxygen the body needs after exercise to react with the accumulated lactic acid and remove it from the cells.**
- **Photosynthesis: An endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.**

Nervous System

- **The brain: An organ made of billions of interconnected neurones which controls complex behaviour and has different regions that carry out different functions.**
- **The central nervous system (CNS): The brain and spinal cord which coordinate the response of effectors.**
- **The eye: A sense organ containing receptors sensitive to light intensity and colour.**
- **Thermoregulatory centre: An area of the hypothalamus in the brain which contains blood temperature receptors and regulates body temperature.**
- **Receptors: Organs or cells that detect stimuli.**
- **Reflex action: A rapid and automatic response to a stimulus.**
- **Stimuli: Changes in the environment.**

Respiration

Aerobic Respiration: using oxygen to break down food molecules is called . Glucose is the molecule normally used for respiration – it is the main . Glucose is to release its energy.

The word equation for aerobic respiration is:

glucose + oxygen → carbon dioxide + water + energy released

You need to be able to recognise the chemical symbols:

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + energy released

Anaerobic respiration

- Most organisms cannot respire without oxygen but some organisms and tissues can continue to respire if the oxygen runs out. These organisms and tissues use the process of
- Human muscle can respire anaerobically for short periods of time – even though the process is relatively inefficient, it's better to continue respiring and be able to run away from danger – or run a race.

- The glucose in muscle is converted to :

glucose → lactic acid + energy released

Some plants, and some such as yeast can respire anaerobically – it's preferable to release less energy but remain alive.

- Glucose in yeast cells is converted to carbon dioxide and , which we refer to simply as 'alcohol':

glucose → ethanol + carbon dioxide + energy released

	Aerobic	Anaerobic
Presence of oxygen	Present.	Absent or in short supply.
Oxidation of glucose	Complete	Incomplete. The products of respiration still contain energy.
Products of respiration	Carbon dioxide and water. The products do not contain stored chemical energy.	Mammalian muscle: lactic acid. Yeast: ethanol and carbon dioxide. Some plants: ethanol and carbon dioxide. The products still contain stored chemical energy.
Amount of energy released	Relatively large amount.	Small amount, but quickly.

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Nervous Control

Method for RPA – Reaction Time

Aim : Investigate the effect of practice/repetition on the reaction time of a ruler drop test. Method

1. Sit down on the chair and place your forearm of your weaker/non-dominant hand on the table with your hand hanging over the end of the table.
2. Have your partner hold a ruler with the bottom end in between your fingers so you can practice holding the ruler with 2 fingers.
3. Have your partner hold the ruler and remove your fingers.
4. Have your partner hold the ruler in line so that the 0 mark is level with the top of your thumb.
5. Your partner will drop the ruler without telling you beforehand, and you will catch the ruler as quickly as you can.
6. Note and record the number level with the top of your thumb after you have caught the ruler in a table such as below.
7. Repeat the test at least 5 times.
8. Swap places with your partner and repeat steps 1-7.
9. Find reaction times by using a conversion table to convert the ruler measurements.

Nervous Control

The human nervous system consists of:

- the central nervous system (CNS) – the brain and spinal cord
- the peripheral nervous system – nerve cells that carry information to or from the CNS

Information is brought to the central nervous system and taken away by nerves which are bundles of neurones.

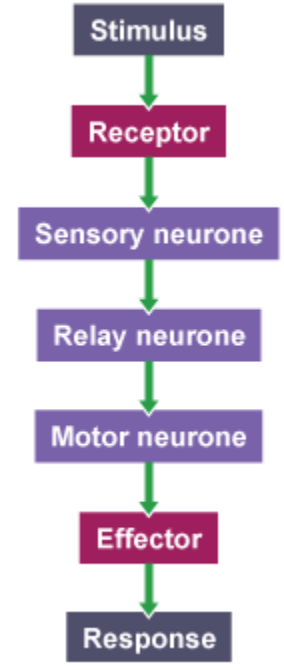
Reflex actions

There are different types of neurons that work together in a reflex action.

This creates an automatic and rapid response to a stimulus, which minimizes any damage to the body from potentially harmful conditions, such as touching something hot.

The nerve pathway followed by a reflex action is called a reflex arc.

For example, a simple reflex arc happens if we accidentally touch something hot.



1.Receptor in the skin detects a stimulus (the change in temperature).
2.Sensory neurone sends electrical impulses to **relay neurone**, which are located in the spinal cord. They connect sensory neurones to motor neurones.
3.Motor neurone sends electrical impulses to an effector.
4.Effector produces a response (muscle contracts to move hand away).

Practice Questions

Q1. (a) (i) Complete the word equation for the process of aerobic respiration.

Glucose + ... → carbon dioxide + water

(ii) Which organ removes carbon dioxide from your body?

.....

(b) Use names from the box to complete the **two** spaces in the passage.

carbon dioxide	lactic acid	nitrogen	oxygen	water

Anaerobic respiration can occur when an athlete does vigorous exercise.

This is because there is not enough in the boc

.(a) Use words from the box to complete the equation for aerobic respiration.

alcohol	**glucose**	**lactic acid**	**water**

..... + oxygen → carbon dioxide + ...
energy)

(a) The table shows the effect of exercise on the action of one person's heart.

	At rest	During exercise
Heart rate in beats per minute	72	165
Volume of blood leaving the heart in each beat in cm^3	75	120
Heart output in cm^3 per minute	5400	

(i) Calculate the heart output for this person during exercise.

Show clearly how you work out your answer.

.....

.....

.....

.....

Answer = ... cm^3 per minute

(ii) During exercise, more oxygen is carried to the working muscles.

Explain why this is helpful during exercise.

.....

.....

.....

.....

.....

(b) Give **two** other changes in the body that help to increase the amount of oxygen delivered to the working muscles during exercise.

1 .....

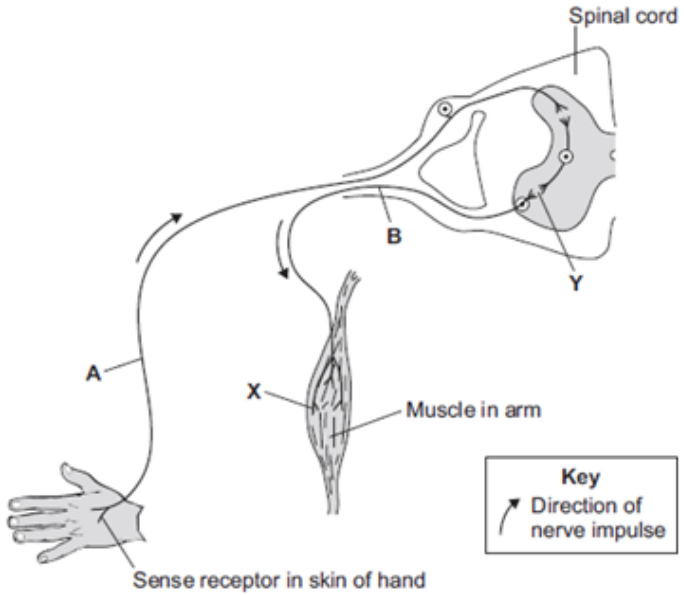
.....

2 .....

.....

Diagram 1 shows the neurones and parts of the body involved in a response to touching a hot object.

Diagram 1



A neurone is a nerve cell. Neurones carry impulses around the body.

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

Neurone **A** is a
- motor neurone.
- relay neurone.
- sensory neurone.

At point **Y** there is a tiny gap between two neurones called
- an effector.
- a receptor.
- a synapse.

Year 10 Chemistry - Term 3: Chemical changes

Key Words

Alkali - This is a soluble hydroxide. They produce OH^- (aq) ions when you add to water.

Bases - The oxide, hydroxide or carbonate of a metal that will react with an acid forming a salt as one of the products

pH - A number which shows how strongly acidic or alkaline a solution is.

Neutralisation - The chemical reaction of an acid with a base in which a salt and water are formed.

Oxidation - The reaction when oxygen is added to a substance or when electrons are lost.

Reduction - A reaction in which oxygen is removed or electrons are gained.

Displacement reaction - A reaction in which more reactive elements take the place of a less reactive element in one of its compounds.

Reactivity Series - A list of elements in order of their reactivity

Carbonates - A salt of the anion CO_3^{2-}, typically formed by reaction of carbon dioxide with bases.

Acid - When dissolved in water, its solution has a pH value less than 7. Acids are proton (H+) donors.

Control variable – a factor in an investigation that we must keep the same to prevent errors in our results.

Independent variable – a factor in an investigation that we change i.e. temperature.

Dependent variable – a factor that we observe/ measure in an investigation.

Mean – the average number in a set of data (add the values together and divide this by the number of values you have)

Reproducible – a measurement is reproducible if it is completed by another person and the same results are obtained.

Acids, Metals and Salts

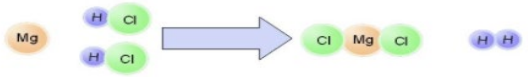
Whenever a reaction does take place between a metal and an acid, a salt and hydrogen gas are formed.

Acid + Metal → Salt + Hydrogen gas

hydrochloric acid + magnesium → magnesium chloride + hydrogen gas

Formula equation:

$$Mg\ (s) + 2\ HCl\ (aq) \longrightarrow MgCl_2\ (aq) + H_2\ (g)$$

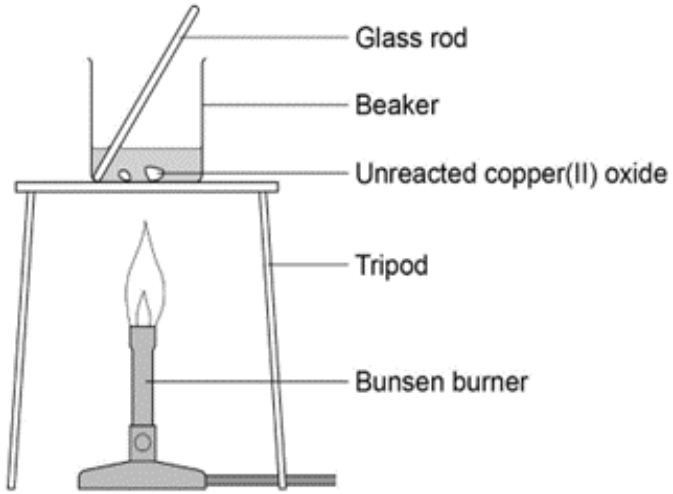


- The magnesium atoms have lost electrons, so magnesium atoms have been oxidised in the reaction.
- The hydrogen ions have gained electrons, so hydrogen ions have been reduced in the reaction.

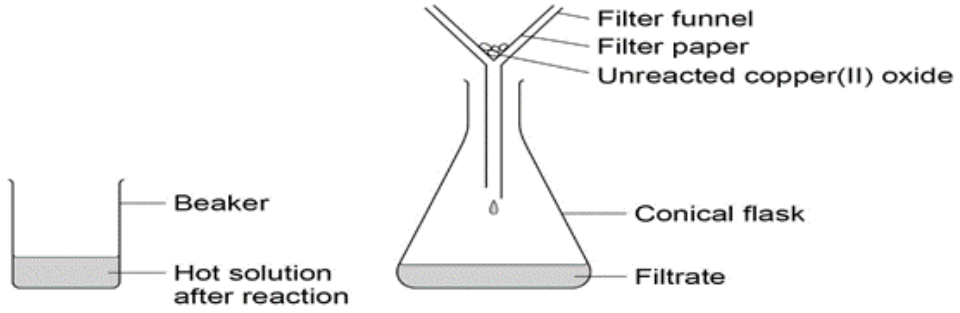
Scan the QR code with your mobile phone to access revision materials.

Method for RPA Salts from Insoluble Bases

1. Measure 40 cm3 sulfuric acid into the 100 cm3 beaker. The volume does not need to be very accurate, so you can use the graduations on the beaker.
2. Set up the tripod, gauze and heatproof mat. Heat the acid gently using the Bunsen burner until it is almost boiling. Turn off the Bunsen burner.
3. Use the spatula to add small amounts of copper (II) oxide powder. Stir with the glass rod. Continue to add copper (II) oxide if it keeps disappearing when stirred. When the copper (II) oxide disappears, the solution is clear blue.
4. Stop adding the copper (II) oxide when some of it remains after stirring. Allow apparatus to cool completely. Copper oxide is now in excess.

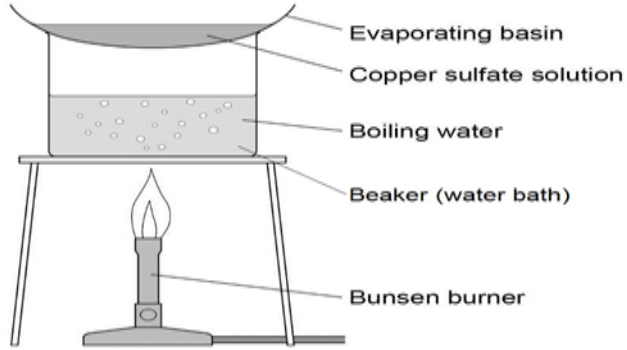


5. Set up the filter funnel and paper over the conical flask. Use the clamp stand to hold the funnel. Filter the contents of the beaker from step 3.



Scan the QR code with your mobile phone to access a 'making salts' RPA video.

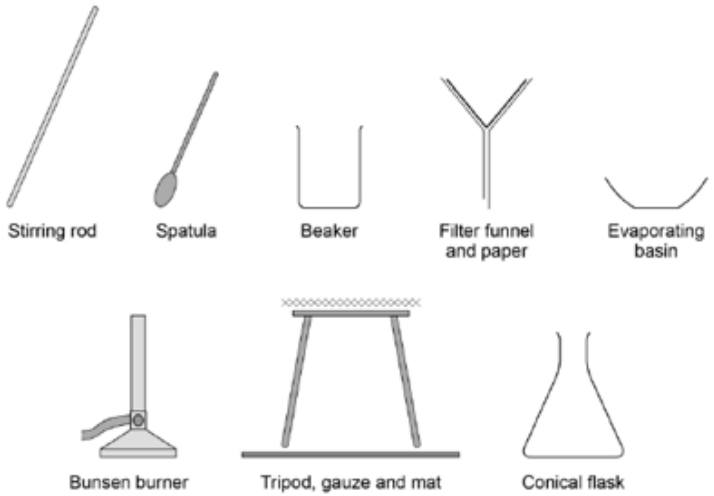
6.When filtration is complete, pour the contents of the conical flask into the evaporating basin. Evaporate this gently using a water bath (250 cm^3 beaker with boiling water) on the tripod and gauze (see diagram). Stop heating once crystals start to form.



7.Transfer the remaining solution to the crystallising dish. Leave this in a cool place for **at least 24 hours**.

8. Remove the crystals from the concentrated solution with a spatula. **Gently** pat the crystals dry between two pieces of filter paper. These are pure dry crystals of copper (II) sulfate.

Q1. This question is about making copper salts.
The figure below shows the apparatus given to a student.



Outline a safe plan the student could use to make pure, dry, crystals of the soluble salt copper sulfate from the insoluble metal oxide and dilute acid.

(Total 6 marks)

Exam Practice.

Complete exam Q1 without looking back at the method.

Now look at the method and improve / amend your answer.

Now try Q2. Try to find the errors in the original student method and then apply your method from answer to Q1 to write a much-improved method for the answer to Q2.

Q2.
A student plans a method to prepare pure crystals of copper sulfate.

The student's method is:

1. Add one spatula of calcium carbonate to dilute hydrochloric acid in a beaker.
2. When the fizzing stops, heat the solution with a Bunsen burner until all the liquid is gone.

The method contains several errors and does not produce copper sulfate crystals.

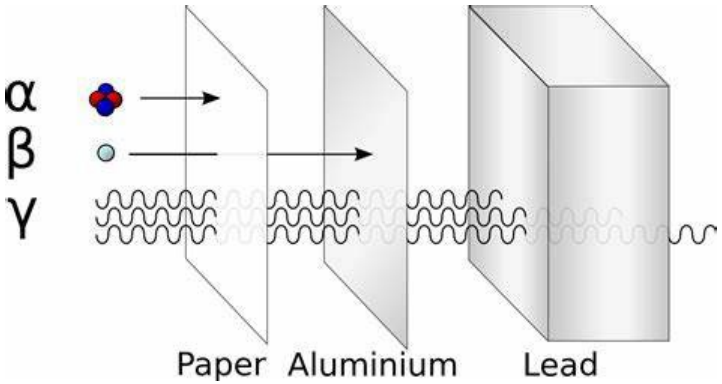
Explain the improvements the student should make to the method so that pure crystals of copper sulfate are produced.

(Total 6 marks)

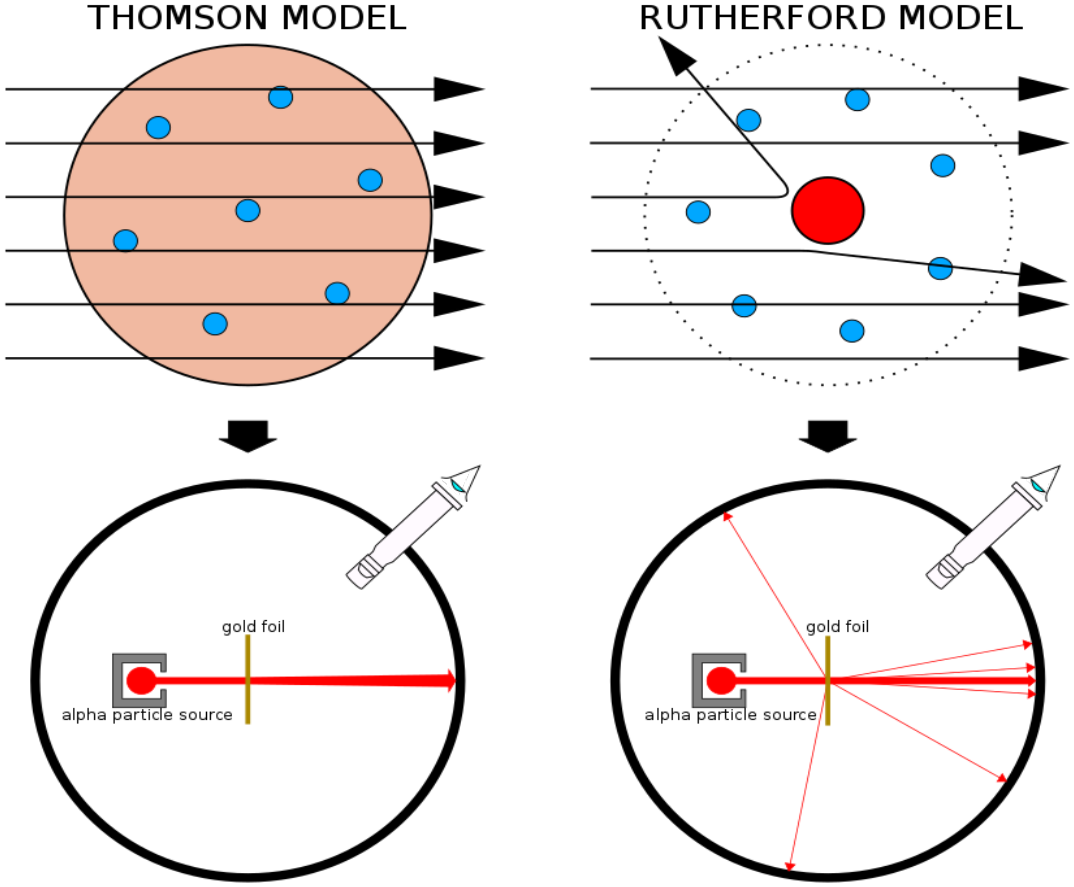
Y10 Science Physics Radio activity

Radioactivity

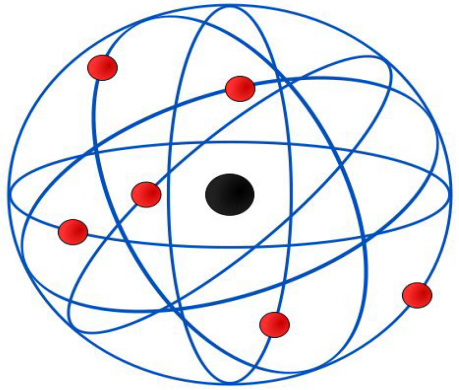
A radioactive substance has unstable nuclei that become stable by emitting radiation. The three main types of radiation are alpha, beta and gamma their penetrating power is shown



The proposed Plum Pudding Model is a model of atomic structure by J.J. Thomson in the late 19th century. Thomson had discovered that atoms are composite objects, made of pieces with positive and negative charge, and that the negatively charged electrons within the atom were very small compared to the entire atom. He therefore proposed that atoms have structure similar to a plum pudding, with tiny, negatively charged electrons embedded in a

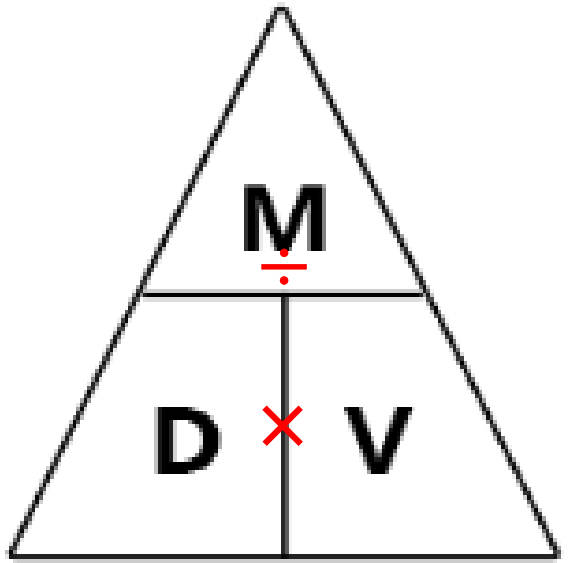


Rutherford's Nuclear Model of the Atom



- The nucleus is very small, dense, and positively charged.
- Electrons surround the nucleus.
- Most of the atom is empty space

Y10 Science Physics Density RPA and RadioactivityKO quiz



Density KO quiz

- What are the units for density
- What are the units for mass
- What are the units for volume?

- Rearrange the equation triangle to find the mass of an object.
- Write a method to find the density for a regular object such as a cube, don't forget to include the equations.

Radioactivity KO quiz

- What is a radioactive substance?
- What are the three types of radiation?
- What material stops each type of radiation?
- The Plum Pudding Model is a model of atomic structure proposed by who?
- Where on the atomic model of the atom are the electrons?
- What is the charge of the nucleus in the centre of the atom?