KING'S LYNN ACADEMY

KNOWLEDGE ORGANISER

Year 10 Autumn Term 1

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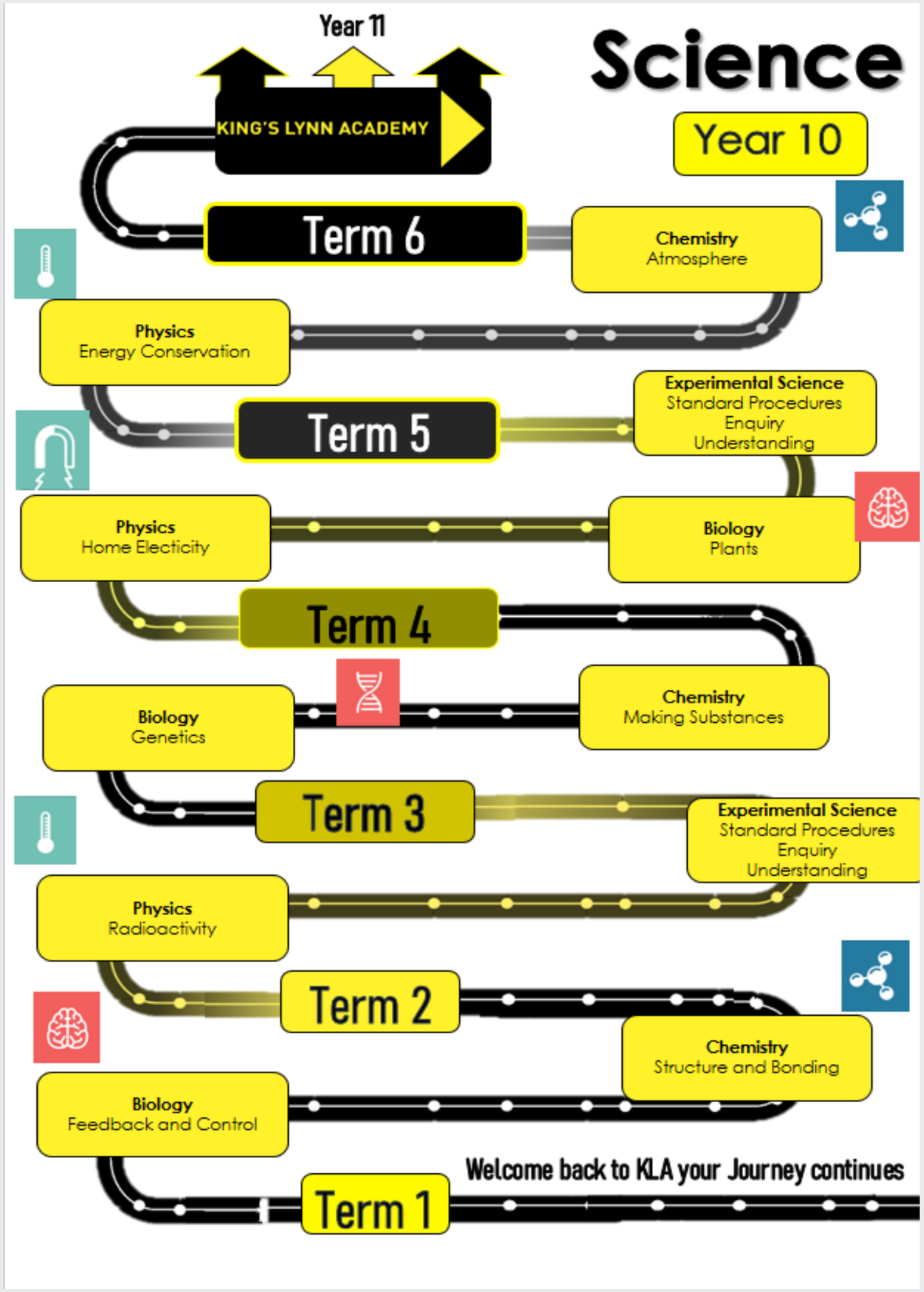


NEXT STEPS:

FEED FORWARD:

Year 10

Science
Knowledge Checklist

	KNOWLEDGE CHECKLIST	KNOWLEDGE PROGRESS R	A	G
1	Life processes are controlled by nerves and hormones			
2	Life processes need a constant internal environment—Homeostasis			
3	Hormones play a vital role in sexual reproduction in humans			
4	Chemical bonds are made in chemical reactions			
5	Chemical bonds involve the transfer or sharing of electrons			
6	Chemical bonds can be ionic, covalent or metallic			
7	Forces can be described and explained using force diagrams			
8	Acceleration is the change of velocity			
9	The acceleration of an object can be calculated from the gradient of a velocity–time graph			
10	Newton's three laws of motion explain the relationships between motion and force			

High Flyers - Enrichment Task

Use of appropriate apparatus and techniques for the observation and measurement of biological changes and/or processes.

Use of appropriate apparatus and techniques for conducting and monitoring chemical reactions, including appropriate reagents and/or techniques for the measurement of pH in different situations.

Use of appropriate apparatus and techniques for measuring motion, including determination of speed and rate of change of speed (acceleration/deceleration).

Q. A bee is flying towards a man's face. The muscles in the eyelid shut the man's eye before the bee hits the eye. Describe the **pathway** taken by the nerve impulse in the blink reflex. Explain **why** we have this reflex. [6 marks]

Q. A swimmer's speed increases as she begins to swim. The swimmer has a top (maximum) speed. Explain **why**. [6 marks]

Q. Lithium chloride is a solid with a high melting point. It conducts electricity only when molten or in solution. Describe the **bonding** present in lithium chloride and explain the **properties** given above. [6 marks

Notes

Forces

Acceleration: Big ideas

What expert understanding do we want after 5 years?

Forces predict motion
Big idea

Objects interact. The overall effect of forces on an object depends on their sum. Objects in equilibrium have constant motion, but change velocity with a resultant force. Newton's laws and the equations of motion can predict motion.

How does the unit develop this?

Vectors
Key Concept

Forces are vectors, with both magnitude & direction. They can be contact or non-contact

Sub-concepts

Scalar vs. Vector, Contact forces vs. Non-Contact Forces

Facts

- Vectors have magnitude & direction; Scalars have only magnitude
- Forces can be contact or non-contact
- When considered in a single plane, unbalanced forces add up to produce a resultant force in a single direction
- Distance vs. Displacement
- Speed vs. Velocity

Newton's 1st (& 3rd) Law
Key Concept

1st Law – an object remains in the same state of motion unless a resultant force acts on it
3rd Law - whenever two objects interact, they exert equal and opposite forces on each other

Sub-concepts

Newton's 1st Law; Newton's 3rd Law; Inertia, Centre of Mass

Facts

- When the resultant force is not zero, an object will accelerate & change direction, speed or shape
- When the resultant force is zero, an object will remain travelling in the same direction, at the same speed. This includes remaining stationary.

Acceleration
Key Concept

Acceleration can be calculated using the formula;

$$Acceleration = \frac{change\ in\ velocity}{time\ taken}$$

Sub-concepts

Calculating Acceleration, Units, calculating acceleration from the gradient of a V/T graph; Displacement from V/T Graph

Facts

- Acceleration is change in velocity ÷ time taken
- Unit is m/s^2 or ms^{-2}
- Gradient of a V/T graph = acceleration
- Area under a V/T graph = displacement [Higher Ability]

Notes

Triple Science? Get extra support here

Combined Science? Get extra support here

	Answer
1.	Enables organisms to react to their surroundings and coordinates behaviour.
2.	Brain and spinal cord.
3	For survival and to prevent damage to the body.
4.	A change to the internal or external environment.
5.	Muscles and glands.
6.	Body temperature, blood glucose concentration, water levels
7.	Junction between 2 neurones where chemicals are released, allowing impulses to cross.
8.	Carry electrical impulses around the body.
9.	System of glands that secrete hormones into the blood stream.
10.	Brain.
11.	Pancreas.
12.	Insulin and glucagon
13.	Oral contraceptives, injection, implant, skin patch, IUD
14.	Barrier methods, copper IUD, spermicidal agents, sterilisation, abstinence
15.	Increases heart rate and boosts delivery of oxygen and glucose to brain and muscles to prepare the body for 'fight or flight'
16.	Stimulates basal metabolic rate, so is important for growth and development
17.	Ovaries in females and testes in males.
18.	Emotionally and physically stressful, low success rate, can lead to risky multiple births.

	Key words
1	**Homeostasis** is the regulation of internal conditions (of a cell or whole organism) in response to internal and external changes, to maintain optimum conditions for functioning.
2	**Reflex actions** of the nervous system are automatic and rapid – they do not involve the conscious part of the brain. They are important for survival because they help prevent damage to the body.
3	**Neurones** carry electrical impulses around the body – relay neurones connect sensory neurones to motor neurones.
4	**Synapses** are physical gaps between neurones, which use neurotransmitter chemicals to allow electrical impulses in the nervous system to cross between neurones.
5	**Involuntary** – not under our conscious control
6	**Receptors** are specialised cells that detect a stimulus. Their job is to convert the stimulus into electrical signals in nerve cells.
7	**Diabetes** is a non-communicable disease where the body either cannot produce or cannot respond to insulin.
8	**Hormonal contraception** contain hormones to inhibit FSH production so no eggs mature
9	The **menstrual cycle** is a recurring process which takes around 28 days. During the process, the lining of the **uterus** is prepared for pregnancy. If implantation of the fertilised egg into the uterus lining does not happen, the lining is then shed. This is known as **menstruation**.
10	**Ovulation** is the process of releasing an egg from an ovary.

	Questions
1	What is the function of the nervous system?
2.	What are the 2 parts of the central nervous system?
3	Why are reflex actions important?
4.	What is a stimulus?
5.	Name 2 types of effectors.
6.	Give three internal conditions controlled in homeostasis
7.	What is a synapse?
8.	What is the function of neurones?
9.	What is the endocrine system?
10.	Where is the pituitary gland located?
11.	Which organ monitors and controls blood glucose concentration.
12.	Which hormones interact to regulate blood glucose levels?
13.	What are the methods of hormonal contraception?
14.	What are the methods of non-hormonal contraception?
15.	What is the function of adrenaline in the body?
16.	What is the function of thyroxine in the body?
17.	Which endocrine glands control secondary sexual characteristics?
18.	State the disadvantages of IVF treatment.

	Know the facts
1	Acceleration is the change in velocity of an object per second.
2	Acceleration is a vector quantity.
3	An object is accelerating if its speed or its direction (or both) are changing.
4	A negative acceleration means an object means an object is slowing down and is called deceleration.
5	Acceleration = change in velocity / time taken ($a = v \Delta / t$).
6	Uniform acceleration is when the acceleration of an object is constant.
7	Newton's First Law says that the velocity, speed, and/or direction of an object will only change if a resultant (unbalanced) force is acting on it.
8	The velocity of an object is both the speed and direction in which it is moving.
9	Distance is how far an object moves, but it does not involve direction.
10	Vectors are a resultant force acting in a diagonal direction. You need to be able to draw vector diagrams.
11	All objects have inertia whether they are moving or not.
12	Know distance-time graphs – how distance travelled by an object travelling in a straight line changes with time
13	Know velocity-time graphs – how velocity of an object changes with time
14	When an object moves through a fluid (liquid or gas) a frictional force drags on it.

	Key words
1	**Scalar quantities** have magnitude only.
2	**Vector quantities** have magnitude and an associated direction.
3	**Magnitude** is the size of a physical quantity.
4	**Streamlining** is the reduction of drag on an object.
5	**Inertia** is the tendency of an object to continue in its current state (at rest or in uniform motion) unless acted on by a resultant force.
6	**Terminal velocity** is the constant velocity a falling object reaches when the frictional force acting on it is equal to its weight.
7	**Air resistance** (drag) is a type of friction between air and another material.
8	**Displacement** is a vector quantity and has both magnitude and direction.
9	**Acceleration** is the change in velocity of an object per second ($m/s/s$ or m/s^2).
10	**Deceleration** is slowing down, or negative acceleration.
11	**Velocity** of an object is its speed in a particular direction. Velocity is a vector quantity because it has both a magnitude and an associated direction.
12	**Speed** is a measure of how far an object moves in a given time.
13	**Resultant force** is the overall force acting on an object.

	Question
1.	What is the difference between distance and displacement?
2.	What is the difference between speed and velocity?
3	What are the typical speeds for a person walking, running and cycling?
4.	What is acceleration?
5.	What is the unit of acceleration?
6.	How can an object be accelerating even if it is travelling at a steady speed?
7	What is happening to an object if it has a negative acceleration?
8	What information does the gradient of the line in a distance-time graph provide?
9	What information does the gradient of the line in a velocity-time graph provide?
10	What is the name for the steady speed of a falling object reaches when the resistive force is equal to its weight?
11	In which direction does the drag on an object always act?
12	What can be done to reduce the drag on an object?
13	What happens to the drag on an object as its speed increases?
14	What does Newton's First Law say?
15	What is the resultant force on an object moving at a steady speed in a straight line?
16	What forces are balanced when an object travels at a steady speed?
17	What is meant by inertia?

Triple Science? Get extra support here

Combined Science? Get extra support here

Extra support can be found at these BBC bitesize links

Notes

	Know the facts
1	Function of the nervous system enables humans to react to their surroundings and to coordinate their behaviour – includes both voluntary (relatively slow) and involuntary actions
2.	Homeostasis maintains optimum conditions for all cell functions and enzyme actions including blood glucose concentration, body temperature and water levels.
3	Reflex arc – the pathway of the electrical impulse. Stimulus → Receptor → Sensory neuron (s) → Coordinator (central nervous system. Relay neuron or interneuron) → Motor neuron(s)→ Effector (muscle or hormone gland)→ Response
4.	The endocrine system is composed of hormone glands. Blood carries the hormones to a target organ, where an effect is produced. Compared to the nervous system, effects caused by the endocrine system are slower but act for longer.
5.	Negative feedback systems work to maintain a steady state. Blood glucose, water and thyroxine levels are all controlled in the body by negative feedback.
6.	Oestrogen – main female reproductive hormone. Testosterone – main male reproductive hormone.
7	Follicle stimulating hormone (FSH) released by pituitary gland. Causes eggs to mature in the ovaries. Stimulates ovaries to produce oestrogen.
8	Oestrogen released by ovaries. Causes lining of uterus wall to thicken. Inhibits release of FSH. Stimulates release of luteinising hormone. Sometimes used in contraceptives for fertility control.
9	Luteinising hormone (LH) released by pituitary gland. Stimulates release of mature eggs from ovaries (ovulation)
10	Progesterone released by ovaries. Maintains thick uterus lining. Inhibits FSH and LH. Forms a mucus plug in the cervix. Used in contraceptives for fertility control.
11	FSH and LH can be given as a drug to treat infertility using invitro fertilisation (IVF) treatment.

Notes

Homeostasis and Response: Big ideas

Organisms

What expert understanding do we want after 5 years?

Cells are alive
Big idea

Maintaining a constant internal environment in response to internal and external change is essential for survival. In humans this is achieved through detection, processing and antagonistic responses by the nervous and endocrine systems, to control blood sugar levels, body temperature and water balance.

How does the unit develop this?

Nervous System
Key Concept

The brain, spinal cord, neurones, synapses, receptors and effectors of the nervous system are
adapted to enable humans to respond to internal and external stimuli. The structures of the eye are
adapted to its function as a sense organ.

Sub-concepts

Nervous system
Reflex arc

Facts

- cells called receptors detect stimuli
- coordination centres (brain and spinal cord) receive and process information from receptors
- Reflex actions are automatic, rapid and protect the body

Endocrine System
Key Concept

The human endocrine system is adapted for coordination and control, including through negative feedback.

Sub-concepts

Hormones and Glands
Pituitary gland

Facts

- Hormones are released from the thyroid gland, pancreas, adrenal gland, testes and ovaries
- The pituitary gland in the brain is the 'master gland'

Hormones and Reproduction
Key Concept

Hormones play a vital role in enabling sexual reproduction in humans: they regulate the menstrual cycle, including ovulation, in adult females. Without this process, sexual reproduction would not be possible.

Sub-concepts

Sex hormones
Menstrual cycle
Fertility

Facts

- Oestrogen is the main female sex hormone
- Testosterone is the main male sex hormone
- Men produce sperm continuously and women have a monthly cycle
- There are 4 hormones in the menstrual cycle
- Fertility can be reduced be a variety of methods of contraception

	Answer
1	Distance is a scalar quantity and only has a magnitude (size), displacement is a vector quantity and has both magnitude and direction.
2	Speed is a scalar quantity and only has a magnitude (size), velocity is a vector quantity and has both magnitude and direction.
3	1.5 m/s, 3.0 m/s and 6.0 m/s
4	Change in velocity of an object per second
5	m/s^2
6	If it is changing direction
7	It is slowing down
8	Speed
9	Acceleration
10	Terminal velocity
11	In the direction opposite to which it is moving
12	Streamlining
13	The drag increases.
14	The velocity of an object will only change if a resultant force is acting on it.
15	Zero.
16	Resistive forces = driving force
17	The tendency of an object to remain in a steady state (at rest or in uniform motion)

Notes

Matter

Structure and Bonding: Big ideas

Notes

What expert understanding do we want after 5 years?

Structure determines properties
Big idea

The properties of a substance depend upon the type of atoms it contains and the strength of the bonds holding them together. The properties determine the uses the substance is suitable for.

How does the unit develop this?

Ionic, Covalent, Metallic
Key Concept

Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures.

Sub-concepts

Bonds hold atoms together.

Facts

- Ionic, Covalent and metallic Bonds
- Structures of Carbon

Triple Science? Get extra support here

Electrolysis
Key Concept

When an ionic compound is melted or dissolved in water, these liquids and solutions are able to conduct electricity and are called electrolytes. Passing an electric current through electrolytes causes the ions to move to the electrodes, producing elements. This process is called electrolysis.

Combined Science? Get extra support here

Sub-concepts

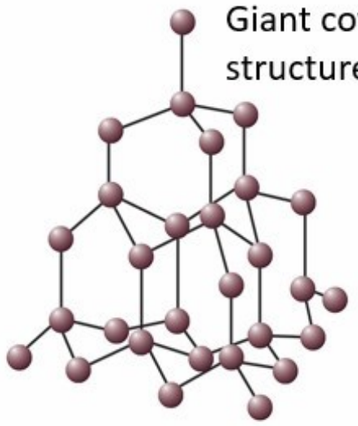
Half Equations
Using electrolysis to extract metals

Facts

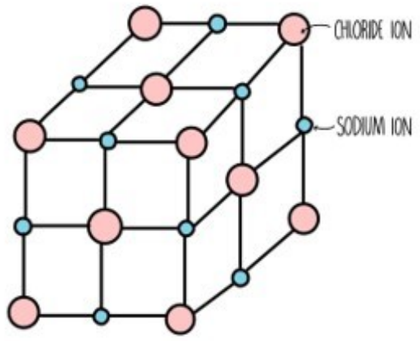
- Molten and Aqueous electrolysis produces different products

	Answer
1	By atoms sharing pairs of electrons.
2	Non-metals.
3	An atom that has lost or gained electrons.
4	Metals and non-metals.
5	Group 1 form 1+, Group 2 form 2+.
6	Electrostatic force of attraction.
7	Regular structure of alternating positive and negative ions, held together by the electrostatic force of attraction.
8	Ions are fixed in position so cannot move, and there are no delocalised electrons.
9	When melted or dissolved as ions are free to move and carry charge.
10	Layers of positive metal ions surrounded by delocalised electrons.
11	The process of using electricity to extract elements from a compound
12	A liquid or solution that contains ions and so can conduct electricity
13	Cathode.
14	Anode.
15	When the metal is more reactive than hydrogen.
16	To lower the melting point.
17	Graphite.
18	They react with the oxygen being formed.

Notes

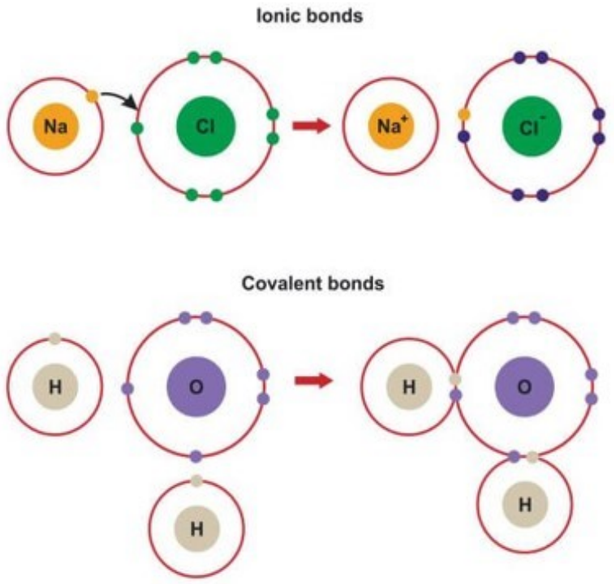


Giant covalent structure



Giant Ionic Lattice

	Question
1	What defines a covalent bond in terms of electrons?
2.	Which type of atoms form covalent bonds between them?
3	What is an ion?
4.	Which kind of elements form ionic bonds
5.	What charges do ions from group 1 and 2 form?
6.	Name the force that holds oppositely charged ions together.
7	Describe the structure of a giant ionic lattice.
8	Why don't ionic substances conduct electricity when solid?
9	When can ionic structures conduct electricity?
10	Describe the structure of a pure metal.
11	What is electrolysis?
12	What is an electrolyte?
13	During electrolysis, where are metals formed?
14	During electrolysis, where are metals formed?
15	In the electrolysis of solutions, when would a metal not be produced at the cathode?
16	In the electrolysis of aluminium oxide, why is the aluminium oxide mixed with cryolite?
17	In the electrolysis of aluminium oxide, what are the anodes made of?
18	In the electrolysis of aluminium oxide, why do the anodes need to be replaced?



Notes

	Know the facts		Key words
1	Particle model assumes: • There are no forces between particles • That all particles in a substrate / material are spherical • That the spheres are solid	1	A **covalent bond** is when pairs of electrons are shared between non-metal atoms.
2.	In a covalent bond the number of electrons shared depends on how many extra electrons an atom needs to make a full outer shell.	2	**Ionic bond** is when metal atoms react with non-metal atoms they transfer electrons to the non-metal
3	Giant covalent structures: Solid at room temperature - high melting and boiling points because the strong covalent bonds between atoms must be broken to melt or boil substances requiring a lot of energy. Examples – diamond, graphite.	3	**Metallic bonding** is the electrostatic attraction between positive metal ions and delocalised electrons.
4.	Simple, small (covalent) molecules: Normally gaseous or liquid at room temperature - low melting and boiling points because only the **inter**molecular forces need to be overcome to melt or boil the substances, not the bonds between the atoms – this does not require a lot of energy. Examples – water, methane.	4	**Delocalised electrons** are electrons that are not associated with a particular atom, e.g. in a metal, outer electrons can be free to move through the solid. This movement allows electricity to be conducted.
5.	Large molecules: Normally solid at room temperature - melting and boiling points are low compared to giant covalent substances but higher than for small molecules. Example – polymers.	5	**Malleable** when substances can be bent or hammered into shape without shattering
6.	In ionic bonding, metal atoms lose electrons to become positive ions. Non-metal atoms gain those electrons to become negative ions.	6	An **alloy** is a **mixture** of two or more elements, at least one of which is a metal.
7	Metals are good conductors of electricity and of thermal energy because delocalised electrons are free to move through the whole structure	7	**Electrolysis** is the process by which an electrolyte of an ionic substance is decomposed (broken down) into simpler substances when an electric current is passed through them.
8	The anode is where the electrons are lost, and the cathode is where electrons are gained during electrolysis of an electrolyte.	8	**Electrolyte** are substances that must be able to conduct electricity
9	Electrolysis is used if the metal is more reactive than carbon.	9	**Anode** - the positive electrode during electrolysis (attracts negative anions).
10	Electrolysis of aluminium oxide extracts aluminium.	10	**Cathode** - The negative electrode during electrolysis (attracts positive cations)