Test bank chapter (9)

Choose the most correct answer

1. The two types of chemical bonds commonly found in compounds are:

a) doric and covalent.
b) ionic and electrolytic.
c) **ionic and covalent.**
d) electrolytic and compound.

2. The electrons used by atoms to form chemical bonds are the:

a) core electrons.
b) valence electrons.
c) lone pair electrons.
d) unpaired electrons.

3. "Atoms tend to gain, lose, or share electrons until they are surrounded by eight valence electrons" is a statement of:

a) the rule of octaves.
b) the double quartet rule.
c) the eight electron rule.
d) the octet rule.

4. When a transition metal atom becomes a +1 ion, the electron lost usually comes from what type of orbital?

a) p
b) f
c) d
d) s

5. A molecule of CS_2 contains

a) two single bonds.
b) two double bonds.
c) one single bond and one double bond.
d) one single bond and one triple bond.

6. An atom in the ground state has atomic number Z=5. Choose the correct electron-dot structure which represents this atom? **ANS. B**

(A) $\cdot\ddot{X}\cdot$

(B) $\ddot{X}\cdot$

(C) $\cdot\ddot{X}\cdot$

(D) $:\ddot{X}\cdot$

7. Which com pound below contains an atom that is surrounded by more than an octet of electrons?

a) PF_5
b) CH_4
c) NBr_3
d) OF_2

العناصر اللي تكون في الدورة الثالثة وإحنا زين.
period 3rd → 4th → 5th ----

8. Which choi ce below correctly lists t he elements in order of i ncreasing ele ctronegativity?

a) C < N < O < F
b) N < C < O < F
c) N < C < F < O
d) C < N < F < O

يقل ↓ ← يزيد
C , N , O , F

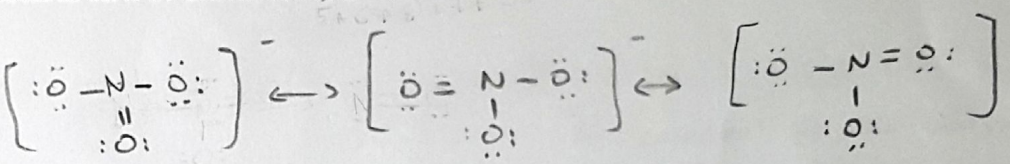
9. Which atom sometimes violates the octet rule?

a) C
b) N
c) O
d) S

يخالف / يشذ
لأنه في الدورة 3

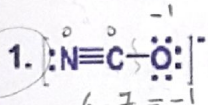
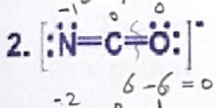
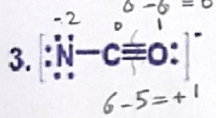
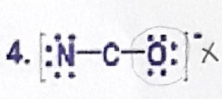
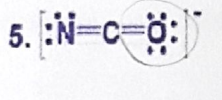
10. How many resonance structures ca n be drawn for NO_3^{-}?

a) 1
b) 2
c) 3
d) 4



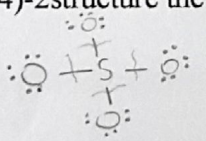
11. Considerin g formal charge, what is the preferred Lewis struc ture of NCO^-? ANS.3

إذا كانوا متساويين شوف العنصر ذو الكهروسالبية الأعلى [O] وبأخذ الشحنة السالبة الأكبر.
-1 > 0 > +1

1. 
2. 
3. 
4. 
5. 

12. In Lewis structure of (S O4)-2structure the corre ct formal charge on sulfur (S) is:

a) +2
b) -2
c) +1
d) 0


6 - 4 = +2

13. Which of th ese pairs of elements wo uld be most likely to form an ionic c ompound?

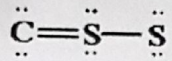
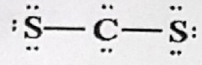
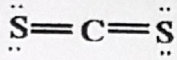
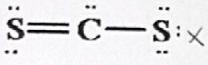
metal + nonmetal

a) Cl and I
b) Al and K
c) Cl and Mg
d) C and S

14. Which of these covalent bonds is the most polar (i.e., highest percent ionic character)?

a) Al — I
b) Si — I
c) Al — Cl
d) Si — Cl

15. The Lewis structure for CS_2 is: ANS.c

a) 
b) 
c) 
d) 

16. The number of lone electron pairs in the N2 molecule is ___.

a) 1
b) 2
c) 3
d) 4

17. Classify the O-H bond in CH3OH as ionic, polar covalent, or nonpolar covalent.

a) Ionic
b) polar covalent
c) nonpolar covalent

18. The Lewis structure for a chlorate ion, ClO3-, should show ___3___ single bond(s), ___0___ double bond(s), and ___10___ lone pair(s).

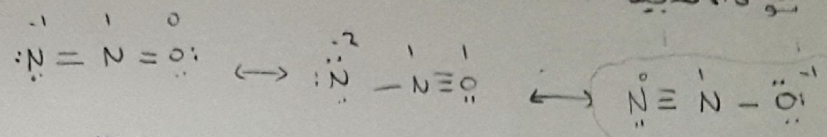
a) 2, 1, 10
b) 3, 0, 9
c) 2, 1, 8
d) **3, 0, 10**

19. The number of resonance structures for the sulfur dioxide molecule that satisfy the octet rule is

a) 1
b) 2
c) 3
d) none of these.

20. What is the formal charge on the oxygen atom in N2O (the atomic order is N-N-O)?

a) 0
b) +1
c) -1
d) -2



21. Which of these substances will display an incomplete octet in its Lewis structure?

a) CO_2
b) Cl_2
c) ICl
d) NO

22. There are ____2____ paired and ___3____ unpaired electrons in the Lewis symbol for a phosphorus atom.

a) 4, 2
b) 2, 4
c) 4, 3
d) 2, 3

Explanation: Read the question carefully here, you are being asked for how many valence electrons are paired and how many are unpaired. The abbreviated electron configuration of the P atom is given by [Ne] $3s^2 3p^3$. The outermost electrons would be arranged as 2 electrons paired and 3 electrons unpaired as shown below:

23. Based on the octet rule, magnesium most likely forms a _____ ion.

a) Mg^{2-}
b) Mg^{2+}
c) Mg^{6-}
d) Mg^{6+}

Explanation: According to the octet rule the Mg atom will achieve an octet by losing its 2 outermost electrons and thus gaining 2+ charges. Since Mg is located in the alkali metal group it will lose electrons rather than gaining them.

24. Based on the octet rule, phosphorus most likely forms a _____ ion.

a) P^{3+}
b) P^{5-}
c) P^{5+}
d) P^{3-}

Explanation: According to the octet rule the phosphorus atom should gain 3electrons, thus gaining 3 negative charges and forming the phosphide ion.

25- The only noble gas without eight valence electrons is _____.

a) Ar
b) Ne
c) He
d) Kr

Explanation: The noble gases are characterized by the presence of eight electrons in their outermost shell with one notable exception of Helium. Since He has only 2 electrons it can never have 8 in its outermost shell.

26- What is the maximum number of double bonds that a hydrogen atom can form?

a) 0
b) 1
c) 2
d) 3

Explanation: Each hydrogen atom has a single electron in its valence shell and as a result can form only one bond. It cannot form a double bond as it does not have the necessary electrons to share.

28. What is the maximum number of double bonds that a carbon atom can form?

a) 4
b) 1
c) 2
d) 0

Explanation: Each carbon atom has 4 valence electrons that it can share with other atoms. Since each double bond corresponds to a pair of electrons, the carbon atom can form only 2 double bonds.

29. Given the electronegativities below, which covalent single bond is most polar?

Atom	H	C	N	O
Electronegativity	2.1	2.5	3.0	3.5

a) C-H = 2.5 - 2.1 = 0.4
b) N-H = 3.0 - 2.1 = 0.9
c) O-H = 3.5 - 2.1 = 1.4
d) O-N = 3.5 - 3.0 = 0.5

Explanation: Bond polarity can be judged based on the differences between the electronegativities of the atoms involved. Of the available choices, the bond between O and H will have the largest electronegativity difference making it the most polar bond in this group.

30. The ion ICl_4^- has _____ valence electrons.

a) 34
b) 36
c) 35
d) 28

Explanation: valence electrons A = (7×1) +(7×1) +1 = 36

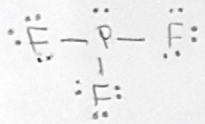
31-Electronegativity _____ from left to right within a period and _____ from top to bottom within a group.

a) decreases, increases
b) increases, increases
c) stays the same, increases
d) **increases, decreases**

Explanation: Atomic size decreases from the left to the right in a period thus making it easier for the nuclei to attract electrons towards themselves resulting in an increase in the electronegativity. On the other hand atomic size increases down a group making it harder for the nuclei to attract the valence electrons towards themselves resulting in a decrease in electronegativity.

32. The Lewis structure of PF_3 shows that the central phosphorus atom has _1_ nonbonding and _3_ bonding electron pairs.

a) 2, 2
b) 1, 3
c) 3, 1
d) 1, 2



33. Which of the following molecules contains both ionic and covalent bonds?

a) C_5H_{12}
b) **$NaClO_4$**
c) $CaCl_2$
d) H_2O

34. The ability of an atom in a molecule to attract electron density to itself is termed

a) Electronegativity
b) Electron affinity
c) Diamagnetism
d) Ionization energy

35- the most polar bond is

a) Br-H
b) I-H
c) Cl-H
d) H-H

لو حمض قوي ← التركيز مضروب في تكوار الهيدروجين في المركب .

لو حمض ضعيف ← حيطلبلي ka في السؤال.

Test bank chapter (15)

Choose the most correct answer

1-What is the concentration of H^+ in a 2.5 M HCl solution?

a) 0
b) 1.3 M
c) 2.5 M
d) 5.0 M

2. What is the OH^- ion concentration in a 5.2×10^{-4} M HNO_3 solution?

a) 1.9×10^{-11} M
b) 1.0×10^{-7} M
c) 5.2×10^{-4} M
d) Zero

$[H^+] = 5.2 \times 10^{-4}$

$[OH^-] = \frac{1 \times 10^{-14}}{5.2 \times 10^{-4}} = 1.92 \times 10^{-11}$

3.Calculate the H^+ ion concentration in lemon juice having a pH of 2.4.

a) 4.0×10^{-2} M
b) 250 M
c) 0.38 M
d) 4.0×10^{-3} M

$[H^+] = 10^{-2.4} = 3.9 \times 10^{-3}$

$\approx 4.0 \times 10^{-3}$

4. Calculate the pH of a 6.71×10^{-2} M NaOH solution.

a) 12.83
b) 2.17
c) 11.82
d) 6.71

$[OH^-] = 6.71 \times 10^{-2}$

$[H^+] = \frac{1 \times 10^{-14}}{6.71 \times 10^{-2}} = 1.49 \times 10^{-13}$

$pH = -\log [H^+]$

$= -\log (1.49 \times 10^{-13}) = 12.83$

5. What is the pH of 0.0200 M aqueous solution of HBr ?

a) 1.00
b) 1.70
c) 2.30
d) 12.30

$[H^+] = 0.0200$

$pH = -\log [H^+]$

$= -\log (0.0200)$

$= 1.698$

≈ 1.70

6.The pOH of a solution of NaOH is 11.30. What is the $[H^+]$ for this solution?

a) 2.0×10^{-3}
b) 2.5×10^{-3}
c) 5.0×10^{-12}
d) 4.0×10^{-12}

$pH + pOH = 14$

$pH = 14 - 11.30$

$= 2.7$

$[H^+] = 10^{-pH}$

$= 10^{-2.7}$

$= 1.99 \times 10^{-3}$

$\approx 2.0 \times 10^{-3}$

7. What is the pH of a 0.0400 M aqueous solution of KOH ?

a) 12.60
b) 10.30
c) 4.00
d) 1.40

$[OH^-] = 0.0400$

$[H^+] = \frac{1 \times 10^{-14}}{0.0400} = 2.5 \times 10^{-13}$

$pH = -\log [H^+] = -\log (2.5 \times 10^{-13}) = 12.60$

8. What is the approximate pH of a solution labeled 6×10^{-5} M HBr?

a) 4.2
b) 4.5
c) 5.8
d) 9.8

$[H^+] = 6 \times 10^{-5}$

$pH = -\log [H^+]$

$= -\log (6 \times 10^{-5}) = 4.22$

9. If the pH = 2 for an HNO3 solution, what is the concentration of HNO_3?

$[H^+] = 10^{-pH}$

$= 10^{-2}$

$[H^+] = 0.01 = [HNO_3]$

a) 0.10
b) 0.20
c) 0.010
d) 0.020

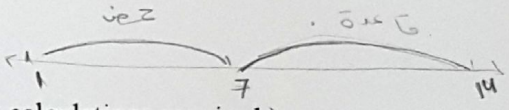
10. A solution in which $[H^+] = 10^{-8}$ M has a pH of ___ and is ___.

a) 8, acidic
b) 6, basic
c) -6, basic
d) 8, basic

$pH = -\log [H^+]$

$= -\log (10^{-8})$

$= 8 > 7 \rightarrow$ basic



11. Which of the following solutions has the lowest pH at 25oC? (No calculations required.)

a) 0.2 M NaOH قاعدة
b) 0.2 M NH3 قاعدة
c) 0.2 M HCl ← حمض
d) pure water

قاعدة ↓ $pH > 7$

حمض ↓ $pH < 7$

$pH = 7$ $pOH = 7$

12. Calculate the pH of a 3.5×10^{-3} M HNO_3 solution.

a) -2.46
b) 0.54
c) 2.46
d) 3.00

$[H^+] = 3.5 \times 10^{-3}$

$pH = -\log [H^+]$

$= -\log (3.5 \times 10^{-3})$

$= 2.455$

13. the pH of 2.6×10^{-2} M KOH.

a) 12.41
b) 15.59
c) 2.06
d) 7.00

$[OH^-] = 2.6 \times 10^{-2}$

$[H^+] = \frac{1 \times 10^{-14}}{2.6 \times 10^{-2}} = 3.846 \times 10^{-13}$

$pH = -\log (3.846 \times 10^{-13})$

$= 12.41$

14. What is the $[H^+]$ ion in a 4.8×10^{-2} M KOH solution?

a) 4.8×10^{-2} M
b) 1×10^{-7} M
c) 4.8×10^{-11} M
d) 4.8×10^{-12} M

$[OH^-] = 4.8 \times 10^{-2}$

$[H^+] = \frac{1 \times 10^{-14}}{4.8 \times 10^{-2}} = 2.083 \times 10^{-13}$

15. What is the $[OH^-]$ ion in a 5.2×10^{-4} M HNO_3 solution?

a) 1.9×10^{-11} M
b) 1.0×10^{-7} M
c) 5.2×10^{-4} M
d) zero

$[H^+] = 5.2 \times 10^{-4}$

$[OH^-] = \frac{1 \times 10^{-14}}{5.2 \times 10^{-4}} = 1.92 \times 10^{-11}$

(14) $[OH^-] = 4.8 \times 10^{-2}$

$pOH = -\log(4.8 \times 10^{-2})$

$= 1.318$

$pH = 14 - 1.318$

$= 12.68$

$[H^+] = 10^{-pH}$

$= 10^{-12.68} = 2.089 \times 10^{-13}$

$$K_w = [H^+][OH^-] = 1 \times 10^{-14}$$

$$pH = -\log [H^+]$$

$$pOH = -\log [OH^-]$$

$$[H^+] = 10^{-pH}$$

$$[OH^-] = 10^{-pOH}$$

Test bank chapter (14)

ملاحظة:
المواد الصلبة والسائلة لا تُكتب في ثابت الاتزان إلا فقط g, aq

Choose the most correct answer

1. Which is the correct equilibrium constant expression for the following reaction?

$Fe_2O_3(s) + 3H_2(g) \leftrightarrow 2Fe(s) + 3H_2O(g)$

$K_c = \frac{[H_2O]^3}{[H_2]^3}$

a) $K_c = [Fe_2O_3]\,[H_2]^3/[Fe]^2[H_2O]^3$
b) $K_c = [H_2]/[H_2O]^3$
c) $K_c = [H_2O]^3/[H_2]^3$
d) $K_c = [Fe]^2[H_2O]^3/[Fe_2O_3]\,[H_2]^3$

2. The following reactions occur at 500 K. Arrange them in order of increasing tendency to proceed to completion (least →greatest tendency).

* بعض أي تفاعل يكون ميله لاعطاء النواتج أكبر
* كل ما كانت قيمة K كبيرة معناته ميل التفاعل لاعطاء النواتج كبيرة

1. $2NOCl \rightleftharpoons 2NO + Cl_2$ $K_p = 1.7 \times 10^{-2}$ ①
2. $2SO_3 \rightleftharpoons 2SO_2 + O_2$ $K_p = 1.3 \times 10^{-5}$ ③
3. $2NO_2 \rightleftharpoons 2NO + O_2$ $K_p = 5.9 \times 10^{-5}$ ②

2 < 3 < 1

a) 2 < 1 < 3
b) 1 < 2 < 3
c) 2 < 3 < 1
d) 3 < 2 < 1

3. Calculate K_p for the reaction $2NOCl(g) \leftrightarrow 2NO(g) + Cl_2(g)$ at 400°C if K_c at 400°C for this reaction is 2.1×10^{-2}.

$K_p = K_c (0.0821\,T)^{\Delta n}$

$= 2.1 \times 10^{-2} (0.0821 \times 673)^1$

$= 1.16 \approx 1.2$

+273 = 673

$\Delta n = (2+1) - 2 = 1$

a) 2.1×10^{-2}
b) 1.7×10^{-3}
c) 0.70
d) 1.2

4. For the reaction $H_2(g) + I_2(g) \leftrightarrow 2HI(g)$, $K_c = 50.2$ at 445°C. If $[H_2] = [I_2] = [HI] = 1.75 \times 10^{-3}$ M at 445°C, which one of these statements is *true*?

كمية وحدة + كمية وحدة ← كميتين

هنا قال إنو كلهم متساوين يعني $1\,H_2 + 1\,I_2 \rightarrow 1\,HI$
طبعًا لما كانو في حالة اتزان.
بس لما وصلو لحالة الاتزان والي صار
المعادلة الموجودة في بداية السؤال أعطانا: $1\,H_2 + 1\,I_2 \rightarrow 2\,HI$ ، وبكذا نستنتج إنو HI زادت عن أول شي إلى أن وصلت لحالة الاتزان.

a) The system is at equilibrium, thus no concentration changes will occur.
b) The concentrations of HI and I_2 will increase as the system approaches equilibrium.
c) The concentration of HI will increase as the system approaches equilibrium.
d) The concentrations of H_2 and HI will fall as the system moves toward equilibrium.

5. For the following reaction at equilibrium, which choice gives a change that will shift the position of equilibrium to favor formation of more products?

يعني اتجه لليمين

$2NOBr(g) \leftrightarrow 2NO(g) + Br_2(g)$, $\Delta H°_{rxn} = 30$ kJ/mol

a) Increase the total pressure by decreasing the volume. ← يروح لقدر الحوكات الأقل
b) Add more NO. ← زاد شي في النواتج، يروح للمتفاعلات
c) Remove Br_2 → لما نشيل Br_2 يروح للنواتج عشان يعوض النقص
d) Lower the temperature. ←

التفاعل ماص للحرارة ولما نقلل درجة الحرارة يتجه للمتفاعلات.

6 - For the following reaction at equilibrium in a reaction vessel, which one of these changes would cause the Br_2 concentration to *decrease*?

$$2NOBr(g) \leftrightarrow 2NO(g) + Br_2(g),\ \Delta H^\circ_{rxn} = 30\ kJ/mol$$

a) Increase the temperature.
b) Remove some NO.
c) Add more NOBr.
d) Compress the gas mixture into a smaller volume.

7. For the reaction at equilibrium $2SO_3 \leftrightarrow 2SO_2 + O_2$ ($\Delta H^\circ_{rxn} = 198$ kJ/mol), if we increase the reaction temperature, the equilibrium will

a) shift to the right.
b) shift to the left.
c) not shift.
d) The question cannot be answered because the equilibrium constant is not given.

8. For the equilibrium reaction $2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g)$, $\Delta H^\circ_{rxn} = -198$ kJ/mol. Which one of these factors would cause the equilibrium constant to *increase*?

a) Decrease the temperature.
b) Add SO_2 gas.
c) Remove O_2 gas.
d) Add a catalyst.

9. The reaction $2SO_3(g) \rightarrow 2SO_2(g) + O_2(g)$ is endothermic. If the temperature is increased

a) more SO_3 will be produced.
b) K_c will decrease.
c) no change will occur in K_c .
d) K_c will increase.

10. If a catalyst is added to a chemical reaction, the equilibrium yield of a product will be … , and the time taken to come to equilibrium will be ……than before.

a) higher; less
b) lower; the same
c) higher; the same
d) the same; less

11- For the reaction , $N_2(g) + 3\ H_2(g) \longrightarrow 2\ NH_3(g)$

Kc = 0.0600 at a certain temperature. In an equilibrium mixture of the three gases, $[NH_3] = 0.242$ M and $[H_2] = 1.03$ M. What is the concentration of N2 in this system?

a) 3.9 M
b) 3.2×10^{-3} M
c) 0.89 M
d) 1.4×10^{-2} M

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$$[N_2] = \frac{(0.242)^2}{(0.0600)(1.03)^3}$$

$$= 0.893$$

11. Consider the reaction ,$NH_4Cl(s) \rightarrow NH_3(g) + HCl(g)$. زود نا الضغط قل الحجم ← عدد المولات اقل

1 mol 2 mol

left

If an equilibrium mixture of these three substances is compressed, equilibrium will _____, because _____.

a) shift to the right; higher pressure favors fewer moles of gas
b) shift top the right; higher pressure favors more moles of gas
c) **shift to the left; higher pressure favors fewer moles of gas**
d) shift to the left; higher pressure favors more moles of gas

12- Consider the equilibrium system; $C(s) + CO2(g) \longrightarrow 2CO(g)$.

If more C(s) is added, the equilibrium will ____; if CO_2 is removed the equilibrium will ____.

a) shift to the left; shift to the left
b) shift to the right; shift to the right CO
c) **shift to the right; shift to the left** CO_2
d) be unchanged; shift to the left

8. Consider the exothermic reaction at equilibrium: $2\ SO_2(g) + O_2(g)\ 2\ SO_3(g)$, If the system is cooled, the equilibrium will _____, because _____.

قللنا درجة الحرارة

exo

a) shift to the left; decreased temperature favors an exothermic reaction
b) shift to the right; decreased temperature favors an exothermic reaction
c) shift to the right; decreased temperature favors an endothermic reaction
d) shift to the left; decreased temperature favors an endothermic reaction

9. A large value of the equilibrium constant indicates that when the reaction reaches equilibrium, mostly _____ will be present.

K > 1 → products

K < 1 → reactants

a) reactants
b) products
c) catalysts
d) shrapnel

في حالة تحقق الاتزان

10. When equilibrium is achieved

a) Q > K
b) Q < K
c) Q = K
d) Q2 = K

11. $CO_2 + H_2 \leftrightarrow CO + H_2O$

If all species are gases and H_2 is added, the amount of CO present at equilibrium will:

a) increase.
b) decrease.
c) remain unchanged.
d) disappear.

12. $CO_2 + H_2 \leftrightarrow CO + H_2O$

If all species are gases and H_2O is added, the amount of CO present at equilibrium will:

a) increase.
b) decrease.
c) remain unchanged.
d) disappear.

13. $CO_2 + H_2 \leftrightarrow CO + H_2O$

If the reaction is endothermic and the temperature is raised, the amount of CO present will:

a) increase.
b) decrease.
c) remain unchanged.
d) disappear.

14. $CO_2 + H_2 \leftrightarrow CO + H_2O$

If all species are gases and the container is compressed, the amount of CO present will:

a) increase.
b) decrease.
c) remain unchanged.
d) disappear.

15. $CO_2 + H_2 \leftrightarrow CO + H_2O$

If all species are gases and the container is compressed, the amount of CO present will:

a) increase.
b) decrease.
c) remain unchanged.
d) disappear.

16. What is K_P in terms of K_c for the following reaction ?$2\,NO(g) + O_2(g) \leftrightarrow 2\,NO_2(g)$

a) $Kp = KcRT$
b) $Kp = Kc/RT$
c) $Kp = KcR/T$
d) $Kp = Kc/(RT)^2$

$K_p = K_c (RT)^{\Delta n}$ $\quad \Delta n = 2 - (2+1) = -1$

$K_p = K_c (RT)^{-1}$

$K_p = \frac{K_c}{RT}$

17. What is t e correct equilibrium constant expression for the reactio n: **ANS. 3**

$$P_4(s) + 6\,Cl_2(g) \longrightarrow 4\,PCl_3(l)$$

$\frac{1}{[Cl_2]^6}$

1. $\frac{[PCl_3]^4}{[P_4]\,[Cl_2]^6}$
2. $\frac{[PCl_3]^4}{[Cl_2]^6}$
3. $\frac{1}{[Cl_2]^6}$
4. $\frac{[Cl_2]^6}{[PCl_3]^4}$
5. $\frac{[4\,PCl_3]^4}{[P_4]\,[6\,Cl_2]^6}$

18. The equat ion relating Kp and K c is

[الاقواس تفرق في الكل]

+ القانون ثابت .

a) $K = K (RT)^{\Delta n}$ (p, c)

b) $K = K RT^{\Delta n}$ (p, c)

c) $K = K RT^{\Delta n}$ (c, p)

d) $K = K (RT)^{\Delta n}$ (c, p)

19. K will be equal to K if (p, c)

a) $\Delta n = 1$

b) $\Delta n = 0$

c) $RT = 0$

d) $\Delta n = -1$

20. Consider the reversib le reaction at equilibrium at 392 °C:

$$2A(g) + B(g) \rightarrow C(g)$$

atm, C:

Th e partial pressures are found to b e: A: 6.70 atm, B: 10.1 atm, C = 3.60 atm. Evaluate K_p for this reaction.

a) 7.94×10^{-3}

b) 0.146

c) 0.053 2

d) 54.5

$$K_p = \frac{P_C}{P_A^2 \cdot P_B}$$

$$= \frac{3.60}{(6.70)^2\,(10.1)} = 7.94 \times 10^{-3}$$

20 . Which of the following will res ult in an eq uilibrium sh ift to the right?

$$PCl_3(g) + Cl_2(g) \leftrightarrow PCl_5(g) \quad DH° = -87.9 \text{ kJ/ mol}$$

a) Increa se temperature/increas e volume
b) Increa se temperature/decrease volume
c) Decrease temper ature/increase volume
d) Decrease temper ature/decre ase volume

21. Which acc urately reflects the ch anges in co ncentration that will oc cur if O_2 is added to disturb the equilibrium?

$$2\,NO(g) + O_2(g) \leftrightarrow 2\,NO_2(g)$$

	[NO]	[O_2]	[NO]
a)	Increase	Increase	Inc ease
b)	Increase	Increase	Decrease
c)	Decrease	Decrease	Decrease
d)	Decrease	Increase	Inc ease

Test bank chapters (24& 25)

Ch oose the mo st correct an swer

1. $C_{10}H_{22}$ is the formula of an ....

$10 \times 2 + 2 = 22 \Rightarrow C_nH_{2n+n}$ "alkane"

a) alkane.
b) alkene.
c) alkyne.
d) aromatic hydrocar bon.

2. A molecule with the form ula C_3H_8 is a(n):

$3 \times 2 = 6 + 2 = 8 \rightarrow C_nH_{2n+2}$ "akane"

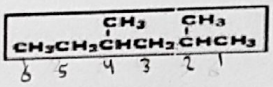
a) hexan e
b) propan e
c) decane
d) butane

3. Which compound below does not ha vegeometric isomers (cis-trans isomers)?

a) 1-butene
b) 2-butene
c) 2-pentene
d) 3-hexe ne

4. The hybridi zation of carbon atoms in alkanes is

a) sp^2
b) sp^3
c) sp
d) sp^3d

5. Select the c orrect IUPA C name for 

a) 1,1,3-trimethylpentane
b) 1-ethyl-1,3-dimethylbutane
c) 2,4-di methylhexane
d) 3,5-di methylhexane.

2,4 - di methyl hexane

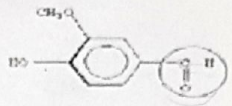
6 - An alkane w ith seven ca rbon atoms in a linear c onfiguration is called a

a) hexen e
b) heptene
c) hepylane
d) **hepta ne**

7. Which type of functional group does not include a carbonyl g roup in its structure?

a) carboxylic acid
b) ether
c) ketone
d) aldehyde

8. Vanillin is used as a fla voring agent. Identify th e functional groupcircled.



a) aldehyde
b) ketone
c) carbox ylic acid
d) Alcoh ol

9. The formula ($CH_3CH_2C\ H_2CH_2CH_2\ CH_2CH_2OH$)represents:

a) an alco hol
b) an alke ne
c) an alkyne
d) an unsaturated hydrocarbon

10. Which of th e following is a ketone?

a) CH CH C OCH
b) CH CH C HO
c) CH OCH
d) CH CH C OOH

11. The genera l formula for *alkenes* is

a) C_nH_{2n+2}
b) $C_{2n}H_{2n}$
c) C_nH_{n+2}
d) C_nH_{2n}

12- Which of these molecules is *unsatu rated*?

a) C_3H_8
b) CH_3OH
c) C_5H_{10}
d) CH_4

8. Which of th ese species is an aromatic compoun d?

a) C_2H_2
b) C_6H_{12}
c) $C_6H_4Br_2$
d) C_5H_{10}

9. Which of these species are *structural isomers* of C_6H_{14}?

I. $CH_3-CH_2-CH(CH_2CH_3)-CH_2CH_3$

II. $CH_3-CH(CH_2-CH_3)-CH_2-CH_3$

III. $CH_3-C(CH_3)(H_3C\ CH_3)-CH-CH_3$

IV. $CH_3-CH_2-CH_2-CH_2-CH_3$

a) I and II
b) I and III
c) II and III
d) II and IV

10. The compound that has a triple bond between one pair of carbon atoms is called

a) analkane.
b) achlorofluorocarbon.
c) analkyne.
d) analkene.

11. The correct structure for 2,3,3-trimethylpentane is

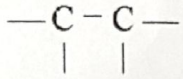
A. $CH_3-CH(CH_3)-C(CH_3)(CH_2CH_3)-CH_3$

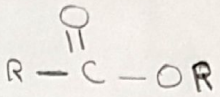
B. $CH_3-C(CH_3)(CH_3)-CH(CH_3)-CH_2CH_3$

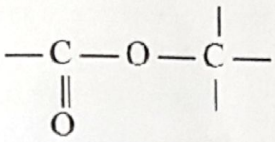
C. $CH_3-CH(CH_3)-CH(CH_3)-CH(CH_3)-CH_3$

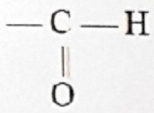
D. $CH_3-CH(CH_3)-CH(CH_2-CH_3)-CH_3$

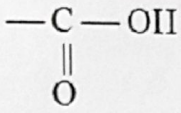
12. Which one of these str uctures represents an *este r* functional group?

A. 

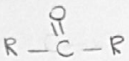


B. 

C. 

D. 

13. The functional group (RCOR) is characteristic of organic _____.



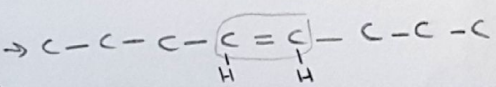
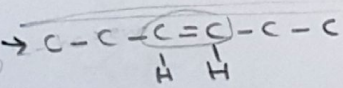
a) ketones
b) acids
c) aldehydes
d) esters

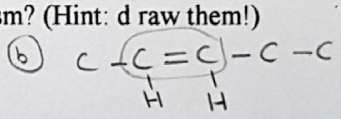
14. Which of the following hydrocarbons does not have isomer s?

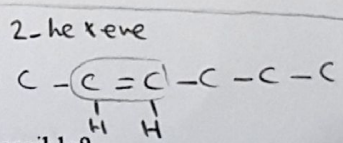
ا ميثان
2 ايثان
3 بروبان

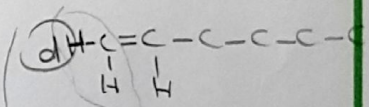
a) C_7H_{16}
b) C_6H_{14}
c) C_5H_{10}
d) C_3H_8

15. Which of th e following does NOT exhibit geometric isomeri sm? (Hint: d raw them!)

a) 4-octene → 
b) 2-pentene
c) 3-hexe ne → 
d) 1-hexe ne

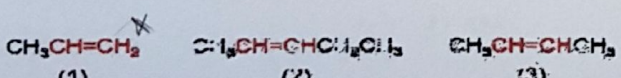
(b) 

2-hexene


(d) 

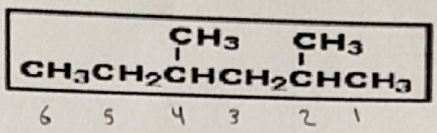
لأن الكربونة الطرفية عند ها 2H

16. For which of the comp ounds below are cis-trans isomers possible?



a) only 2
b) both 1 and 2
c) **both 2 and 3**
d) all thr ee

17. Select the correct IUPA C name for



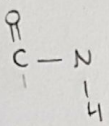
a) 1,1,3-trimethylpentane
b) 1-ethyl-1,3-dimethylbutane
c) 2,4-di methylhexane
d) 3,5-dimethylhexa ne

2,4 - di methyl hexane

18. A protein is:

a) a pol ymer of ami no acids
b) a fatt y acid ester of glycerol
c) a pol ysaccharide
d) an addition polym er

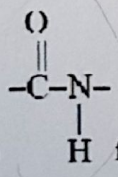
19. A peptide bond (also c alled an ami de bond) joi ns two amin o acids together. What atoms are linked by this b ond?



a) C — O
b) C — H
c) C — N
d) N — S

20. An amino acid is a compound that contains at least

a) one amino group and one amide group.
b) two amino groups and one car boxylic acid group.
c) one hydroxyl gro up and one m ethyl group.
d) one carboxylic acid group and one amino group



21. The functi onal group found in proteins is called a (an)

أميد أو ببتيد

a) amide.
b) carbox ylic acid.
c) amine.
d) amino acid.

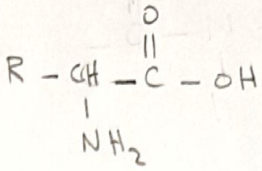
22. Which one of these choices is the general structural formula of an amino acid?

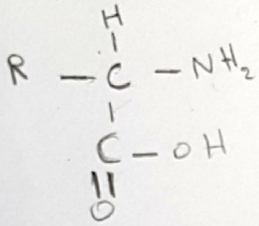
A. $R–CH_2–\overset{\overset{O}{\|}}{C}–NH_2$

B. $R–CH_2–NH_2$

C. $\begin{array}{l} R–CH–OH \\ \quad\quad | \\ \quad\quad NH_2 \end{array}$

D. $\begin{array}{l} R–CH–NH_2 \\ \quad\quad | \\ \quad\quad COOH \end{array}$





CH 4.

1) $M_i V_i = M_f V_f \Rightarrow M_f = \frac{M_i V_i}{V_f} = \frac{50 \times 0.436}{250} = 8.72 \times 10^{-2}\ M$

2) $M_i V_i = M_f V_f \Rightarrow V_i = \frac{M_f V_f}{M_i} = \frac{60 \times 0.200}{4.00} = 3\ mL$

3) $V_1 = 25\ mL$, $M_1 = 0.100$, $V_2 = 50\ mL$, $M_2 = 0.100$

$M_f = ?$, $V_f = 25 + 50 = 75\ mL$

القانون : $M_1 V_1 + M_2 V_2 = M_f V_f$

$= (0.1 \times 25) + (0.1 \times 50) = M_f \times 75$

$\frac{7.5}{75} = \frac{M_f \times 75}{75} \Rightarrow M_f = 0.1$

4) $n = \frac{m}{M} = \frac{11.7}{32} = 0.365\ mol$, $M = \frac{n}{V} = \frac{0.365}{(230 \div 1000)} = 1.589$

الكتلة المولية ← من الجدول الدوري

5) $n = M \cdot V = 2.75 \times (35.1 \div 1000) = 0.09625\ mol$

$m = n \times M = 0.09625 \times 97.998 = 9.43\ g$

الكتلة المولية

[ماني سؤال 6]

7) $n = \frac{m}{M} = \frac{5.35}{141} = 0.0379\ mol$, $M = \frac{n}{V} = \frac{0.0379}{(330 \div 1000)} = 0.1148$

8) $n = M \cdot V = 0.0158 \times (750 \div 1000) = 0.01185\ mol$

$m = n \times M = 0.01185 \times 23.949 = 0.283\ g$

الكتلة المولية

[ماني سؤال 9]

10) $M_i V_i = M_f V_f \Rightarrow M_f = \frac{M_i V_i}{V_f} = \frac{50 \times 0.436}{250} = 0.0872 = 8.72 \times 10^{-2}$

[ماني سؤال 11]

12) $n = \frac{m}{M} = \frac{3.682}{122.5} = 0.03\ mol$, $M = \frac{n}{V} = \frac{0.03}{(375 \div 1000)} = 0.08 = 8.0 \times 10^{-2}$

CH 5.

1) $\frac{V_1 P_1}{T_1} = \frac{V_2 P_2}{T_2} \Rightarrow V_2 = \frac{V_1 P_1 T_2}{T_1 P_2} = \frac{47.2 \times (1240 \div 760) \times (25+273)}{(25+273) \times (730 \div 760)} = 80.2\ L$

2) Boyl's law → $PV = constant$, $P_1 V_1 = P_2 V_2$, $\frac{P_1}{P_2} \times \frac{V_2}{V_1}$

هوا نفسو

3) $\frac{V_1 P_1}{T_1} = \frac{V_2 P_2}{T_2} \Rightarrow V_2 = \frac{V_1 P_1 T_2}{T_1 P_2} = \frac{6 \times (740 \div 760) \times 273}{(35+273) \times 1} = 5.17\ L$

4) $D = \frac{MP}{RT} = \frac{71 \times 1}{0.08206 \times 273} = 3.16\ g/L$

ملاحظة / أي كلمة غاز مع عنصر يعني قصرو ثنائي دايمًا ، لأنا الغازات تيجي ثنائية بس (O_2, F_2, Cl_2 ...الخ)

5) $n = \frac{m}{M} = \frac{76}{38} = 2\ mol$, $PV = nRT \Rightarrow P = \frac{nRT}{V} = \frac{2 \times 0.08206 \times (-37+273)}{1.50}$

$= 25.8 \approx 26\ atm.$

6) $D = \frac{MP}{RT} = \frac{17 \times 2}{0.08206 \times (25+273)} = 1.39\ g/L$ الأمونيا $[NH_3]$

7) $1\ atm \rightarrow 760\ mmHg$

$2\ atm \rightarrow ?$ $= 1520\ mmHg.$

8) $PV = nRT \Rightarrow n = \frac{PV}{RT} = \frac{10.4 \times (71.9 \div 1000)}{0.08206 \times (465+273)} = 0.0123\ mol$

$m = n \times M = 0.0123 \times 18 = 0.222\ g.$

9) $D = \frac{MP}{RT} \Rightarrow M = \frac{DRT}{P} = \frac{4.95 \times 0.08206 \times (-35+273)}{(1020 \div 760)} = 72$

10) في الصفحة اللي ورا ←

11) $\frac{V_1}{T_1} \times \frac{V_2}{T_2} \Rightarrow V_2 = \frac{V_1 T_2}{T_1} = \frac{6 \times 620}{310} = 12\ L$

تابع CH 5

10) $PV = nRT$

$PV = \frac{m}{M}RT$

الكتلة المولية للصيغة الجزيئية ← $M = \frac{mRT}{PV} = \frac{0.087 \times 0.08206 \times 273}{1 \times (33.6 \div 1000)} = 58\ g/mol$

① نجيب الـ empirical formula :

- نحول كل جرام لعدد مولات .
- نقسم على أصغر عدد مولات .
- لو طلع أعداد عشرية نضرب في أعداد صحيحة ابتداءً من 2 إلين ما تصير كلها صحيحة .

$n_C = \frac{0.480}{12} = 0.04\ mol$ ، $n_H = \frac{0.100}{1.008} = 0.0992$

هذا أصغر فَ نقسم عليه كل العناصر .

$C = \frac{0.04}{0.04} = 1$ $H = \frac{0.0992}{0.04} = 2.48$

طلع عشري فلازم نضرب في أعداد صحيحة إلين يصير صحيح أو قريب لأنه يكون صحيح

- لو جربنا 2 ← $2.48 \times 2 = 4.96$

يعني تقريبًا 5

- نضربها كلها في 2 . $H = 2.48 \times 2 = 4.96 \approx 5$ ، $C = 1 \times 2 = 2$

- نكتب الصيغة الأولية ← C_2H_5

② نجيب الكتلة المولية للصيغة الأولية اللي طلعناها :

$M = (2 \times 12) + (5 \times 1) = 29$

③ نوجد Ratio عشان نجيب الصيغة الجزيئية .

$Ratio = \frac{Molar\ Mass\ of\ Moleculer\ formula}{Molar\ Mass\ of\ empirical\ formula}$

$= \frac{58}{29} = 2$

④ نضرب الـ Ratio في الصيغة الأولية اللي طلعناها :

$2(C_2H_5) \longrightarrow C_4H_{10}$

تابع CH_5 ⇒

12) $n_{CH_4} = \frac{90}{16} = 5.625 \text{ mol}$, $n_{Ar} = \frac{10}{39.95} = 0.250 \text{ mol}$

$X_i = \frac{n_i}{n_i + n_B} = \frac{5.625}{5.625 + 0.250} = 0.957$

$P_i = X_i \; P_{total} = 0.957 \times 250 = 239.25 \text{ torr}$

يحتاج تحول من atm لأنو أساسًا طلبو بـ torr

13) $n_N = \frac{1.4}{(2\times14)} = 0.05 \text{ mol}$, $n_O = \frac{4.8}{(2\times16)} = 0.15 \text{ mol}$

$n_{total} = 0.05 + 0.15 = 0.2 \text{ mol}$

$PV = nRT \Rightarrow P = \frac{nRT}{V} = \frac{0.2 \times 0.08206 \times (57+273)}{(200 \div 1000)} = 27 \text{ atm.}$

14) $P_{H_2} = P_{total} - P_{H_2O}$

$= 736 - 22.4 = 713.6 \text{ torr}$

$P_1 = 713.6 \text{ torr} \rightarrow 0.938 \text{ atm}$, $V_2 = 30 \text{ mL} \rightarrow 0.03 \text{ L}$

$T_1 = 24 + 273 = 297 \text{ k}$, $P_2 = 1 \text{ atm}$, $T_2 = 273 \text{ k}$

$V_2 = ??$

$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \Rightarrow V_2 = \frac{P_1 V_1 T_2}{P_2 T_1} = \frac{0.938 \times 0.03 \times 273}{1 \times 297}$

$= 0.025 \text{ L}$

$\downarrow$

25.86 mL ⇒

15) $\frac{V_1}{n_1} = \frac{V_2}{n_2} \Rightarrow V_2 = \frac{V_1 n_2}{n_1} = \frac{1 \times 4}{4} = 1$

16) $V_1 = 6$, $P_1 =$ نفسو , $T_1 =$ نفسها , $P_2 = \frac{1}{3} P_1$, $T_2 = \frac{1}{2} T_1$, $V_2 = ??$

$\frac{V_1 P_1}{T_1} = \frac{V_2 P_2}{T_2} \Rightarrow V_2 = \frac{V_1 P_1 T_2}{T_1 P_2}$

$= \frac{(6)(P_1)(\frac{1}{2}T_1)}{(T_1)(\frac{1}{3}P_1)} = \frac{(6)(\frac{1}{2})}{(\frac{1}{3})} = 9 \text{ L}$ ⇒

تابع CH5.

17) $\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow \frac{V_1}{303} = \frac{V_2}{293} \Rightarrow 303 : 293$

18) $\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow V_2 = \frac{V_1 T_2}{T_1} = \frac{50 \times 546}{273} = 100\ L$

19) $PV = nRT \Rightarrow V = \frac{nRT}{P} = \frac{0.33 \times 0.08206 \times (520 + 273)}{(880 \div 760)} = 18.54 \approx 19\ L$

$n_{KHCO_3} = \frac{m}{\mathcal{M}} = \frac{33}{100} = 0.33\ mol$

20) $\frac{V_1}{n_1} = \frac{V_2}{n_2} \Rightarrow \frac{V_1}{2} = \frac{29.5}{3} \Rightarrow V_1 = 19.66\ L$

$PV = nRT \Rightarrow n = \frac{PV}{RT} = \frac{(760 \div 760)(19.66)}{0.08206 \times (127 + 273)} = 0.598\ mol$

$m = n \times \mathcal{M} = 0.598 \times 122.551 = 73.28\ g$

21) * أنا أقول كذا ومقتنعة في الحل حقي ☺

هوا قالي إيش القانون المناسب أو الأفضل اللي يطلع حجم واحد مول في الغاز.

$PV = nRT \Rightarrow V = \frac{nRT}{P} = \frac{(1)RT}{P} = \frac{RT}{P}$

* الدكتورة تقول كذا وكان ما عجبني ☺

molar volume $(\frac{V}{n})$

$PV = nRT \Rightarrow \frac{V}{n} = \frac{RT}{P}$

22) $PV = nRT$ [المتغيرات اللي تتناسب عكسيًا " يعني لا تكون حجم بعض هو قسمة "]

23) $1\ atm \rightarrow 760\ mmHg$

$?? \rightarrow 562\ mmHg$

$= 0.739\ atm$

24) $1\ mole \rightarrow 22.4\ L$

25) $0°C$, $1\ atm$.

26) mole fraction → unitless

* الكسر المولي بدون وحدة.

- CH_5 تابع

27) $X_i = \frac{n_i}{n_i + n_B}$ تعريف الكسر المولي استنادًا لقانون دالتون للضغط الجزيئية :

النسبة بين عدد مولات أول واحد مقسوم على كل المولات .

28) $PV = nRT$, P = atm / V = L / n = mol / R = Latm/Kmol / T = K

29)
* الغاز طبيعي يكون في الحالة الغازية عند الضغط الأتموسفيري الحادي اللي هوا 1 عند درجة حرارة 25 C .
* البخار يكون حالة غازية لأي مادة سواءً سائل أو صلب عند درجة حرارة وضغط عاديين طبيعيين .

30) $n = \frac{m}{M} = \frac{19.6}{16} = 1.225$ mol , $PV = nRT \Rightarrow V = \frac{nRT}{P} = \frac{1.225 \times 0.08206 \times (27+273)}{1.59}$

$= 18.96$ L

31) $D = \frac{MP}{RT} \Rightarrow M = \frac{dRT}{P}$ * نجيب الكتلة المولية عشان نعرف مين الغاز ؟

$= \frac{1.456 \times 0.08206 \times (45+273)}{1} = 37.9$

$d = \frac{m}{V} = \frac{4.37}{3} = 1.456$ g/L

طيب بما إنو غاز ثنائي يعني ذي كتلتو الذرية ، نقسم على اثنين عشان نعرف مين هوا .

$\frac{37.9}{2} = 18.99 \Rightarrow F \rightsquigarrow F_2$

32) $P_{H_2} = P_{total} - P_{H_2O} = 685 - 18.6 = 666.4$ mmHg.

$n = \frac{PV}{RT} = \frac{(666.4 \div 760) \times 7.80}{0.08206 \times (21+273)} = 0.283$ mol

$m = n \times M = 0.283 \times (2 \times 1.008) = 0.5713$ g

33) خواص الغاز/ عالي الانضغاطية ، مسافات كبيرة بين الجزيئات ، تشكيل مخاليط متجانسة بغض النظر عن طبيعة الغازات .

34) $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \Rightarrow V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{3 \times (2.1 \div 1000) \times (25+273)}{(4+273) \times 0.95} = 7.13 \times 10^{-3}$ L

7.13 mL

35) $n = \frac{PV}{RT} = \frac{(945 \div 760) \times (2.74)}{0.08206 \times (33+273)} = 0.1356$ mol

$m = n \times M = 0.1356 \times 28 = 3.79$ g

تابع CH5

36) أي الغازات التالية تحتوي على أكبر كثافة، إذا كانوا درجة الحرارة والضغط ثابتين.

$D = \frac{MP}{RT}$ ⇒ P, T ثابتة → $D = \frac{M}{R}$

$D_{H_2} = \frac{(2 \times 1.008)}{0.08206} = 24.56$ g/L

$D_{CClF_3} = \frac{104.453}{0.08206} = 1272.88$ g/L ← هذا الأكبر.

$D_{CO_2} = \frac{44}{0.08206} = 536.19$ g/L

$D_{C_2H_6} = \frac{30.048}{0.08206} = 366.17$ g/L

37) $d = \frac{MP}{RT} \Rightarrow \frac{m}{V} = \frac{MP}{RT} \Rightarrow M = \frac{mRT}{PV} = \frac{0.389 \times 0.08206 \times (97+273)}{(728 \div 760) \times (102 \div 1000)}$

$= 120.93 \approx 121$ g/mol

38) $d = \frac{MP}{RT} \Rightarrow M = \frac{dRT}{P} = \frac{6.13 \times 0.08206 \times 273}{1} = 137.3$ g/mol

40) $X_i = \frac{n_i}{n_{total}} = \frac{1.50}{1.27 + 3.04 + 1.50} = 0.258$ (ماني سؤال 39)

$P_i = X_i \, P_{total}$

$= 0.258 \times 1380 = 356$ mmHg

41) نفس سؤال 32.

42) $M = \frac{mRT}{PV} = \frac{0.271 \times 0.08206 \times (140+273)}{(847 \div 760)(294 \div 1000)} = 28$ g/mol ← الكتلة المولية للصيغة الجزيئية

الكتلة المولية للصيغة الأولية CH_2 ← $(1 \times 12) + (2 \times 1) = 16$

$Ratio = \frac{28}{16} = 2.$ $\quad CH_2 \xrightarrow{\times 2} C_2H_4$

43) $PV = nRT \Rightarrow V = \frac{mRT}{MP} = \frac{12 \times 0.08206 \times (25+273)}{87 \times 0.950} = 3.55$ L.

$n = \frac{m}{M}$

CH7

1) lowest energy → ground state.

2) All s orbitals are: spherical " كروية "

3) $[He]2s^2 2p^2$

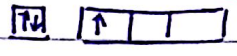
$2 + 4 \longrightarrow 6 \rightsquigarrow C$

4) (V) 5 في المجموعة ← يعني يفترض ←

ينتهي بـ : $4s^2 3d^3$

5) $(Ga):31 \rightarrow [Ar]4s^2\ 3d^{10}\ 4p^1$, $4s^2 4p^1$ "الكترونات المدار الخارجي" valence electron

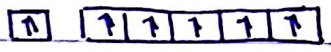
6) $[Ne]3s^2 \boxed{3p^1}$ (n, L, m_L, m_s)



$3p^1$

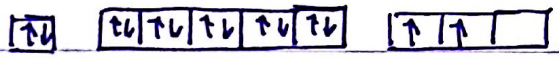
3 يعني $n=3$, p يعني $L=1$,

7) Cr → $[Ar]4s^1 3d^5$ "half-filled" حسب قاعدة " عمود الكروم والنحاس يمشي على ذي القاعدة بس "



عدد الأزواج غير الرابطة ← 6

8) Se → 34 → $[Ar]4s^2 3d^{10} 4p^4$



عدد الأزواج غير الرابطة ← 2

9) $n = 3$, $L = 2$

number of orbital: $(2L+1)$ أو (n^2)

دام أعطانا L يعني خصص أكثر. → $2L+1 = 2(2)+1 = 5$

10) $n^2 = 4^2 = 16$

11) $2n^2$

12) $Na: 11 \rightarrow 1s^2 2s^2 2p^6 \boxed{3s^1}$ يبغى أعداد الكم الممكنة لآخر إلكترون في ذرة الصوديوم.

$n = 3$, $L = 0$, $m_L = 0$, $m_s = \frac{1}{2}$

13) $Ca: 20 \rightarrow [Ar]4s^2$

14) Row 2 ← $n=3$ صح ، $L=2$ صح لأنه أصغر من n ، $m_L=-3$ خطأ لأن L=2 وتاخذ من $+L$ إلى $-L$

15) d → 5 orbital.

فيه 5 غرف

تابع CH 7

16) $[Ar]\,4s^2\,3d^{10}\,4p^4$

$18 + 16 = 34 \rightarrow Se.$

17) Ni: 28 $\rightarrow [Ar]\,4s^2\,3d^8$

2 unpaired. → para.

18) $c = \lambda \nu \Rightarrow \nu = \frac{c}{\lambda} = \frac{3 \times 10^8}{0.53} = 5.66 \times 10^8$

19) $E = h\nu \Rightarrow E = \frac{hc}{\lambda}$ (تتناسب طرديًا مع التردد وعكسيًا مع الطول الموجي).

20) $\lambda = \frac{hc}{E} = \frac{(6.626 \times 10^{-34})(3 \times 10^8)}{5.25 \times 10^{-19}} = 3.78 \times 10^{-7}$

21) $E = h\nu \Rightarrow \nu = \frac{E}{h} = \frac{4.38 \times 10^{-18}}{6.626 \times 10^{-34}} = 6.61 \times 10^{15}$

22) $E = \frac{-2.18 \times 10^{-18}}{n^2} \Rightarrow n = \sqrt{\frac{-2.18 \times 10^{-18}}{E}} = \sqrt{\frac{-2.18 \times 10^{-18}}{-1.362 \times 10^{-19}}} = 4$

رجع بدأ تعداد الأسئلة من 19 :).

19) $n_i = 2$, $n_f = 6$

$n_i < n_f \longrightarrow$ absorption

$E = R_H \left(\frac{1}{n_i^2} - \frac{1}{n_f^2}\right) = 2.18 \times 10^{-18} \left(\frac{1}{2^2} - \frac{1}{6^2}\right) = 4.84 \times 10^{-19}$ J.

$E = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{hc}{E} = \frac{(6.626 \times 10^{-34})(3 \times 10^8)}{4.84 \times 10^{-19}} = 4.103 \times 10^{-7}$ m

$\downarrow \times 10^9$

410.3 nm

CH7 تابع

20) 4

21) angular. ← عدد الكم الذي يحدد الشكل

22) $3^2 = 9$ ← عدد الأوربيتال في الثالث يعني 3

23) s = 0 , p = 1 , d = 2 , f = 3

24) n = 1 , بقيه المدارات ← 3 p

بس في المدار الأول فيه s

25) principal quantam number ← يعني قيمة n

ويقولي أول d موجودة في أي مدار ؟ طبعًا المدار 2 و3 ما في d

فـ هيكون يبدأ من الثالث 3d

26) shell يعني n ← نطلع عدد الأوربيتال بـ n^2

27) ما في سؤال 27 :)

28) 6e. ← كل p فيه 3 غرف ، كل غرفة فيها إلكترونين يعني

29) نفس سؤال 28.

30) xenon(Xe) فيه 54 إلكترون يعني يعبّي مدار 3p بالكامل وبالراحة كمان بدون ما نوزع حتى ،

وأي مدار p فيه 6 إلكترونات.

31) $[Ar]\ 4s^2\ 3d^{10}\ 4p^3$

$18 + 15 = 33 \rightsquigarrow As.$

32) $Br: 35 \rightarrow [Ar]\ 4s^2\ 3d^{10}\ 4p^5$ يبقى رقم الكم في المدار n الخارجي لذرة البروم

أكبر رقم هنا 4.

33) ns^1 يعني المجموعة الأولى ← Alkali metal.

34) $c = \lambda \nu$

35) electron energies are quantized.

36) 5d يعني ← $l = 2$ ← $m_l = -2, -1, 0, 1, 2$ ، أي واحد في الخيارات خطأ ؟

37) Angular quantum number ← واحد من الخيارات ما يُحتسب إنو داخل لأن المستويات اللي فيه أكبر من 2 خطأ ، لأن المستوى الثاني ما فيه d

38) 1,1,1 حين من الخيارات هو ممكن يكون عدد كم ؟
n L m_L
لأن L ما ينفع يصير نفس الـ n لازم أصغر.

39) حين هوا عدد الكم اللي يحدد طاقة الإلكترون في ذرة الهيدروجين ؟ n ← يحدد الطاقة.
(n)
L ← الشكل.
m_L ← الاتجاه

برا الأسئلة من 39 كمان :).

39) أي ترتيب إلكتروني مخالف لقاعدة باولي ؟ d لأن لازم نوزع الإلكترونات فردية بعدين نزاوجها.

40) أي من الخيارات صالح لأن يكون أربعة أعداد كم (n, L, m_L, m_s)

✓ a) $2, 0, 0, +\frac{1}{2}$
$n=2$ صح، $L=0$ صح بما إنها أصغر من n، $m_L=0$ صح لأن $L=0$

✗ b) $2, 2, 1, -\frac{1}{2}$
$n=2$ صح، $L=2$ خطأ لأن ما يصير عدد L يساوي n، يعني الخيار كلو خطأ.

✗ c) $1, 0, 1, +\frac{1}{2}$
$n=1$ صح، $L=0$ صح دامها أصغر من عدد n، $m_L=1$ خطأ لأن m_L هي من +L إلى -L
0 يعني ما في موجبة وسالب

✗ d) $2, 1, +2, +\frac{1}{2}$
$n=2$ صح، $L=1$ صح دامها أصغر من n، $m_L=2$ خطأ لأن إذا $L=1$ حيكون $m_L = -1, 0, +1$

41) حين من الخيارات غير صالح لأن يكون أربعة أعداد كم ؟

✓ a) $2, 0, 0, +\frac{1}{2}$
$n=2$ صح، $L=0$ صح لأنها أصغر من n، $m_L=0$ صح.

✓ b) $2, 1, 0, -\frac{1}{2}$
$n=2$ صح، $L=1$ صح لأنها أصغر من n، $m_L=0$ صح لأن $L=1$ يعني m_L حيكون $-1, 0, +1$

✗ c) $1, 1, 0, +\frac{1}{2}$
$n=1$ صح، $L=1$ خطأ لأن ما ينفع $L=n$

✓ d) $1, 0, 0, +\frac{1}{2}$
$n=1$ صح، $L=0$ صح لأنها أصغر من n، $m_L=0$ صح.

CH8

1) العناصر في الجدول الدوري الحديث ترتبت على حسب زيادة ؟ العدد الذري. Atomic number

2) طاقة التأين ← من اليسار لليمين في الدورة ، و ← من الأسفل للأعلى في المجموعة

تزيد ↑ تزيد →

3) 8A < 2A < 1A < 3A < 5A < 4A < 6A < 7A ← أعجب شي

4) Ca_3X_2 ← X = -3 و Ca = +2 ، X = -3 يعني $[Na_3X]$ بما إنو كوّن ذا Na = +1

5) Atomic radius ينقص ↓ يزيد

هوا قال increase يعني يزيد [من أعلى لأسفل المجموعة ، و من اليمين لليسار في الدورة].

6) Atomic radius للمجموعة يزيد كل ما نزلنا تحت بسبب :

principal quantum number. المجموعة الأولى مثلاً ns يعني كل ما نزلنا الـ n بس حيتغير. اللي هوا

7) increasing size يعني خاص بالـ radius ، و increase يعني من الأصغر للأكبر.

O , F , S , Mg , Ba ← يقل ↓ يزيد

O > F , S > O , Ba > Mg , Mg > S

Ba > Mg > S > O > F ، من الأصغر للأكبر [F < O < S < Mg < Ba].

8) F , K , Ge , Br , Rb radius ← يقل ↓ يزيد

F < Br , K < Rb , Br < Ge < K

F < Br < Ge < K < Rb

9) يزيد → ↓ ينقص ، 1A < 3A < 2A < 4A < 6A < 5A < 7A < 8A

Br , O , C , P

أعلى شي حيكون فوق في الجدول

C	N	O	F
P	S	Cl	
	Se	Br	

← هذي الأكبر فنقارن العناصر اللي فيها أسفل

C < O

largest ← O

تابع CH8

10) يزيد ← ، يقل ↓

Na, Al, Se, Cl

Na < Al < Cl

Al < S

S < Se

⇒ Na < Al < Se < Cl

11) يقل ← ، يزيد ↓ radius الأيون أكبر ق نقارن بس بين الأيونات Cl^-, Br^-, F^-

F < Cl < Br

12) يقل ← ، يزيد ↓ Br^-, Cl^-, O^{2-}, F^-

$O^{2-} > Br > Cl > F$

13) هي الجزيئات لها نفس الإلكترونات iso electronic .

a] B → 5+5 = 10 , Si → 14+4 = 18 X

b] O → 8+2 = 10 , F → 9+1 = 10 , Ne → 10 , Na → 11-1 = 10 ✓

14) Ar : 18 → Cl^- : 17+1 = 18

Ne : 10 → F^- : 9+1 = 10

15) الكلور له قابلية أكثر لتكوين أنيون من الصوديوم بسبب :

الكلور electron affinity أكبر من الصوديوم (electron affinity القدرة على جذب الإلكترون يعني يتحول لأنيون) .

16) Alkaline earth metal → Group 2A.

17) Boron (B) ← 3A → 3

18) Ar : 18 , K^+ : 19-1 = 18

19) Fe^{+3} , Fe : 26 → [Ar] ~~$4s^2$~~ $3d^6$ → Fe^{+3} [Ar] $3d^5$

في العناصر الانتقالية نسحب من ns ثم من (n-1)d .

20) [Ar] $4s^2$ $3d^{10}$ $4p^1$

3A

21) Sn → 4A → 4 electron.

22) P → [Ne] $3s^2 3p^3$ → P^{3-} (3 orbitals)

V → [Ar] $4s^2 3d^3$ → V^{5+} (كاملة)

S → [Ne] $3s^2 3p^4$ → S^{2-} (3 orbitals)

Sc → [Ar] $4s^2 3d^1$ → Sc^{2+}

مين اللي عنده أزواج غير رابطة ؟ Sc^{2+}

23) 4f → lanthanide elements.

24) X > Y (يقل ← يزيد) نفترض أن X ← Y

كأنو في بداية الجدول الدوري يعني ممكن إنو يكون فلزي أكثر metallic .

25) K^+, P^{3-}, S^{2-}, Cl^-, increasing → small to large.

$K < Cl^- < S^{2-} < P^{3-}$. وكل ما زادت شحنة الأيون كل ما كبر الحجم anion > cation

26) Se → nonmetal + found in group 6A

28) $ns^2 np^6$: الإلكترونات المدار الخارجي في الغازات النبيلة تكون (ما في سؤال 27 :)

29) Cl^- → 17 + 1 = 18 , K^+ → 19 − 1 = 18

30) Ga → period 4 , group 3A.

31) Ti → d-block (من العناصر الانتقالية اللي بينتهي توزيعها بـ d)

32) Co → [Ar] $4s^2 3d^7$

[Ar] $3d^7$ ← Co^{+2} فيه غلط في السؤال ذا ، لو قالت تبا Co حيكون [Ar] $4s^2 3d^7$

لو قالت تبا Co^{2+} حيكون [Ar] $3d^7$.

33) anion > atom > cation

كبرت الشحنة كبر الحجم . كبرت الشحنة صغر الحجم

$A^{2+} < A^+$

34) isoelectronic → same number of electrons.

تابع CH8 .

35) ionization energy. الطاقة اللازمة لنزع إلكترون من الذرة ← طاقة التأين

36) يزيد ↓ يقل ، $1A < 3A < 2A < 4A < 6A < 5A < 7A < 8A$

C ، N ، O ، B

4 ، 5 ، 6 ، 3

$B < C < O < N$

37) anion > atom > cation N^{-3} ، Li^{+} ، C ، O^{2-}

$Li^{+} < C < O^{2-} < N^{3-}$

Test bank chapter (1)

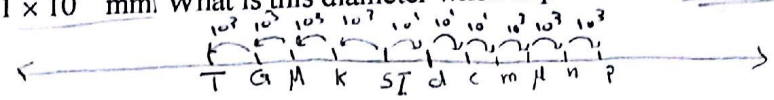
Choose the correct answer

1. The SI unit of time is the

   a) hour
   b) second
   c) minute
   d) ampere

2. The diameter of an atom is approximately 1×10^{-7} mm. What is this diameter when expressed in nanometers?

   a) 1×10^{-18} nm
   b) 1×10^{-15} nm
   c) 1×10^{-9} nm
   d) **1×10^{-1} nm**



$1 \times 10^{-7} \times 10^{6} = 0.1$
$= 1 \times 10^{-1}$

mm → nm
من كبير لصغير ضرب

3. 6.0 km is how many micrometers?

من كبير لصغير ضرب

   a) 6.0×10^{6} μm
   b) 1.7×10^{-7} μm
   c) 6.0×10^{9} μm
   d) 1.7×10^{-4} μm

6×10^{9}

10^{9} 10^{-6}

4. The SI prefixes *giga* and *micro* represent, respectively:

   a) 10^{-9} and 10^{-6}.
   b) 10^{6} and 10^{-3}.
   c) 10^{3} and 10^{-3}.
   d) 10^{9} and 10^{-6}.

5. Which of these quantities represents the largest mass?

   a) 2.0×10^{2} mg → $2.0 \times 10^{2} \div 10^{3} = 0.2$ g
   b) 0.0010 kg → $0.0010 \times 10^{3} = 1$ g
   c) 1.0×10^{5} μg → $1.0 \times 10^{5} \div 10^{6} = 0.1$ g
   d) 2.0×10^{2} cg → $2.0 \times 10^{2} \div 10^{2} = 2$ g

6. How many cubic centimeters are there in exactly one cubic meter?

   a) 1×10^{-6} cm^3
   b) 1×10^{-3} cm^3
   c) 1×10^{-2} cm^3
   d) 1×10^{6} cm^3

$1 \text{ m} = 1 \times 10^{2}$ cm
↓
$1 \text{ m}^3 = (1 \times 10^{2})^3 = 1 \times 10^{6}$ cm^3

7. Ammonia boils at -33.4°C. What temperature is this in °F?

a) -60.1°F
b) -92.1°F
c) -28.1°F
d) +13.5°F

$F = [(9 \div 5) \times C] + 32$

$= [(9 \div 5) \times (-33.4)] + 32 = -28.12\ °F$

8. Which of the following is not an SI base unit?

a) **Kilometer**
b) Kilogram
c) Second
d) Kelvin

9. Which of the following SI base units is not commonly used in chemistry?

a) kilogram
b) kelvin
c) **candela** → في الفيزياء
d) mole

10. Which of the following prefixes means 1/1000?

1×10^{-3} → milli

a) kilo
b) deci
c) centi
d) milli

11. Which of the following prefixes means 1000?

1×10^{3} → kilo

a) kilo
b) deci
c) centi
d) milli

12. Convert -77°F to kalvin ?

a) 212.6 K
b) -212.6 K
c) -28.1 K
d) +13.5 K

$C = (5 \div 9)(F - 32)$

$= (5 \div 9)(-77 - 32) = -60.55$

$K = C + 273.15$

$= -60.55 + 273.15 = 212.6\ K$

13. The number 0.0005678 expressed in scientific notation is:

5.678×10^{-4}

a) 5.678×10^{4}
b) 5.67×10^{-7}
c) 5.678×10^{-4}
d) $5.678\ 10^{-3}$

Explanation: Since this number is less than one star moving the decimal point to the right until there is ONE non-zero number to the left of the decimal point. Write the rest of the number as is. Write the exponent as the number of places the decimal point was moved.

14. Which of the following is the smallest distance?

a) 21 m $\rightarrow$ 21 m
b) 2.1×10^{2} cm $\rightarrow 2.1 \times 10^{2} \div 10^{2} = 2.1$ m
c) 21 mm $\rightarrow 21 \div 10^{3} = 0.021$ m
d) **2.1×10^{4} pm** $\rightarrow 2.1 \times 10^{4} \div 10^{12} = 2.1 \times 10^{-8}$

Explanation: Even though 2.1×10^{4} is the largest number in this question, the units of pm (picometers) are the smallest units here, making it the smallest distance.

15. What temperature is 95 °F when converted to degrees Celsius?

a) 63 °C
b) **35 °C**
c) 127 °C
d) 15 °C

$C = (5 \div 9)(F - 32)$
$= (5 \div 9)(95 - 32) = 35^{\circ}C$

16. What temperature is 37 °C when converted to kelvin?

a) **310.15**
b) 99 k
c) 236 k
d) 67.15

$K = 37 + 273.15$
$= 310.15$ K

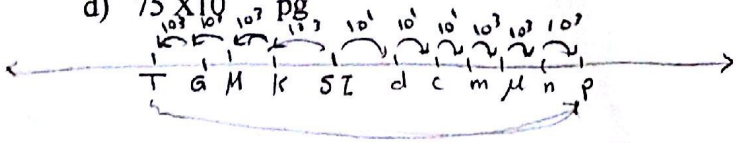
17. What temperature is 77 K when converted to degrees Celsius?

a) − 296 °C
b) 105 °C
c) **−196 °C**
d) 25 °C

$K = C + 273.15 \Rightarrow C = K - 273.15$
$= 77 - 273.15$
$= -196.15\ ^{\circ}C$

18. Express 75 Tg as pg

a) 0.75 pg
b) **75×10^{24} pg**
c) 0.75 pg
d) 75×10^{-24} pg



من كبير لصغير نضرب $T \rightarrow p$

75×10^{24}

19. The SI prefixes *Tera* and *nano* represent, respectively

a) 10^{-9} and 10^{-6}
b) 10^{6} and 10^{-3}
c) 10^{3} and 10^{-3}
d) 10^{12} and 10^{-9}

20. Which of these quantities represents the smallest mass?

a) 2.0×10^{2} mg → $2.0 \times 10^{2} \div 10^{3} = 0.2$ g
b) 0.0010 kg → $0.0010 \times 10^{3} = 1$ g
c) 1×10^{5} µg → $1 \times 10^{5} \div 10^{6} = 0.1$ g
d) 2.0×10^{2} cg → $2.0 \times 10^{2} \div 10^{2} = 2$ g

21. Express 7.5 ng as Tg

$7.5 \div 10^{21} = 7.5 \times 10^{-21}$

a) 7.5×10^{-21} Tg
b) 75×10^{24} Tg
c) 0.75 Tg
d) 7.5×10^{21} Tg

n → T ص صغير لكبير نقسم

28. At what temperature does the numerical reading on a Fahrenheit thermometer equal that on a Celsius thermometer?

a) 0 °F
b) **– 40°F**
c) 100 °F
d) –32 °F

F = C نفرض إنو

ونفرض بأي قانون سواءً C أو F

ناخذ مثلاً F

Explanation: since the temperature reading is the same so that mean °F = °C $F = (\frac{9}{5} \times C) + 32$

? F = [°C × 9/5] + 32 °F

بما افرضنا إنهم متساويين

فلو أخذنا كل F وطبقنا بدالها C

يصير :

Let temperature = t

$t = [t \times 9/5] + 32$ °F $\quad C = (\frac{9}{5} \times C) + 32$

$t - 9/5\ t = 32$ °F $\quad C = \frac{9}{5} C + 32$

$-4/5\ t = 32$ °F $\quad \frac{5}{5} C - \frac{9}{5} C = 32$

$t = -40$ °F $= -40$ °C $\quad \frac{5}{-4} \times \frac{-4}{5} C = 32 \times \frac{5}{-4}$

$C = -40$

Test bank chapter (2)

Choose the correct answer

NOTE: A periodic table is required to work many of the problems in this chapter.

1. Which of these elements is most likely to be a good conductor of electricity?

   a) N
   b) S
   c) He
   d) Fe

2. An atom of the isotope sulfur-31 consists of how many protons, neutrons, and electrons? (p = proton, n = neutron, e = electron)

   a) 15 p, 16 n, 15 e
   b) 16 p, 15 n, 16 e
   c) 16 p, 31 n, 16 e
   d) 32 p, 31 n, 32 e

3. A magnesium ion, Mg^{2+}, has

   a) 12 protons and 13 electrons.
   b) 24 protons and 26 electrons.
   c) 12 protons and 10 electrons.
   d) 24 protons and 22 electrons.

4. 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

5. The elements in a column of the periodic table are known as

   a) metalloids.
   b) a period.
   c) noble gases.
   d) a group.

6. Which is the correct formula for copper (II) phosphate?

a) Cu_2PO_4
b) $Cu_3(PO_4)_2$
c) Cu_2PO_3
d) $Cu(PO_4)_2$

7. The correct name for NH_4NO_3 is

a) ammonium nitrate.
b) ammonium nitrogen trioxide.
c) ammonia nitrogen oxide.
d) hydrogen nitrogen oxide.

8. What is the formula for the ionic compound formed by calcium ions and nitrate ions?

a) Ca_3N_2
b) $Ca(NO_3)_2$
c) Ca_2NO_3
d) Ca_2NO_2

9. The Stock system name for Mn_2O_7 is

a) dimanganese heptaoxide.
b) magnesium oxide.
c) manganese(VII) oxide.
d) manganese(II) oxide.

10. Which of these elements is chemically similar to oxygen?

a) sulfur
b) calcium
c) iron
d) nickel

11. The formula of stannic oxide is SnO_2. The valence of Sn is:

a) +1
b) +2
c) +3
d) +4

Explanation: to know the charge on Sn atom, make this simple calculation remember that the charge on oxygen atom is -2 , let X is the charge on Sn atom

X+ (-2 (charge on O) × 2 (number of O atoms) = 0 (equal zero because the compound is neutral)

X - 4 = 0 >>>>>> x = + 4

12. Which pair of atoms constitutes a pair of isotopes of the same element?

same Z
different A

(a). $^{14}_{6}X$ $^{14}_{7}X$

(b). $^{14}_{6}X$ $^{12}_{6}X$

(c). $^{17}_{9}X$ $^{17}_{8}X$

(d). $^{19}_{10}X$ $^{19}_{9}X$

Explanation: Isotopes of an element are atoms of the same element with same number of protons but different number of neutrons. Only choice (b) has 2 atoms of X with 6 protons and 8 and 6 neutrons respectively.

13. Elements in Group 8A are known as the _____.

a) chalcogens
b) alkali metals
c) **noble gases**
d) alkaline earth metals

14. _____ typically forms ions with a 2+ charge.

↓
2A

a) Transition metals
b) Halogens
c) **Alkaline earth metals**
d) Alkali metals

Explanation: The alkaline earth metals are in group 2A of the periodic table and lose 2 electrons to form cations with 2 positive charges.

15. An *anion* is defined as

a) **a charged atom or group of atoms with a net negative charge.**
b) a stable atom.
c) a group of stable atoms.
d) an atom or group of atoms with a net positive charge.

16. A cation is defined as

a) a charged atom or group of atoms with a net negative charge.
b) a stable atom.
c) a group of stable atoms.
d) **an atom or group of atoms with a net positive charge.**

17. Atoms of the same element with different mass numbers (or number of neutrones) are called

a) ions.
b) neutrons.
c) chemical families.
d) **isotopes.**

18. How many neutrons are there in an atom of lead $_{82}Pb$ whose mass number is 208?

$n = 208 - 82$
$= 126$

a) 82
b) **126**
c) 208
d) 290

19. Molecules consist of the same element with different numbers of atoms and chemical structure are called …

a) Ions
b) Neutrons
c) **Allotropes**
d) Isotopes

20. An atom of the isotope ^{16}S-31 consists of how many protons, neutrons, and electrons?

$p = 16,\ e = 16,\ n = 31 - 16 = 15$

a) 15 p, 16 n, 15 e
b) **16 p, 15 n, 16 e**
c) 16 p, 31 n, 16 e
d) 32 p, 31 n, 32 e

21. A magnesium ion, $_{20}Ca^{2+}$, has $p = 20,\ e = 20 - 2 = 18$

a) 20 protons and 22 electrons.
b) 20 protons and 20 electrons.
c) **20 protons and 18 electrons.**
d) 22 protons and 20 electrons.

22. A sulfide ion, $_{16}S^{2-}$, has: $p = 16,\ e = 16 + 2 = 18$

a) 16 protons and 16 electrons
b) 32 protons and 16 electrons
c) 16 protons and 14 electrons
d) **16 protons and 18 electrons**

23. Which of these pairs of elements would be most likely to form a molecular compound?

nonmetal + nonmetal
nonmetal + metalloid

a) Na and Br
b) Ca and O
c) **C and O**
d) Zn and O

24. What is the formula for the ionic compound formed by calcium ions and nitrate ions?

$Ca \rightarrow NO_3$
$(+2) \quad (-1)$
$Ca(NO_3)_2$

a) $CaN_{3\ 2}$
b) **$Ca(NO_3)_2$**
c) $CaNO_{2\ 3}$
d) $CaNO_{2\ 2}$

25. Which is the correct formula for copper(II) phosphate?

a) $CuPO$
b) $Cu_3(PO_4)_2$
c) Cu_2PO_3
d) $Cu(PO_4)_2$

26. The correct name for NH_4NO_3 is

a) **ammonium nitrate.**
b) ammonium nitrogen trioxide.
c) ammonia nitrogen oxide.
d) hydrogen nitrogen oxide.

27. The correct name for PCl_5 is

a) monophosphate pentachloride
b) phosphorus chloride
c) monophosphate tetrachloride
d) **phosphorus pentachloride**

28. Which of the following expressions represents two molecules of water?

a) HO
b) HO_2
c) $2\,H_2O$
d) $2\,HO_2$

29. The empirical formula of a compound with molecules containing 12 carbon atoms, 14 hydrogen atoms, and 6 oxygen atoms is _____.

a) $C_{12}H_{14}O_6$
b) C_2H_4O
c) CH_2O
d) $C_6H_7O_3$

Explanation: The empirical formula is always the simplest possible whole number ratio between the atoms of the molecules.

30. The charge on the manganese in the salt MnF_3 is _____.

a) +1
b) -1
c) +3
d) -2

Explanation: Since every F has one negative charge, the Mn can have only 3 positive charges.

30. Magnesium reacts with a certain element to form a compound with the general formula MgX. What would the most likely formula be for the compound formed between potassium and element X?

a) KX
b) K_2X_2
c) K_2X_3
d) **None of the above**

Explanation: In the compound MgX, X must have 2 negative charges since Mg will always have 2 positive charges. The element K will always form an ion with 1 positive charge and hence the only combination of K and X could be K_2X, which is not one of the options.

31. Barium forms an ion with a charge of _____.

a) +1
b) -2
c) +3
d) None of the above.

Explanation: Barium is in group 2A of the periodic table and forms ions with only 2 positive charges.

31. Aluminum forms an ion with a charge of _____.

a) +2
b) -3
c) **+3**
d) +1

32. Iodine forms an ion with a charge of _____.

a) -7
b) +1
c) **-1**
d) +2

33. The chemical symbol for the ion with 11 protons and 10 electrons.

a) Na
b) F^-
c) Ne
d) **Na^+**

عنصرين من الجدول الدوري

34. Which of these compounds is a binary compound?

a) **NaCl**
b) $MgSO_4$
c) NaOH
d) HCN

35. Atoms with the same number of electrons and number of protons are called...

متعادلة .

a) ions
b) isotopes
c) **neutral atoms**
d) different atoms

36. Atoms which have different number of electrons are called...

a) **ions**
b) isotopes ×
c) neutral atoms ×
d) different atoms

37. Use the following table and choose which of the species are positively charged?

نقص عدد الالكترونات عن عدد البروتونات حقيقا .

Atom or ion element	I	II	III	IV	V	VI
Atom or ion electrons (e)	6	10	18	10	28	7
Atom or ion protons (p)	6	8	17	11	30	7
Atom or ion neutrons (n)	6	8	18	11	36	6

A. III and V
B. **IV and V**
C. II and III
D. I and VI

38. Which isotope has 45 neutrons?

(a). $^{80}_{36}Kr$ → 80 - 36 = 44
(b). $^{78}_{34}Se$ → 78 - 34 = 44
(c). $^{80}_{35}Br$ → 80 - 35 = 45
(d). $^{34}_{17}Cl$ → 34 - 17 = 17

39. In the periodic table, the elements are arranged in _____.

على حسب العدد الذري

a) alphabetical order
b) **order of increasing atomic number**
c) order of increasing metallic properties
d) order of increasing neutron content

40. An element in the upper right corner of the periodic table is _____.

a) either a metal or metalloid
b) definitely a metal
c) **definitely a non-metal**
d) either a metalloid or a non-metal

41. An element that appears in the lower left corner of a periodic table is _____.

a) either a metal or metalloid
b) **definitely a metal**
c) either a metalloid or a non-metal
d) definitely a non-metal

42. A molecular formula always indicates _____.

a) **how many of each atom are in a molecule**
b) the simplest whole-number ratio of different atoms in a compound ×
c) which atoms are attached to which in a molecule ×
d) the isotope of each element in a compound ×
e)

43. An empirical formula always indicates_____.

a) which atoms are attached to which in a molecule
b) how many of each atom are in a molecule
c) **the simplest whole-number ratio of different atoms in a compound**
d) the geometry of a molecule

44. There are _____ protons, _____ neutrons, and _____ electrons in $^{131}_{53}I^-$.

$p = 53$, $n = 131 - 53 = 78$

$e = 53 + 1 = 54$

a) 131, 53, and 54
b) 131, 53 and 52
c) **53, 78, and 54**
d) 53, 131, and 52

45. Which species has 48 electrons?

(a). $^{118}_{50}Sn^{+2}$ → 50 - 2 = 48
(b). $^{116}_{50}Sn^{+4}$
(c). $^{112}_{48}Cd^{+2}$
(d). $^{68}_{31}Ga$

Test bank chapter (3)

Choose the correct answer

1. What is the mass, in grams, of one copper atom?

a) 1.055 10^{-22} g
b) 63.55 g
c) 1 amu
d) 1.66 10^{-24} g

$n = \frac{m}{M} = \frac{N}{N_A}$

$\frac{m}{63.55} \times \frac{1}{6.022\times10^{23}}$

$m = 1.055\times10^{-22}$ g

2. Determine the number of moles of aluminum in 96.7 g of Al.

a) 0.279 mol
b) 3.58 mol
c) 7.43 mol
d) 4.21 mol

$n = \frac{m}{M}$

$= \frac{96.7}{26.98} = 3.58$ mol

3. Which of the following samples contains the greatest number of atoms?

a) 100 g of Pb
b) 2.0 mole of Ar
c) mole of Fe
d) 5 g of He

$n = \frac{m}{M} = \frac{N}{N_A}$

[a] $\frac{100}{207.2} \times \frac{N}{6.022\times10^{23}}$

$N = 2.906\times10^{23}$ atom

[b] $N = n \times N_A$

$= 2 \times 6.022\times10^{23} = 1.204\times10^{24}$

[c] $N = 1 \times 6.022\times10^{23}$

$= 6.022\times10^{23}$ atom

[d] $\frac{5}{4.003} \times \frac{N}{6.022\times10^{23}}$

$N = 7.52\times10^{23}$ atom

4. Formaldehyde has the formula CH_2O. How many molecules are there in 0.11 g of formaldehyde?

a) 6.1 10^{-27}
b) 3.7 10^{-3}
c) 4
d) 2.2 10^{21}

$\frac{0.11}{30.026} \times \frac{N}{6.022\times10^{23}}$

$N = 2.206\times10^{21}$

5. How many sulfur atoms are present in 25.6 g of $Al_2(S_2O_3)_3$?

a) 0.393
b) 6
c) 3.95 10^{22}
d) 2.37 10^{23}

$\frac{25.6}{390.38} = \frac{N}{6.022\times10^{23}}$

$N = 3.949\times10^{22}$ molecule of $Al_2(S_2O_3)_3$

1 molecule $Al_2(S_2O_3)_3$ → 6 atom S

3.949×10^{22} → ? atom S

$= 2.369\times10^{23}$ atom of S

6. The percent composition by mass of a compound is 76.0% C, 12.8% H, and 11.2% O. The molar mass of this compound is 284.5 g/mol. What is the molecular formula of the compound?

a) $C_{10}H_6O$
b) $C_9H_{18}O$
c) $C_{16}H_{28}O_4$
d) $C_{18}H_{36}O_2$

$nC = \frac{76}{12} = 6.33$, $nH = \frac{12.8}{1.008} = 12.69$, $nO = \frac{11.2}{16} = 0.7$

$\frac{6.33}{0.7} = 9$, $\frac{12.69}{0.7} = 18$, $\frac{0.7}{0.7} = 1$

empirical for. → $C_9H_{18}O$ => molar mass = (9×12)+(18×1)+(1×16) = 142

Ratio = $\frac{284.5}{142} = 2$

$2(C_9H_{18}O)$

$C_{18}H_{36}O_2$ ← molecular formula.

7. What is the coefficient of H_2O when the following equation is properly balanced with the smallest set of whole numbers?

___ Al_4C_3 + 12 H_2O → 4 $Al(OH)_3$ + 3 CH_4

4 Al, 3C | 24 H, 120 | 4 Al, 120 | 12 H → 24 H | 3C, 12 H

a) 3
b) 4
c) 6
d) 12

8. When 22.0 g NaCl and 21.0 g H_2SO_4 are mixed and react according to the equation below, which is the limiting reagent? **$2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$**

الأصغر هو الذي ينتج الأصغر.

$n_{NaCl} = \frac{22}{58.44} = 0.376 \div 2 = 0.188$ mol

$n_{H_2SO_4} = \frac{21}{98.086} = 0.214 \div 1 = 0.214$ mol

a) H_2SO_4
b) Na_2SO_4
c) HCl
d) NaCl

9. When the following equation is balanced, the coefficients are _____.

4 NH_3 (g) + 7 O_2 (g) → 4 NO2 (g) + 6 H2O (g)

(a). 1, 1, 1, 1

(b). 2, 3, 2, 3

(c). 4, 7, 4, 6

(d). 1, 3, 1, 2

10. How many moles of carbon atoms are in 4 mol of dimethylsulfoxide (C_2H_6SO)?

1 mol C_2H_6SO → 2 mol C
4 mole → ?
= 8 mole C

a) 2
b) 6
c) 8
d) 4

Explanation: This is based on reading the formula and correctly extracting information from it. The formula C_2H_6SO indicates that every mole of this compound has 2 moles of carbon atoms in it. Thus 4 moles of the compound would have 4 x 2 = 8 moles of C atoms.

11. There are _____ sulfur atoms in 25 molecules of $C_4H_4S_2$.

1 molecules $C_4H_4S_2$ → 2 atoms S
25 → ?
= 50 atom

a) 1.5×10^{25}
b) 4.8×10^{25}
c) 3.0×10^{23}
d) **50**

Explanation: The molecular formula indicates that every molecule of $C_4H_4S_2$ has 2 sulfur atoms per molecule and hence 25 molecules of this compound will have 25 x 2 = 50 atoms of sulfur.

12. There are _____ hydrogen atoms in 25 molecules of $C_4H_4S_2$.

1 molecule $C_4H_4S_2$ → 4 atom H

25 → ?

= 100 atom

a) 25
b) 3.8×10^{24}
c) 6.0×10^{25}
d) **100**

Explanation: The formula of $C_4H_4S_2$ indicates that there are 4 hydrogen atoms per molecule and hence 100 hydrogen atoms in 25 molecules of $C_4H_4S_2$.

13. How many grams of oxygen are in 65.0 g of $C_2H_2O_2$?

$n = \frac{65}{58} = 1.12$ moles of $C_2H_2O_2$

1 mol $C_2H_2O_2$ → 2 mol O

1.12 → ?

= 2.24 mol O

$m = n \times M$

$= 2.24 \times 16 = 35.86$ g

a) 18
b) 29
c) 9.5
d) **35.8**

Explanation: This question uses the mole to mole ratio between oxygen and $C_2H_2O_2$ and needs the following steps. $\frac{65.0\text{ g } C_2H_2O_2}{58.0\text{ g}\cdot\text{mol}^{-1}} \times \frac{2\text{ moles O}}{1\text{ mole } C_2H_2O_2} \times \frac{15.99\text{ g O}}{1\text{ mole of O}} = 35.8\text{ g of O}$

17. How many moles of carbon dioxide are there in 52.06 g of carbon dioxide? CO_2

$n = \frac{m}{M} = \frac{52.06}{44} = 1.183$ mol

a) 0.8452
b) **1.183**
c) 1.183×10^{23}
d) 8.648×10^{2}

Explanation: This is a straight-forward conversion from grams to moles of CO_2 which is done as follows:

$$52.06\text{ g } CO_2 \times \frac{1\text{ mole } CO_2}{43.99\text{ g } CO_2} = 1.183\text{ moles of } CO_2$$

18. How many moles of the compound magnesium nitrate, Mg(NO3)2, are in a2.35 g sample of this compound?

$n = \frac{2.35}{148.31} = 0.0158$

a) 38.4
b) 65.8
c) 0.0158
d) 0.0261

Explanation: This is a straight-forward conversion from grams to moles of Mg(NO3)2 which is done as

follows:

$$2.35\text{ g } Mg(NO_3)_2 \times \frac{1\text{ mole } Mg(NO_3)_2}{148.3148\text{ g}} = 0.0158\text{moles}$$

19. A 25.5-g sample of ammonium carbonate contains _____ mol of ammonium ions.

a) 0.468
b) 0.288
c) 0.531
d) 2.00

NH_4 + CO_3 (+) (-2)

$(NH_4)_2CO_3$

① $n = \frac{25.5}{96} = 0.2656$ mole

② 1 mol $(NH_4)_2CO_3$ → 2 mol NH_4

0.2656 mol → ?

= 0.531 mol of NH_4

Explanation: Realize that the formula for ammonium carbonate is (NH4)2CO3 and calculate the molar mass (96.0856 g/mol). Convert grams to moles and then using the stoichiometric ratio find the # of moles of ammonium ions.

$$25.5\text{ g } (NH_4)_2CO_3 \times \frac{1\text{ mol } (NH_4)_2CO_3}{96.0856\text{ g}} \times \frac{2\text{ moles } NH_4^+}{1\text{ mol } (NH_4)_2CO_3} = 0.531\text{ moles}$$

20. Magnesium and nitrogen react in a combination reaction to produce magnesium nitride:

$$3Mg + N_2 \rightarrow Mg_3N_2$$

In a particular experiment, a 5.47-g sample of N_2 reacts completely. How many grams of Mg are needed for this reaction?

a) 14.2 g
b) 24.1 g
c) 16.1 g
d) 0.92 g

① $n = \frac{5.47}{(2\times14)} = 0.195$ mol

② 3 mol Mg → 1 mol N_2

? ← 0.195 N_2

= 0.586 mol Mg

③ $m = n \times M$

$= 0.586 \times 24.31$

$= 14.2$ g

Explanation: Ensure that the equation is balanced. The grams of N_2 must be converted to moles of N_2 and then using the stoichiometric ratio between the Mg and N_2, the grams of Mg can be calculated.

$$5.47\text{ g } N_2 \times \frac{1\text{ mole } N_2}{28.0134\text{ g}} \times \frac{3\text{ mole Mg}}{1\text{ mole } N_2} \times \frac{24.3050\text{ g Mg}}{1\text{ mole Mg}} = 14.2\text{ g Mg}$$

21. What information would you need to calculate the average atomic mass of an element?

a) The number of neutrons in the element.
b) The atomic number of the element.
c) The mass and abundance of each isotope of the element.
d) The position in the periodic table of the element.

22. The atomic masses of Cl (75.53 %) and Cl (24.47 %) are 34.968 amu and 36.956 amu, respectively. Calculate the average atomic mass of chlorine.

a) 35.96 amu
b) 35.45 amu
c) 36.47 amu
d) 71.92 amu

$$\frac{(75.53 \times 34.968) + (24.47 \times 36.956)}{100} = 35.45 \text{ amu}$$

23. How many atoms are there in 5.10 moles of sulfur (16S=32 amu)?

a) 3.07×10^{24}
b) 9.59×10^{22}
c) 6.02×10^{23}
d) 9.82×10^{25}

$$N = n \times N_A$$
$$= 5.10 \times 6.022 \times 10^{23}$$
$$= 3.071 \times 10^{24}$$

24. Iodine has two isotopes 126I and 127I, with the equal abundance.Calculate the average atomic mass of Iodine (53I).

50 %. 50 %.

a) 126.5 amu
b) 35.45 amu
c) 1.265 amu
d) 71.92 amu

$$\frac{(126 \times 50) + (127 \times 50)}{100} = 126.5 \text{ amu}$$

25. The atomic masses of 6Li and 7Li are 6.0151 amu and 7.0160 amu, respectively. Calculate the natural abundance of these two isotopes. The average atomic mass of Lithium (Li=6.941 amu).

a) ^{6}Li= 7.49% , ^{7}Li= 92.51%
b) ^{7}Li= 7.49% , ^{6}Li= 92.51%
c) ^{6}Li= 8.49% , ^{7}Li= 95.51%
d) ^{7}Li= 7.22% , ^{6}Li= 82.51%

$$\frac{(6.0151\ X) + (100 - X)(7.0160)}{100} = 6.941$$

$$100 \times \frac{6.0151\ x - 7.0160\ X + 701.6}{100} = 6.941 \times 100$$

$$6.0151X - 7.0160X = -7.5$$
$$-1.0009\ X = -7.5 \Rightarrow \boxed{X = 7.49}$$

^{6}Li = 7.49 %.
^{7}Li = 100 - 7.49 = 92.506 %

26. How many atoms are present in 3.14 g of copper (Cu)?

a) 2.98×10^{22}
b) 1.92×10^{23}
c) 1.89×10^{24}
d) 6.02×10^{23}

$$n = \frac{m}{M} = \frac{N}{N_A}$$
$$\frac{3.14}{63.55} = \frac{N}{6.022 \times 10^{23}}$$
$$N = 2.975 \times 10^{22}$$

27. Nitric oxide (NO) reacts with oxygen gas to form nitrogen dioxide (NO_2), a dark-brown gas:

$$2NO\,(g) + O_2(g) \rightarrow 2NO_2(g)$$

In one experiment 0.886 mole of NO is mixed with 0.503 mole of O_2. Calculate the number of moles of NO_2 produced (note: first determine which is the limiting reagent).

a) 0.886 mol
b) 0.503 mol
c) 1.01 mol
d) 1.77 mol

$n_{NO} = 0.886 \div 2 = 0.443$ ← الكاشف المحدود

$n_{O_2} = 0.503 \div 1 = 0.503$

2 mol NO → 2 mol NO_2

0.886 mol → ?

$= 0.886$ mol

28. The fertilizer ammonium sulfate [$(NH_4)_2SO_4$] is prepared by the reaction between ammonia (NH_3) and sulfuric acid:

$$2NH_3(g) + H_2SO_4(aq) \rightarrow (NH_4)_2SO_4(aq)$$

How many kilograms of NH_3 are needed to produce 1.00×10^5 kg of $(NH_4)_2SO_4$?

a) 1.70×10^4 kg
b) 3.22×10^3 kg
c) 2.58×10^4 kg
d) 7.42×10^4 kg

① $n = \frac{1.00 \times 10^5}{132} = 757.575$ mol

② 2 mol NH_3 → 1 mol $(NH_4)_2SO_4$

? ← 757.575 mol

$= 1.515 \times 10^3$ mol NH_3

③ $m = n \times M$

$= 1.515 \times 10^3 \times 17$

$= 2.575 \times 10^4$ g

29. Consider the combustion of carbon monoxide (CO) in oxygen gas:

$$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$$

Starting with 3.60 moles of CO, calculate the number of moles of CO_2 produced if there is enough oxygen gas to react with all of the CO.

a) 7.20 mol
b) 44.0 mol
c) 3.60 mol
d) 1.80 mol

2 mol CO → 2 mol CO_2

3.60 mol CO → ??

$= 3.60$ mol CO_2

30. Nitrous oxide (N_2O) is also called "laughing gas." It can be prepared by the thermal decomposition of ammonium Nitrate (NH_4NO_3). The other product is H_2O. The balanced equation for this reaction is:

$$NH_4NO_3 \rightarrow N_2O + 2H_2O$$

How many grams of N_2O are formed if 0.46 mole of NH_4NO_3 is used in the reaction?

a) 2.0 g
b) 3.7×10^1 g
c) 2.0×10^1 g
d) 4.6×10^{-1} g

1 mol NH_4NO_3 → 1 mol N_2O

0.46 mol NH_4NO_3 → ??

$= 0.46$ mol N_2O

$m = n \times M$

$= 0.46 \times 44 = 20.24$

$= 2.0 \times 10^1$ g

31. What is the theoretical yield of chromium that can be produced by the reaction of 40.0 g of Cr_2O_3 with 8.00 g of aluminum according to the chemical equation below?

$$2Al + Cr_2O_3 \quad Al_2O_3 + 2Cr$$

a) 7.7 g
b) **15.4 g**
c) 27.3 g
d) 30.8 g

① نحدد الكاشف المحدد.

$n_{Cr_2O_3} = \frac{40}{152} = 0.263 \div 1 = 0.263$ mol

$n_{Al} = \frac{8}{26.98} = 0.296 \div 2 = 0.148$ mol ← الأصغر هو الكاشف المحدد

② 2 mol Al → 2 mol Cr

0.296 Al → ??

= 0.296 mol Cr

③ $m = n \times M$

$= 0.296 \times 52 = 15.392$ g

32. Hydrogen fluoride is used in the manufacture of Freons (which destroy ozone in the stratosphere) and in the production of aluminum metal. It is prepared by the reaction

$$CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$$

In one process 6.00 kg of CaF_2 are treated with an excess of H_2SO_4 and yield 2.86 kg of HF. Calculate the percent yield of HF.

نحول kg إلى g

a) 93.0 %
b) 95.3 %
c) 47.6 %
d) 62.5 %

① $n = \frac{6 \times 10^3}{78} = 76.92$ mol CaF_2

② 1 mol CaF_2 → 2 mol HF

76.92 mol → ??

= 153.84 mol HF

③ $m = n \times M = 153.84 \times 20 = 3076.8$ g

④ $\text{Yield} = \frac{2.86 \times 10^3}{3076.8} \times 100$

$= 92.95\ \%$

$\approx 93\%$.

33. When 22.0 g NaCl and 21.0 g H_2SO_4 are mixed and react according to the equation below, which is the limiting reagent?

$$2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$$

a) NaCl
b) H_2SO_4
c) Na_2SO_4
d) No reagent is limiting.

$n_{NaCl} = \frac{22}{58.44} = 0.376 \div 2 = 0.188$ mol ← الأصغر هو الكاشف المحدد

$n_{H_2SO_4} = \frac{21}{98} = 0.214 \div 1 = 0.214$ mol

34. Hydrochloric acid can be prepared by the following reaction:

$$2NaCl(s) + H_2SO_4(aq) \rightarrow 2HCl(g) + Na_2SO_4(s)$$

How many grams of HCl can be prepared from 2.00 mol H_2SO_4 and 150 g NaCl?

a) 7.30 g
b) 93.5 g
c) 146 g
d) 150 g

① $n_{NaCl} = \frac{150}{58.44} = 2.566 \div 2 = 1.283$ mol ← الأصغر هو الكاشف المحدد

$n_{H_2SO_4} = 2.00 \div 1 = 2$ mol

② 2 mol NaCl → 2 mol HCl

2.566 mol → ??

= 2.566 mol HCl

③ $m = n \times M$

$= 2.566 \times 36.458$

$= 93.55$ g

35. Calculate the molar mass of Li_2CO_3.

a) 73.89 g
b) 66.95 g
c) 41.89 g
d) 96.02 g

$(2 \times 6.941) + (12 \times 1) + (3 \times 16)$
$= 72.98$ g

36. How many molecules of ethane (C_2H_6) are present in 0.334 g of C_2H_6?

a) 2.01×10^{23}
b) 6.69×10^{21}
c) 4.96×10^{22}
d) 8.89×10^{20}

$n = \frac{m}{M} = \frac{N}{N_A}$

$\frac{0.334}{30} = \frac{N}{6.022 \times 10^{23}}$

$N = 6.70 \times 10^{21}$

37. All of the substances listed below are fertilizers that contribute nitrogen to the soil. Which of these is the richest Source of nitrogen on a mass percentage basis?

a) Urea, $(NH_2)_2CO$
b) Ammonium nitrate, NH_4NO_3
c) Guanidine, $HNC(NH_2)_2$
d) Ammonia, NH_3

(a) $N\% = \frac{(2 \times 14)}{40} \times 100 = 70\%$

(b) $N\% = \frac{(2 \times 14)}{80} \times 100 = 35\%$

(c) $N\% = \frac{(3 \times 14)}{59} \times 100 = 71\%$

(d) $N\% = \frac{14}{17} \times 100 = 82\%$

38. Allicin is the compound responsible for the characteristic smell of garlic. An analysis of the compound gives the following percent composition by mass: C: 44.4 percent; H: 6.21 percent; S: 39.5 percent; O: 9.86 percent. What is its molecular formula given that its molar mass is about 162 g?

a) $C_{12}H_{20}S_4O_2$
b) $C_7H_{14}SO$
c) $C_6H_{10}S_2O$
d) $C_5H_{12}S_2O_2$

$nC = \frac{44.4}{12} = 3.7$, $nH = \frac{6.21}{1.008} = 6.160$, $nS = \frac{39.5}{32.07} = 1.231$, $nO = \frac{9.86}{16} = 0.616$

$\frac{3.7}{0.616} = 6$, $\frac{6.160}{0.616} = 10$, $\frac{1.231}{0.616} = 2$, $\frac{0.616}{0.616} = 1$

Emprical formula $\rightarrow C_6H_{10}S_2O \Rightarrow$ molar mass $= 162$ g

39. The formula for rust can be represented by Fe_2O_3. How many moles of Fe are present in 24.6 g of the compound?

a) 2.13 mol
b) 0.456 mol
c) 0.154 mol
d) 0.308 mol

(1) $n = \frac{m}{M} = \frac{24.6}{159.7} = 0.154$ mol Fe_2O_3

(2) 1 mol $Fe_2O_3 \rightarrow$ 2 mol Fe
0.154 mol $\rightarrow$??

$= 0.308$ mol Fe

40. What is the mass, in grams, of one copper atom?

a) $1.055 \quad 10^{-22}$ g
b) 63.55 g
c) 1 amu
d) $1.66 \quad 10^{-24}$ g

$n = \frac{m}{M} = \frac{N}{N_A}$

$\frac{m}{63.55} = \frac{1}{6.022 \times 10^{23}}$

$m = 1.055 \times 10^{-22}$ g

41. How many grams of sulfur (S) are needed to react completely with 246 g of mercury (Hg) to form HgS?

a) 39.3 g
b) 24.6 g
c) 9.66×10^{3} g
d) 201 g

42. Tin(II) fluoride (SnF_2) is often added to toothpaste as an ingredient to prevent tooth decay. What is the mass of F in grams in 24.6 g of the compound?

a) 18.6 g
b) 24.3 g
c) 5.97 g
d) 75.7 g

① $n = \frac{24.6}{156.7} = 0.156$ mol SnF_2

② 1 mol SnF_2 → 2 mol F
0.156 mol → ??
$= 0.3139$ mol F

③ $m = n \times M$
$= 0.3139 \times 19$
$= 5.965$ g

43. What is the empirical formula of the compound with the following composition? 2.1 percent H, 65.3 percent O, 32.6 percent S.

a) H_2SO_4
b) H_2SO_3
c) $H_2S_2O_3$
d) HSO_3

$n\,H = \frac{2.1}{1.008} = 2.08$, $nO = \frac{65.3}{16} = 4.08$, $\frac{32.6}{32.07} = 1.016$

$\frac{2.08}{1.016} = 2$, $\frac{4.08}{1.016} = 4$, $\frac{1.016}{1.016} = 1$

Empirical formula → H_2SO_4

44. Which of the following samples contains the greatest number of atoms?

a) 100 g of Pb
b) 2.0 mole of Ar
c) mole of Fe
d) 5 g of He

$n = \frac{m}{M} \times \frac{N}{N_A}$

① $N = \frac{m N_A}{M}$

② $N = n \times N_A$

(a) $N = \frac{100 \times 6.022 \times 10^{23}}{207.2} = 2.9 \times 10^{23}$

(b) $N = 2 \times 6.022 \times 10^{23} = 1.2 \times 10^{24}$

(c) $N = 1 \times 6.022 \times 10^{23} = 6.022 \times 10^{23}$

(d) $N = \frac{5 \times 6.022 \times 10^{23}}{4.003} = 7.5 \times 10^{23}$

45. Formaldehyde has the formula CH_2O. How many molecules are there in 0.11 g of formaldehyde?

a) $6.1 \quad 10^{-27}$ molecule
b) $3.7 \quad 10^{-3}$ molecule
c) $4 \quad 10^{21}$ molecule
d) $2.2 \quad 10^{21}$ molecule

$N = \frac{m N_A}{M}$

$= \frac{0.11 \times 6.022 \times 10^{23}}{30} = 2.2 \times 10^{21}$

46. Determine the number of moles of aluminum in 96.7 g of Al.

a) 0.279 mol
b) 3.58 mol
c) 7.43 mol
d) 4.21 mol

$$n = \frac{m}{M} = \frac{96.7}{26.98} = 3.58 \text{ mol}$$

47. How many sulfur atoms are present in 25.6 g of $Al_2(S_2O_3)_3$?

a) 0.393
b) $3.95 \ 10^{22}$
c) $7.90 \ 10^{22}$
d) $2.37 \ 10^{23}$

① $N = \frac{m \ N_A}{M} = \frac{25.6 \times 6.022 \times 10^{23}}{389.96} = 3.95 \times 10^{22}$ molecules

② 1 molecule $Al_2(S_2O_3)_3 \rightarrow$ 6 atom S

3.95×10^{22} molecule $\rightarrow$??

$= 2.37 \times 10^{23}$ atom S

48. What is the coefficient of H_2O when the following equation is properly balanced with the smallest set of whole numbers?

$$\_\_ Al_4C_3 + \underline{12} H_2O \quad \underline{4} Al(OH)_3 + \underline{3} CH_4$$

a) 3
b) 4
c) 6
d) 12

50. Which of the following equations is balanced?

A) $2C + O_2 \longrightarrow CO$ ×

B) $2CO + O_2 \longrightarrow 2CO_2$ ✓

C) $H_2 + Br_2 \longrightarrow HBr$ ×

D) $2K + H_2O \longrightarrow 2KOH + H_2$ ×

51. Determine the number of moles of aluminum in 96.7 g of Al

a) 0.279 mol
b) 3.58 mol
c) 7.43 mol
d) 4.21 mol

$$n = \frac{m}{M}$$

$$= \frac{96.7}{26.98} = 3.58 \text{ mol}$$