تدريبات لطالب السنة التحضيرية فى المحاضرات

**General Chemistry for Preparatory Year Students Chapter 4: Chemical bonding and chemical reactions (PEARSON BOOK)**

# Main objectives and sub-objectives

1. **Reaction stoichiometry**
   1. Mole-to-mole conversions
   2. Mass-to-mass conversions
2. **Determining the limiting reactant**
3. **Calculating theoretical and percent yield**
4. **Calcula ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ting solution concentration**
   1. Using molarity in calculations
   2. Determining solution dilution
5. **Using solution stoichiometry to find volumes and amounts**
6. **Writing ionic and complete ionic equations**
7. **Writing equations for acid-base reactions**
8. **Writing equations for precipitation reactions**
9. **Defining electrolyte and non-electrolyte solutions**
10. **Oxidation-reduction reactions**
    1. Identifying oxidation and reduction processes
    2. Assigning oxidation states
    3. Identifying oxidizing agents, and reducing agents using oxidation states
11. **Types of chemical bonds**
    1. Ionic bonds
    2. Metallic bonds
    3. Pure covalent and polar covalent bonds
12. **Electronegativity and its relation with bond polarity**
13. **Bond energy and bond length**

# A-Knowledge

1. **Oxidation is …………………**

a- gaining of electrons and increasing the oxidation state b- losing of electrons and increasing the oxidation state

c- losing of positive charges d- gaining of negative charges

1. **Reducion is …………………**

a- gaining of electrons and decreasing the oxidation state b- losing of electrons and increasing the oxidation state

1. losing of positive charges
2. gaining of negative charges
3. **The spectator ions in the given reaction are**

2KI(aq.) + Pb (NO3)2 (aq.) + = KNO3 (aq.) + PbI2(s)

a- Pb+ , I- b- K+ , I-

c- K+ , NO3- d- NO3+ , K+

1. **For the given reaction, which of the following is reducing agent?**

Zn(s) + Fe2+ = Zn2+ + Fe(s)

a- Fe b-Zn

c- Fe2+ d- Zn2+

1. **Electron sea model is characteristic of ………………………………**

a- Covalent bonding b- ionic bonding

c- Metallic bonding d- Lattice energy

1. **For the given reaction, which of the following is oxidizing agent?**

Cr2O72- + Fe2+ +14H+ = Fe3+ + Cr3+ + 7H2O

a- Fe2+ b- Cr3+ c- Fe3+ d- Cr2O72-

1. **The number of lone pairs in water molecule H2O is ……………**

a- 1 b- 3

c- 2 d- zero

1. **The number of lone pairs in ammonia molecule NH3 is ……………**

a- 1 b- 3

c- 2 d- zero

1. **The type of bonding in ice molecule is ………………..**

a- ionic bonding b- covalent bonding

c- metallic bonding d- none bonding

1. **The type of bonding in iron Fe(s) is ………………..**

a- ionic bonding b- covalent bonding

c- metallic bonding d- none bonding

1. **The type of bonding in table salt (NaCl) is ………………..**

a- ionic bonding b- covalent bonding

c- metallic bonding d- none bonding

1. **A solution that conducts electricity very well is known as.**

a- Nonelectrolyte b-Electrolyte

c- Weak electrolyte d-Solvent

1. **In a solution, the agent that gets dissolved is known as**

a- Solvent b- Mixture c- Solute d- Colloid

1. **The bond between Sr and O in SrO is**
   1. a pure covalent (b) a polar covalent (c) an ionic (d) non
2. **The bond between Br and Br in Br2 is**

a pure covalent (b) a polar covalent (c) an ionic (d) non

1. **Metals tend to ---------electrons to become ions.**

a-lose, positive b- gain, negative c- lose, neutral d- lose, negative

1. **The bond energy of a chemical bond is the energy required to break 1 mole of bonds in the ……………..**
   1. solid phase (b) liquid phase (c) gas phase (d) non
2. **Elements with very different electronegativities form**
   1. ionic bonds (b) covalent bonds (c) polar covalent (d) non
3. **In a covalent Lewis structure, neighboring atoms share electrons to**

attain octets

* 1. core (b) valance (c) ionic (d) covalent

(e) non

1. **Which one of the following is a correct expression for molarity?**
2. mol solute/L solvent
3. mol solute/mL solvent
4. mol solute/mL solution
5. mol solute/L of solution
6. **Which of the following is considered a strong electrolyte?**

a) NH4NO3

b) C12H22O12

1. PbCl2
2. HC2H3O2
3. **Which one of the following is a diprotic acid?**
4. nitric acid
5. chloric acid
6. phosphoric acid
7. sulfuric acid
8. **Which of the following is a weak electrolyte?**

a- HCl b- pure H2O c- NaCl d- sugar

1. **Which one of the following is a weak acid?**
2. HNO3 b) HCl c) HI d) HF
3. **Which one of the following is a correct expression for 0.2 molar solution of NaOH?**
   1. 0.2 moles NaOH in one liter of water
   2. 0.2 moles NaOH in one milliliter of water
   3. 0.2 moles NaOH in one liter of solution
4. none
5. **Which of the following is not right concerning the dilution rule?**
6. The mass of the solute in dilute and the concentrated solution is the same
7. The number of moles of solute in the dilute and the concentrated solution is the same
8. The concentration of solute in the dilute and the concentrated solution is the same
9. **The following reaction Al(s) + 3 NiNO3(aq) → Al(NO3)3(aq) + 3Ni(s) is … .**

a- Acid-base reaction b- Precipitation

c- Oxidation - reduction d- Decomposition

1. **Which of the following compounds is soluble in water?**
2. CaS
3. MgCO3
4. PbCl2
5. BaSO4
6. **The net ionic equation for the reaction between aqueous sulfuric acid and aqueous sodium hydroxide is .**

a) H+ (aq) + HSO4- (aq) + 2OH- (aq) → 2H2O (l) + SO42- (aq)

b) H+ (aq) + HSO4- (aq) + 2Na+ (aq) + 2OH- (aq) → 2H2O (l) + 2Na+ (aq) + SO42-

(aq)

c) SO42- (aq) + 2Na+ (aq) → 2Na+ (aq) + SO42-(aq)

d) H+ (aq) + OH- (aq) → H2O( l)

1. **When an acid reacts with a base, the result is**
2. cancellation.
3. elimination.
4. neutralization.
5. adduct formation.
6. **The bond in CsCl is ------------**
7. Ionic bond
8. polar covalent bond
9. covalent bond
10. metallic bond
11. **Determine the oxidizing agent in the following reaction. Ni(s) + 2 AgClO4(aq) → Ni(ClO4)2(aq) + 2 Ag(s)**
12. Ag
13. Ni
14. Cl
15. O
16. **Choose the bond below that is the most polar.**
17. C-N
18. C-F
19. C-O
20. C-C
21. **Which molecule or compound below contains a polar covalent bond?**
22. C2H4
23. ZnS
24. LiI
25. NCl3
26. **Electronegativity from left to right within a period and**

from top to bottom within a group.

1. decreases, increases
2. increases, increases
3. stays the same, increases
4. increases, decreases
5. **The most electronegative element is …………….**
6. Na
7. F
8. Fr
9. Ca
10. **The least electronegative element is …………….**
11. Na
12. F
13. Fr
14. Ca
15. **The bond in H2S is** …………………
16. ionic bond
17. polar covalent bond 1
18. covalent bond
19. metallic bond

# B-Comparison

1. **Choose the bond below that is the weakest.**
2. Na-Cl
3. I-I
4. C=N
5. Li-F
6. **Choose the bond below that is the strongest.**
7. C-F
8. C=O
9. C-I
10. C≡N
11. **Which of the following has the most bond strength?**

a- N-N b- N ≡ N

c- N=N d- N-H

1. **Which of the following is redox reaction?**

a- NaCl(aq.) + AgNO3(aq.) = AgCl(s) + NaNO3(aq.) b- HCl(aq.) + NaOH(aq.) = H2O(l) + NaCl(aq.)

1. Na(s) + Cl2(g) = 2NaCl(s)
2. HCl(aq.) + H2O(l) = H3O+(l) + Cl-

(aq.)

1. **Which of the following is a precipitation reaction?**

a- NaCl(aq.) + AgNO3(aq.) = AgCl(s) + NaNO3(aq.) b- HCl(aq.) + NaOH(aq.) = H2O(l) + NaCl(aq.)

1. Na(s) + Cl2(g) = 2NaCl(s)
2. HCl(aq.) + H2O(l) = H3O+

(l)

+ Cl-(aq.)

1. **Which of the following bonds have the most polarity?**

a- N-Cl b- N-O

c- N-F d- N-N

1. **Which of the following bonds have the least bond length?**

a- N-Cl b- N-Br

c- N-I d- N-F

1. **Which compound do you expect the resulting aqueous solution to conduct electrical current?**
   1. (CH3)2O (b) Ca(NO3)2 (c) CH3OH (d) C6H12O6
2. **Which of these pairs of elements would be most likely to form an ionic compound?**

a- P and Br b- Cu and K c- C and O d- O and Zn

1. **The net ionic equation of the following reaction is …………….**

AgNO3(aq) + Na2SO4(aq) → Ag2SO4(s) + NaNO3(aq)

1. NO3- + Na+(aq) → Ag2SO4(s)
2. NO3- + SO42-(aq) → NaNO3(aq) c- Ag+ + SO42-(aq) → Ag2SO4(s) d- NO3- + Na+(aq) → Ag2SO4(s)

e- NO3- + Na+(aq) → NaNO3(aq.)

1. **Which combination will produce a precipitate?**
2. Pb(NO3)2 (aq) and HCl (aq)
3. Cu(NO3)2 (aq) and KC2H3O2 (aq)
4. KOH (aq) and HNO3 (aq)
5. AgC2H3O2 (aq) and HC2H3O2 (aq)
6. **Which choice below correctly lists the elements in order of increasing electronegativity?**
7. C < N < O < F
8. N < C < O < F
9. N < C < F < O
10. C < N < F < O
11. **Complete the following reaction**

|  |  |  |
| --- | --- | --- |
| **NaNO3(aq.) + Li2SO4(aq.)** | → | ……………….. |
| a- NaSO4 + Li NO2 |  | b- NaSO4 + Li NO3 |
| c- Na2SO4 + Li NO3 |  | d- NO reaction |

1. **Which statement correctly describes triple bonds?**
2. Three electrons are shared.
3. The octet rule is violated.
4. Three pairs of electrons are shared.
5. They are often formed by oxygen

# C- Thinking

1. **Oxygen has 6 valence electrons and it is diatomic. How many covalent bonds are there in an O2 molecule?**

a-single b-double c-triple d- none of them

1. **The oxidation state of Cr and O in CrO 2- are**

**4**

(a) +3, -2 (b) +6, -2 (c) -6, +2 (d) -3, +1 (e) non

1. **How many grams of Li are needed to produce 9.89g of H2?**

2*Li*(*s*)  2*H* 2*O*(*l*)  2*LiOH* (*aq*)  *H* 2 (*g*)

a) 68.1 g b) 32 g c) 3.2 g d) 6.81 g

1. **If 856 g of C6H12O6 is consumed by a person over a certain period, what is the mass of CO2 produced?**

C6H12O6(*s*) + 6 O2(*g*) → 6 CO2(*g*) + 6 H2O(*l*)

a) 1.25 x 103 g

b) 125 g

c) 1.25 g

d) 0.125 g

1. **3.54 x107 g of TiCl4 are reacted with 1.13x 107g of Mg. Calculate the theoretical yield of Ti in grams ?**

*TiCl*4 (*g*)  2*Mg* (*l*)  *Ti*(*s*)  2*MgCl*2 (*l*)

a) 7.4 g

b) 8.9 x106 g

c) 8.9 x103 g

d) 7.4 x106 g

1. **Nitrogen dioxide NO2 can be synthesized by the reaction:**

N2(*g*) + 2 O2(*g*) → 2 NO2(*g*)

Starting with 46.3 g N2 and 92.0 g O2, find the theoretical yield of NO2 in grams.

1. 132 g
2. 20 g
3. 55 g
4. 150 g
5. **Determine the percent yield of a reaction that produces 28.65 g of Fe when 50.00 g of Fe2O3 react with excess Al according to the following reaction.**

Fe2O3 (s) + 2 Al(s) → Al2O3(s) + 2 Fe(s)

a) 61.03% b) 28.65% c) 81.93% d) 20.02%

1. **How many moles of CuO can be produced from 0.900 mol of Cu2O in the following reaction?**

2 Cu2O(*s*) + O2(*g*) → 4 CuO(*s*)

1. 0.450 mol
2. 0.900 mol
3. 1.80 mol
4. 3.60 mol
5. **Which substance is the limiting reactant when 2.0 g of sulfur reacts with 3.0 g of oxygen and 4.0 g of sodium hydroxide according to the following chemical equation:**

2 S(*s*) + 3 O2(*g*) + 4 NaOH(*aq*) → 2 Na2SO4(*aq*) + 2 H2O(*l*)

1. S(*s*)
2. O2(*g*)
3. NaOH(*aq*)
4. None of these substances is the limiting reactant.
5. **What volume (mL) of a concentrated solution of magnesium chloride (9.00 M) must be diluted to 350. mL to make a 2.75 M solution of magnesium chloride?**

a) 2.75

b) 50.0

c) 45.0

d) 107

1. **What is the molarity of an 85 ml ethanol C2H5OH solution containing 1.77g of ethanol:**

a) 0.452 M

**b)** 6.000 M

**c)** 0.006 M

**d)** 1.900 M

1. **The molarity of an aqueous solution containing 75.3 g of glucose (C6H12O6) in 35.5 mL of solution is .**

A) 1.85

B) 2.12

**C)** 11.8

D) 3.52

1. **The molarity (M) of an aqueous solution containing 22.5 g of sucrose (C12H22O11) in 35.5 mL of solution is .**

A) 0.0657

B) 1.85 × 10-3

C) 1.85

D) 3.52

1. **A solution is prepared by dissolving 35.0 g of NaCl in water to make 500 mL of solution. What is the molarity?**

a) 7.00 M

b) 3.04 M

c) 1.97 M

d) 1.20 M

1. **What is the volume (in ml) of 0.315M NaOH solution contains 6.22 g of NaOH?**

a) 494 ml

b) 0.494 ml

1. 6 ml
2. 389 ml
3. **What mass of KI is required to make 500 mL of a 2.80 *M* KI solution?**

a) 232.4 g

b) 1400 g

c) 0.232 g

d) 353 g

1. **How would you prepare 60.0 mL of 0.200 *M* HNO3 from a stock solution of 4.00 *M* HNO3?**
2. 66 mL
3. 60 ml
4. 30 ml
5. 0.3 ml
6. **If 10.0 mL of a 10.0 *M* stock solution of NaOH is diluted to 250 mL, what is the concentration of the resulting solution?**
7. 1.4 *M*
8. 2.1 M
9. 0.4 M
10. 13 M
11. **To make 250.0 mL of 0.500 M KI solution, mL of 6.00 M KI must be used.**

a) 20.8

b) 41.7

c) 500.0

d) 3000.0

1. **What volume of 0.150 M KCl is required to completely react with 0.150 L of 0.175 M Pb(NO3)2 :**

2 KCl(*aq*) + Pb(NO3)2(*aq*)  PbCl2(*s*) + 2 KNO3(*aq*)

a) 0.34 L

1. 23 L
2. 34 L
3. 25 L
4. **According to the following reaction, what volume of 0.244 M KCl solution is required to react exactly with 50.0 mL of 0.210 M Pb(NO3)2 solution?**

2 KCl(aq) + Pb(NO3)2(aq) → PbCl2(s) + 2 KNO3(aq)

1. 97.4 mL
2. 116 mL
3. 43.0 mL
4. 86.6 mL
5. **In the given reaction, 7.5 g of Al was reacted with 24.8 g Cl2, which of the following is the limiting reactant**?

2 Al(s) + 3Cl2(g) → 2 AlCl3(s)

a- Al b- Cl2 c- AlCl3 d- non of them

1. **What is the molarity of a solution that contains 30 g of NaOH in 500 mL of solution?**

a- 1.2 M b- 1.5 M

c- 0.75 M d- 1.3 M

1. **What volume does need to dilute 3000 ml of 0.5 M KOH solution to a 10 M stock solution?**

a- 150 ml b- 1.5 L

c- 1500 ml d- 15 L

1. **For the reaction shown, calculate the theoretical yield of the product (in moles) for 4 mol Ti and 4 mol Cl2**

Ti(s) + 2Cl2(g) TiCl4(l)

* 1. 4 mol (b) 8 mol (c) 2 mol (d) 6 mol (e) non

1. **How many moles of KCl are in 0.556 L of a 2.3 M KCl solution.**

(a) 1.28 (b) 2.55 (c) 3.62 (d) 4.32 (e) non

1. **To what volume should you dilute 50 mL of a 12 M stock HNO3 solution to obtain a 0.1 M HNO3 solution?**
   1. 3 L (b) 6 L (c) 4 L (d) 3 L (e) non
2. Calculate how many moles of NO2 form when amount of 1.3 mol of N2O5 reactant completely reacts.

2N2O5(g) 4NO2(g) + O2(g)

* 1. 1.3 mol (b) 2.6 mol (c) 0.65 mol (d) 3.9 mol (e) non

1. **For the following acid base reaction calculate the mass in grams of the acid necessary to completely react with and neutralize 4.85 g of the base.**

HCl(aq) + NaOH(aq) H2O(l) + NaCl(aq)



(a) 2.05 (b) 4.1 (c) 4.85 (d) 2.42 (e) non

1. **The number of moles of hydrogen atoms in 1.3 mol CH4 is**

(a) 5.2 (b) 1.3 (c) 4.0 (d) 1.0

1. **According the balance equation 6CO2(g) +6H2O(l) 6O2 (g) + C6H12O6(aq) the grams of C6H12O6 form when 37.8 g of CO2 completely react is -------------------------------------**

(a) 25.8 g (b) 258 g (c) 378 g (d) 37.8 g

1. **The mass (in grams) of the product formed when 2.5 g of the underlined reactant completely reacts.**

(a) 3.79 g (b) 37.9 g (c) 11.5 g (d) 25 g

1. **According the balance equation 2NO(g) +5H2(g) 2NH3(g) +2H2O(g) if you start with 90 g NO and 12.5 g H2 the limiting reacting is --------------**

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* 1. NO(g) (b) NH3 (c) H2 (g) (d) H2O

1. **If 30 g KCl is dissolved in enough water to make 2 L of solution, the molarity of the solution is ……………..**

(a) 0.2 M (b) 2M (c) 0.4 M (d) 0.1 M

1. **The volume should you dilute of (1.5 L of 10 M NaOH) solution to obtain a 3.00 M is -----------------------------**

(a) 0.3 L (b) 5 L (c) 0.5 L (d) 10 L

1. **The oxidation state of Cr in Cr2O3 is:**

(a) +2, -6 (b) +3, -2 (c) -2, +3 (d) -2,+6

1. **If the theoretical yield of iron was 30.0 g and actual yield was 25.0 g, what is the percent yield for the following reaction?**

2 Al(*s*) + Fe2O3(*s*) → Al2O3(*aq*) + 2Fe(*aq*)

a- 12.0 b- 0.833 c- 83.3 d- 1.2