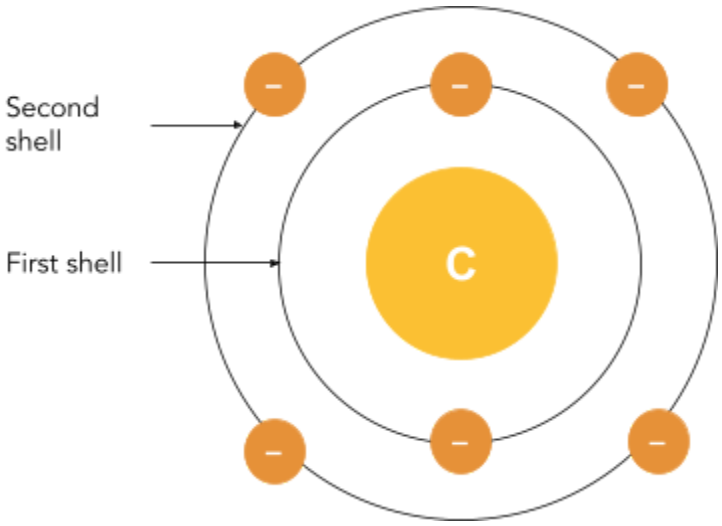
Acids and Bases
ANSWERS

Atoms

Atomic Structure
STOP AND CHECK (PAGE 6)

- Atoms are made up of:
    - A densely packed nucleus made up of positively charged protons and uncharged neutrons.
    - Negatively charged electrons orbiting the nucleus arranged into shells.
    - Electrons orbit the nucleus in orderly paths known as shells/levels.



Electron Configuration

STOP AND CHECK (PAGE 7)

- Carbon: 2, 4
- Oxygen: 2, 6
- Sodium: 2, 8, 1

The Periodic Table

STOP AND CHECK (PAGE 10)

- Lithium:
    - Protons: 3
    - Neutrons: 4
    - Electrons: 3
    - Valence electron: 1 electron in Group 1
- Fluorine:
    - Protons: 9
    - Neutrons: 10
    - Electrons: 9
    - Valence electron: 7 electrons in Group 7
- Magnesium:
    - Protons: 12
    - Neutrons: 12
    - Electrons: 12
    - Valence electron: 2 valence electrons in Group 2

Velocity-time Graphs

STOP AND CHECK (PAGE 13)

- The acceleration of an object can be determined by calculating the gradient on its velocity-time graph.
- On a velocity-time graph, the x-axis represents time, whilst the y-axis represents the velocity.
- A gradient of 0 tells you that the object is not accelerating, so has an acceleration of 0.

- The distance travelled can be calculated on a velocity-time graph by calculating the area under the graph.

Atoms

QUICK QUESTIONS (PAGE 10)

- To calculate the number of protons an element has, copy the atomic number.
- To calculate the number of electrons an element has, copy the atomic number (the number of protons).
- To calculate the number of neutrons, subtract the atomic number from the mass number. (Number of neutrons = mass number - atomic number)
- There are 18 electrons in the first three shells of an atom (2, 8, 8)

Ions

Valence Shells

STOP AND CHECK (PAGE 12)

- Valence electrons are important as they determine the stability of an atom. The stability determines a number of properties, such as how likely it is to form an ion.
- Atoms can get a full valence shell by sharing electrons with other atoms (forming a covalent bond), or by gaining or losing electrons (forming an ion).

Forming Ions

STOP AND CHECK (PAGE 13)

- Positive ions are formed when atoms lose electrons. They have a positive charge because they have more protons than electrons.
- Negative ions are formed when atoms gain electrons. They have a negative charge because they have more electrons than protons.

Ionic Bonds

STOP AND CHECK (PAGE 14)

- An ionic bond is an interaction caused by the attraction between a negatively charged ion, and the positively charged ion it gained its electrons from.

Ionic Compounds

STOP AND CHECK (PAGE 18)

- Sodium fluoride: NaF
- Magnesium oxide: MgO
- Lithium carbonate: Li_2CO_3
- Aluminium oxide: Al_2O_3
- Aluminium chloride.
- Iron oxide. There are two different formulae because Iron can lose either two or three electrons. This changes the ratio of ions needed to create a balanced ionic compound.

Ions

QUICK QUESTIONS (PAGE 18)

- Valence shells and electrons are important, as their number determines how stable an atom is. The less stable an atom is, the more likely it is to form ions and ionic bonds.
- Atoms want full valence shells in order to be stable.
- Ions are formed when they lose or gain electrons. They have a charge due to the unbalanced number of positively charged protons and negatively charged electrons.
- Ionic bonds form between ions. This is a name for the attraction between positive and negative ions, caused by the phenomenon of opposites attract.
- Ionic compounds have an overall neutral charge. The ionic formula tells you the ratio of each ion within the ionic compound. You can figure it out by comparing how many electrons each ion needs to lose or gain.

Rates of Reaction

Reaction Rate

STOP AND CHECK (PAGE 20)

- The reaction rate is defined as the time it takes all of the product to form, or all of the reactants to be used up.

Collision Theory

STOP AND CHECK (PAGE 21)

- For a collision to be successful, particles must collide with enough energy, at the correct orientation.

Activation Energy

STOP AND CHECK (PAGE 21)

- Activation energy is the minimum amount of energy required within a reaction for the reaction to occur.

Measuring Reaction Rate

STOP AND CHECK (PAGE 22)

- The reaction rate can be calculated by measuring how quickly a gas is produced, how quickly the mass of a reactant decreases, the time it takes for a colour to appear or disappear, or how long it takes for a solid reactant to vanish.

Reaction Rate Graphs

STOP AND CHECK (PAGE 23)

- Reaction rates slow down as the amount of reactants available to react decreases. The reaction rate eventually reaches zero when there are no reactants left, so no reaction can take place.

Concentration

STOP AND CHECK (PAGE 24)

- As concentration increases, the rate of reaction increases, as particles are more likely to collide. As concentration decreases, the rate of reaction decreases, as it is less likely that particles will collide.

Temperature

STOP AND CHECK (PAGE 25)

- As temperature increases, the rate of reaction increases. This is due to an increase in kinetic energy, which makes particles more likely to collide. An increase in temperature also increases the activation energy available within the reaction, which makes reactions more likely to occur.

Surface Area

STOP AND CHECK (PAGE 27)

- Surface area is found by calculating the area of each side of a shape and adding them together.
- The surface area of a solid can be increased by splitting a larger solid into multiple smaller ones.
- As surface area increases, the rate of reaction increases. This is due to there being more exposed particles available for the reaction to proceed.

Catalysts

STOP AND CHECK (PAGE 27)

- A catalyst is a special molecule, which speeds up a reaction without being used in the reaction itself. It speeds the rate of reaction by lowering the activation energy required for a successful collision to occur.

Rates of Reaction

STOP AND CHECK (PAGE 28)

- The reaction rate determines how quickly reactants are used up, or products are formed in a reaction. It can be determined by measuring the amount of reactants lost, the amount of product formed, or through observations such as colours forming or disappearing.
- A reaction will occur if particles collide with sufficient energy (enough to overcome the activation energy), and at the right orientation.
- Activation energy refers to the amount of kinetic energy that is required for a certain reaction to occur.
- The reaction rate is affected by the following:
    - **Concentration:** The more tightly packed the particles are in a solution (i.e. the higher the concentration) the faster the reaction rate.
    - **Surface area:** A large surface area will increase the rate of reaction as there are more available particles to react.
    - **Catalysts:** Catalysts increase the reaction rate by lowering the activation energy required for a successful collision to occur.
    - **Temperature:** The more kinetic energy within the system (i.e. heat), the faster particles will move, increasing the likelihood of a successful collision.

Acids and Bases

Defining Acids and Bases

STOP AND CHECK (PAGE 30)

- An acid is a molecule that releases hydrogen ions when it reacts with water. A base is a molecule that releases hydroxide ions (OH^-) when it reacts with water.

pH Scale

STOP AND CHECK (PAGE 30)

- The pH scale tells us how acidic or basic a compound is
- Acidic compounds have a pH of below 7, basic compounds have a pH of above 7, neutral compounds have a pH of 7.

Indicators

STOP AND CHECK (PAGE 32)

- Indicators tell us whether a solution is acidic, basic or neutral. Some indicators can also tell us the degree of acidity or basicity.

Acids and Bases

STOP AND CHECK (PAGE 38)

- This is a neutralisation reaction.
- The student could add universal indicator to the original solution of acid. They could then add the base slowly, waiting for the colour to change before adding more. When the solution turned green, they would know the acid had been neutralised.
- $HNO_3 + KOH \rightarrow KNO_3 + H_2O$. The salt formed is potassium nitrate.

- The salt could be separated from the water by pouring the solution into an evaporating dish and placing the dish on top of a Bunsen burner. The water would evaporate, leaving the salt behind in the evaporating dish.