

SESSION 14.
REVISION TUTORIAL ANSWERS

QUESTION 1. SYMBOLS AND FORMULAS.

1 mark for each answer

(a) Give the symbol for the following elements:

- | | | | |
|-----------------|---------------------|--------------|----|
| (i) sodium | Na | (ii) calcium | Ca |
| (iii) strontium | Sr | (iv) boron | B |
| (v) lead | Pb | (vi) sulfur | S |
| (vii) fluorine | F (not Fl) | (viii) argon | Ar |
| (ix) copper | Cu | (x) iron | Fe |

(b) Give the name for each of the following elements:

- | | | | |
|----------|------------|-----------|-----------|
| (i) K | potassium | (ii) Be | beryllium |
| (iii) Al | aluminium | (iv) Si | silicon |
| (v) P | phosphorus | (vi) As | arsenic |
| (vii) I | iodine | (viii) He | helium |
| (ix) Co | cobalt | (x) Mn | manganese |

(c) Give the formula for each of the following compounds:

- | | | | |
|---------------------------|-----------------------------------|----------------------------|---|
| (i) calcium oxide | CaO | (ii) sodium bromide | NaBr |
| (iii) aluminium nitrate | Al(NO ₃) ₃ | (iv) magnesium nitride | Mg ₃ N ₂ |
| (v) lithium phosphate | Li ₃ PO ₄ | (vi) ammonium sulfate | (NH ₄) ₂ SO ₄ |
| (vii) iron(II) sulfide | FeS | (viii) iron(III) oxide | Fe ₂ O ₃ |
| (ix) copper(II) carbonate | CuCO ₃ | (x) chromium(III) chloride | CrCl ₃ |

(d) Give the name for each of the following compounds:

- | | | | |
|---|--------------------|--|--------------------|
| (i) KF | potassium fluoride | (ii) ZnCl ₂ | zinc chloride |
| (iii) Fe(NO ₃) ₃ | iron(III) nitrate | (iv) CuSO ₄ | copper(II) sulfate |
| (v) BaCO ₃ | barium carbonate | (vi) (NH ₄) ₃ PO ₄ | ammonium phosphate |
| (vii) RbBr | rubidium bromide | (viii) MgO | magnesium oxide |
| (ix) NaOH | sodium hydroxide | (x) CaI ₂ | calcium iodide |

(e) Name the following covalent compounds:

- | | | | |
|----------------------------|-------------------|--------------------|----------------|
| (i) BF_3 | boron trifluoride | (ii) CO_2 | carbon dioxide |
| (iii) H_2O | water | (iv) NH_3 | ammonia |
| (v) CH_4 | methane | | |

(f) Give the formula for the following covalent molecules:

- | | | | |
|---------------------------|-----------------|-----------------------------|------------------------|
| (i) sulfur(VI) fluoride | SF_6 | (ii) phosphorus trichloride | PCl_3 |
| (iii) nitrogen dioxide | NO_2 | (iv) dinitrogen pentoxide | N_2O_5 |
| (v) silicon tetrachloride | SiCl_4 | | |

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QUESTION 2. **ATOMIC STRUCTURE AND CHEMICAL BONDS.**

4 marks for each answer.

(a) Explain the meaning each of the following terms:

- (i) atomic number the number of protons in the nucleus of an atom
- (ii) ground state when all electrons in an atom occupy the lowest available energy levels
- (iii) cation a species carrying a positive electrical charge
- (iv) anion a species carrying a negative electrical charge
- (v) ionic bond bond between two oppositely charged ions being held together by electrostatic attraction
- (vi) covalent bond bond between atoms due to their sharing electrons
- (vii) unsaturated molecule molecule which contains at least one double or triple bond

(b) What type of bond is expected to be present in a compound of a metal and a non-metal?
ionic

(c) What type of bond is expected to be present in a compound of two non-metals?
covalent

(d) Why do Group I elements form +1 charged ions in their compounds?

The Group I elements have one more electron in their outer level than a noble gas atom, so loss of 1 electron to form a M^+ ion results in that ion being isoelectronic with a noble gas.

(e) Why do the halogens (Group VII) form -1 charged ions in their ionic compounds?

The Group VII atoms only require 1 more electron to become isoelectronic with a noble gas and this can be achieved if they form a 1^- ion.

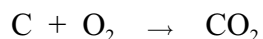
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QUESTION 3. **WRITING EQUATIONS.**

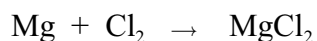
4 Marks for each equation.

(a) Write a **formula equation** for each of the following reactions:

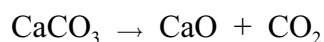
(i) Carbon is burnt in oxygen to form carbon dioxide.



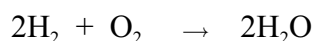
(ii) Magnesium metal combines with chlorine to form magnesium chloride.



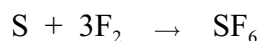
(iii) Calcium carbonate is heated to form calcium oxide and carbon dioxide.



(iv) Hydrogen and oxygen combine to form water



(v) Sulfur combines with fluorine to form sulfur hexafluoride

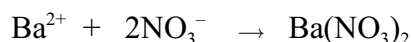


(b) Write an **ionic equation** for each of the following reactions. Delete all spectator ions from your final equation.

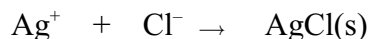
(i) Potassium chloride is dissolved in water.



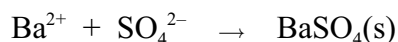
(ii) A solution of barium nitrate is evaporated to form solid barium nitrate.



(iii) Water solutions of silver nitrate and sodium chloride are mixed to precipitate silver chloride solid.



(iv) Water solutions of barium chloride and sodium sulfate are mixed, precipitating barium sulfate solid.



(v) Calcium oxide is mixed with hydrochloric acid to form a salt in solution and water.



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QUESTION 4. **MOLES.**

10 Marks for each answer.

(a) What is the mass of 4.50 mole of neon?

(Atomic weight: Ne = 20.2)

1 mole = GFW of Ne = 20.2 g/mole

∴ 4.50 mole = $4.50 \times 20.2 \text{ g} = 90.9 \text{ g}$

(b) How many moles of water are present in 36.0 g of water?

(Atomic weights: H = 1.01, O = 16.00)

mass of 1 mole of $\text{H}_2\text{O} = 2 \times 1.01 + 16.0 \text{ g} = 18.0 \text{ g}$

number of moles of water in 36.0 g = $36.00 / 18.0 = 2.00 \text{ mole}$

(c) What is the mass of 1 mole of sodium chloride?

(Atomic weights: Na = 23.0, Cl = 35.5)

1 mole of NaCl weighs $(23.0 + 35.5) \text{ g} = 58.5 \text{ g}$

(d) How many moles of O_2 are present in 8.0 g of oxygen gas?

(Atomic weight: O = 16.0)

1 mole of O_2 weighs $2 \times 16.0 \text{ g} = 32.0 \text{ g}$

∴ 8.0 g of $\text{O}_2 = 8.0 / 32.0 \text{ mole} = 0.25 \text{ mole}$

(e) Which is heavier, 4.00 mole of H_2 gas or 0.500 mole of He gas, and by how much?

(Atomic weights: H = 1.01, He = 4.00)

4.00 mole of H_2 has a mass = $4.00 \times \text{GFW of } \text{H}_2 = 4.00 \times (2 \times 1.01) \text{ g} = 8.08 \text{ g}$

0.50 mole of He has a mass = $0.500 \times \text{GFW of He} = 0.500 \times 4.00 \text{ g} = 2.00 \text{ g}$

∴ the hydrogen has the greater mass by 6.08 g

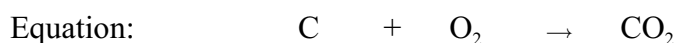
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QUESTION 5. **STOICHIOMETRIC AND SOLUTION CALCULATIONS.**

10 marks for each of (a) and (b).

(a) What mass of carbon would combine exactly with 32.0 g of O₂ gas to form CO₂ gas?

(Atomic weights: C = 12.0, O = 16.0)

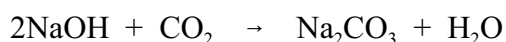


Mole ratios: $1 \text{ mol} \quad 1 \text{ mole} \quad 1 \text{ mole}$

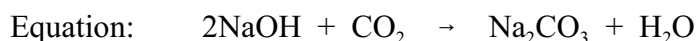
Moles of O₂ used = mass of O₂/GFW = 32.0/(2 × 16.0) = 1.00 mole

∴ moles of C used = 1.00 mole and mass of carbon = moles × GFW
= 1.00 × 12.0 g = 12.0 g

(b) Sodium hydroxide combines with carbon dioxide to produce sodium carbonate and water according to the following molecular equation:



Calculate the mass of sodium hydroxide required to prepare 53.0 g of sodium carbonate. (Atomic Weights: Na = 22.99, C = 12.00, O = 16.00, H = 1.01)



Mole ratios: $2 \text{ mole} \quad 1 \text{ mole}$

Moles of Na₂CO₃ = mass/GFW = 53.0/(22.99 × 2 + 12.00 + 16.00 × 3)
= 53.0/106.0 = 0.500 mole

From the mole ratios above, 2 moles of NaOH are needed to form 1 mole of Na₂CO₃

∴ moles of NaOH needed = 2 × 0.500 = 1.00 mole

Mass of sodium hydroxide = moles × GFW of NaOH = 1.00 × (22.99 + 16.00 + 1.01) g
= 40.0 g

10 marks for each answer in part (c).

(c) (i) Calculate the amount in moles of sodium chloride required to make 0.50 L of 0.10 M solution.

1.00 L of 1.00 M solution has 1.00 mole of sodium chloride present

∴ 1.00 L of 0.10 M solution has 0.10 mole of sodium chloride present

and 0.50 L of 0.10 M solution has 0.50 × 0.10 mole of sodium chloride present
= 0.050 mole

or

$$\text{molarity (M)} = \frac{\text{moles (n)}}{\text{volume (L)}}$$

∴ n = M × L = 0.10 × 0.50 = 0.050 mole

(ii) What volume of 2.0 M sodium sulfate solution would contain 0.50 mole of sulfate ions?

The formula for sodium sulfate is Na₂SO₄, so 1 mole of sodium sulfate contains 1 mole of sulfate ions, SO₄²⁻.

∴ 1.00 L of 2.0 M sodium sulfate contains 2.0 mole of sodium sulfate and thus 2.0 mole of SO₄²⁻

and $\frac{1.00 \times 0.50}{2.00}$ L contains 0.50 mole of SO₄²⁻ = 0.25 L

or

$$\text{molarity (M)} = \frac{\text{moles (n)}}{\text{volume (L)}}$$

$$\therefore \text{volume (L)} = n/M = 0.50/2.0 = 0.25 \text{ L}$$

(iii) In order to prepare 1.00 L of 0.40 M sodium nitrate, what mass of sodium nitrate must be weighed out? (Atomic weights: Na = 22.99, N = 14.01, O = 16.00)

$$\text{Moles of NaNO}_3 \text{ required} = M \times V = 0.40 \times 1.00 = 0.40 \text{ mole}$$

$$\text{Mass} = \text{moles} \times \text{GFW} = 0.40 \times (22.99 + 14.01 + 3 \times 16.00) = 34.0 \text{ g}$$

MARK /50 ÷ 5 = Transfer to graph on the back page.

QUESTION 6. PERIODIC TABLE.

3 marks for each part (a) - (d).

(a) Give the symbols for the first 5 elements of periodic Group I

Li Na K Rb Cs

(b) Give the names of the first four elements of periodic Group VII (halogens)

fluorine, chlorine, bromine, iodine

(c) Where in the periodic table are the most non-metallic elements located?

top right hand corner

(d) Where in the Periodic Table are the elements which are (i) most easily oxidised (ii) most easily reduced?

(i) on the left hand side, particularly in the bottom left hand corner

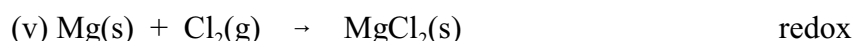
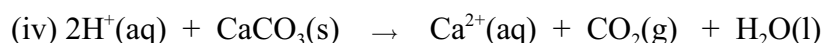
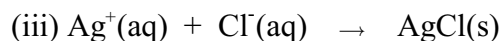
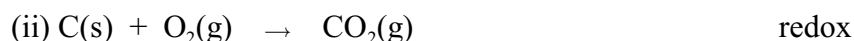
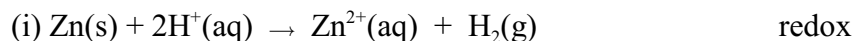
(ii) on the right hand side apart from the noble gases, especially the elements in the top right hand corner.

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QUESTION 7. REDOX.

2 marks for each answer.

(a) Write "redox" beside all of the following reactions that are redox reactions.

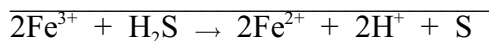
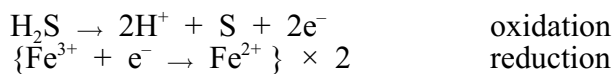
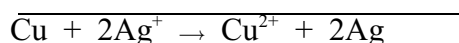
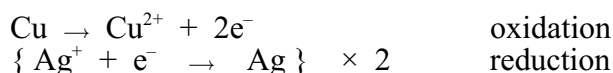
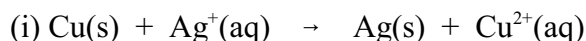


(b) Give the oxidation number for the underlined atom in each of the following:



6 marks for each part of (c)

(c) Balance the following redox equations using the ion-electron half equation method. Indicate for each half equation whether it is an oxidation or a reduction.



MARK / 30: ÷ 3 = Transfer to graph on the back page.

QUESTION 8. ACIDS AND BASES.

(a) **2 marks for each answer.** Give the formula for the following species:



5 marks for each answer in parts (b), (c) and (d)

(b) Calculate the pH of 0.10 M HNO₃ in water.

[H⁺] = 0.10 M as nitric acid is a strong acid and is completely dissociated into H⁺ and NO₃⁻ ions.

$$\therefore \text{pH} = -\log[\text{H}^+] = -\log(0.10) = -(-1.0) = +1.0$$

(c) Calculate the concentration of H₃O⁺ ions in a solution of pH = 3.60.

$$\text{pH} = 3.60, \text{ so } [\text{H}^+] = 10^{-3.60} \text{ M} = 2.5 \times 10^{-4} \text{ M.}$$

(d) Calculate the pH of a 0.10 M solution of NaOH in water.

$$[\text{H}^+][\text{OH}^-] = 10^{-14}$$

If $[\text{OH}^-] = 0.10 \text{ M} (= 10^{-1.0} \text{ M})$, then $[\text{H}^+] = 10^{-14.0}/10^{-1.0} = 10^{-13.0} \text{ M}$

and $\text{pH} = 13.0$

MARK / 23:..... $\div 2.3 = \dots\dots\dots$ Transfer to graph on the back page.