

Question 1:

[Maximum mark: 1]

Most of the mass of an atom is found in the:

- a) Electrons
- b) Electron shells
- c) Nucleus
- d) Outer orbit

Question 2:

[Maximum mark: 1]

Which variable is measured in kelvin (K)?

- a) Pressure
- b) Temperature
- c) Volume
- d) Mass

Question 3:

[Maximum mark: 1]

Which equation represents the ideal gas law?

- a) $F=ma$
- b) $E=mc^2$
- c) $PV=nRT$
- d) $V=IR$

Question 4:

[Maximum mark: 1]

The outermost electron shell of an atom is called the:

- a) Valence shell
- b) Inner shell
- c) Nuclear shell
- d) Core shell

Question 5:

[Maximum mark: 1]

What did Rutherford's gold foil experiment show?

- a) Atoms are solid spheres.
- b) Electrons are embedded in positive charge.
- c) Electrons have fixed energy levels.
- d) Atoms are mostly space.

Question 6:

[Maximum mark: 6]

Chlorine exists naturally as two isotopes, chlorine-35 and chlorine-37.

- a. State what is meant by the term isotope. (2)
- b. Explain why these two isotopes have identical chemical properties but different physical properties.
- c. Chlorine-35 has a natural abundance of 75.8%, while chlorine-37 has a natural abundance of 24.2%. Calculate the relative atomic mass of chlorine. Give your answer to two decimal places.

Question 7:

[Maximum mark: 6]

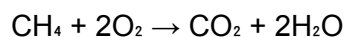
Magnesium reacts with chlorine to form magnesium chloride.

- a. Write the balanced chemical equation for the reaction.
- b. Explain how ionic bonding is formed in magnesium chloride. Include the movement of electrons in your answer.
- c. State one physical property of magnesium chloride that results from its bonding.

Question 8:

[Maximum mark: 6]

Methane burns completely in oxygen according to the equation:



- a. State the mole ratio of methane to oxygen.
- b. Calculate the number of moles in 32.0 g of oxygen gas (O_2).
- c. Using the balanced equation, determine:

The number of moles of methane required to react with 32.0 g of oxygen, and the number of moles of carbon dioxide produced.

Question 9:

[Maximum mark: 6]

An atom of phosphorus has an atomic number of 15.

- a. Determine the electron configuration of phosphorus.
- b. Identify the:
 - (i) period in the periodic table,
 - (ii) group number,
 - (iii) classification as a metal, non-metal, or metalloid.
- c. Explain why phosphorus has a larger atomic radius compared with chlorine, even though both elements are in the same period.

Question 10:

[Maximum mark: 6]

Carbon dioxide (CO_2) is a covalent molecule.

- a. Draw the Lewis structure of CO_2 , including all lone pairs.
- b. State the molecular shape of CO_2 .
- c. Explain why CO_2 is a non-polar molecule even though each $\text{C}=\text{O}$ bond is polar.