

STRAND 2

INVESTIGATING MATTER

1. Which of the following is the correct symbol for the magnetic quantum number?

- A. n
- B. ℓ
- C. m_s
- D. m_l

2. The placing of electrons into the lowest energy level first is an application of

- A. Hund's rule.
- B. Aufbau principle.
- C. Avogadro's principle.
- D. Pauli exclusion principle.

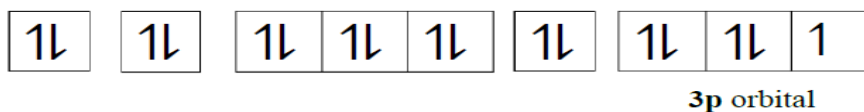
3. The strongest ion - dipole attraction exists between

- A. Cl^- and H_2O .
- B. Na^+ and H_2O .
- C. Ca^{2+} and H_2O .
- D. Al^{3+} and H_2O .

4. The expression that is used to calculate the molality of a solution is

- A. $\frac{\text{moles of solute}}{\text{volume of solvent}}$
- B. $\frac{\text{mass of solute}}{\text{volume of solvent}}$
- C. $\frac{\text{moles of solute}}{\text{kilogram of solvent}}$
- D. $\frac{\text{moles of one component}}{\text{total moles}}$

5. Use the orbital diagram for chlorine shown below to answer the questions that follow.



- (i) Write the electron configuration of the most common ion of chlorine using s, p, d notation.
- (ii) Determine the four quantum numbers for the 1st electron in the 3p orbital.

6. Consider the abbreviated electron configuration for the elements sodium and magnesium to answer the questions that follow.

Sodium (Na) - $[\text{Ne}] 3s^1$

Magnesium (Mg) - $[\text{Ne}] 3s^2$

- (i) Identify the element that will have a higher value of the 1st ionisation energy.
- (ii) Provide an explanation for your answer to part (i) above.

7. Draw the Lewis structure of phosphate ion (PO_4^{3-}).

8. The following experimental procedure was carried out to determine the effect of hydrogen bonds.

Step 1	Equal volumes of water and cyclohexane was taken in separate boiling tubes and the liquid levels were marked.
Step 2	Each sample of liquid was kept in a refrigerator overnight.
Step 3	The volume of each sample was observed upon solidification.

- Which liquid sample, water or cyclohexane will have an increase in volume upon solidification?
- Provide an explanation for your answer to part (i) above.

9. State Gay-Lussac's law.

10. To determine the value of the gas constant (R), some potassium permanganate (KMnO_4) was decomposed in a test-tube. The following data was obtained during the experiment.

Mass of oxygen gas	0.095 g
Volume of oxygen gas	0.082 L
Temperature	28 °C
Pressure	100.3 kPa

Note: $M(\text{O}_2) = 32 \text{ g mol}^{-1}$

- Name the apparatus that was used to determine the volume of oxygen gas produced.
 - Calculate the value of the gas constant (R) using the experimental data given in the table above.
 - The value of the gas constant (R) obtained in this experiment is not exactly the same as the theoretical value. State one possible source of error that resulted to this difference.
11. Volume percent ($\text{V/V } \%$) can be used to express the percentage of ethanol in alcohols. The table below shows the volume percent values of four different alcohols.

Alcohol	Volume percent
Alcohol A	40 %
Alcohol B	43 %
Alcohol C	47 %
Alcohol D	58 %

A 750 mL of an unknown alcohol contains 322.50 mL of ethanol. Determine the unknown alcohol (A, B, C or D) by calculating the volume percent ($\text{V/V } \%$).