



chemistry 1

first exams

عندما تطمح في شيء وتسعى جادا في الحصول
عليه.. فإن العالم بأسره يكون في صفك
باولو كويلو

Date 19/11/2005

Chapter 1: Chemical Foundations

1. Perform the following calculations and give the answer rounded to the correct number of significant figures:

Look

$$\frac{15.415 - 14.515}{3.5} + 0.0402957$$

- a) 0.30 b) 0.300 c) 0.3000 d) 0.3 e) 0.2999
2. The average velocity of oxygen molecules, O_2 , at $1000^\circ C$ is 8.00×10^2 m/s. Calculate the velocity in km/h ($k=1000$, $1\text{ h}=60\text{ min}$, $1\text{ min}=60\text{ s}$).
- a) 2.16×10^3 b) 2.52×10^3 c) 2.88×10^3 d) 1.80×10^3 e) 1.44×10^3

3. The number of significant figures in the measurement 0.002090 is:
- a) 3 b) 4 c) 5 d) 6 e) 7

Chapter 2: Naming Simple Compounds

4. The correct name for the compound N_2O_5 is:
- a) Dinitrogen pentoxide b) Dinitrogen trioxide
c) Nitrogen oxide d) Dinitrogen monoxide
e) Dinitrogen tetroxide
5. The correct formula for the compound *Titanium(IV) nitrate* is:
- a) $TiNO_3$ b) $TiNO_2$ c) Ti_4NO_3
d) $Ti(NO_3)_4$ e) $Ti(NO_2)_4$

Chapter 3: Stoichiometry

6. How many moles of C atoms are present in 52.0 g of C_6H_6 ?
- a) 1.00 b) 2.00 c) 3.00 d) 4.00 e) 5.00

7. If 0.40 g sample containing C, O and H is burned in air to produce 0.53 g CO_2 . What is the mass percent of C in the sample? $C + O_2 \rightarrow CO_2$

- a) 21 b) 25 c) 30 d) 45 e) 36

8. How many molecules of water are produced when 0.600 mole of CH_4 react with excess O_2 ? Avogadro's number = 6.02×10^{23} .
 $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
- a) 3.61×10^{23} b) 4.82×10^{23} c) 7.22×10^{23}
d) 6.02×10^{23} e) 8.43×10^{23}
9. A 1.520 g sample of a compound containing only N and O is found to contain 1.06 g of oxygen. What is the empirical formula of the compound?
- a) NO b) N_2O c) N_2O_3 d) NO_2 e) N_2O_5
10. What is the mass of sulphur that is formed when 8.50 g of H_2S is reacted with 12.75 g of SO_2 according to the unbalanced equation?
 $\text{H}_2\text{S} + \text{SO}_2 \rightarrow \text{S} + \text{H}_2\text{O}$
(Molar Masses (g/mol) of H_2S =34.09, SO_2 =64.07. Atomic Mass of S=32.07).
- a) 7.76 b) 12.0 c) 10.6 d) 9.18 e) 13.4

Chapter 4: Chemical Reactions and Solution Stoichiometry

11. A 0.50 g sample of HF (Molar Mass= 20. g/mol) is dissolved in water to give 1.0×10^2 mL of solution. The molarity of this solution is:
- a) 0.20 b) 0.25 c) 0.50 d) 1.0 e) 2.0
12. What volume (in mL) of 18.0 M sulphuric acid must be used to prepare 10.0 L of 0.200 M aqueous H_2SO_4 solution?
- a) 278 b) 222 c) 167 d) 111 e) 55.6

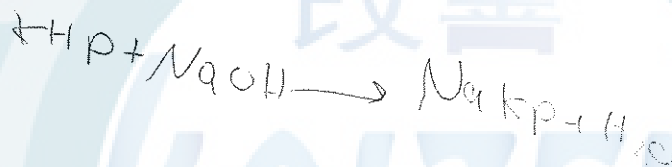
13. A 0.6000 g sample of a metal chloride (MCl_2) was dissolved in water and treated with excess aqueous silver nitrate. The silver chloride that formed weighed 1.286 g. Calculate the atomic mass of M.
(Atomic masses of Cl=35.50, Ag=108.0)



- a) 152.2 b) 96.38 c) 62.90 d) 40.59 e) 76.00

14. A student weighs out 0.528 g of KHP (Molar Mass=204 g/mol) and titrates to the equivalence point with 36.78 mL of NaOH solution. What is the molarity of the NaOH solution? KHP has one acidic hydrogen.

- a) 0.0911 b) 0.0784 c) 0.0757 d) 0.0730 e) 0.0704



Handwritten calculation:
$$\frac{0.528 \text{ g}}{204 \text{ g/mol}} = 0.002588 \text{ mol}$$
$$\frac{0.002588 \text{ mol}}{0.03678 \text{ L}} = 0.0704 \text{ M}$$

15. Balance the following oxidation reduction reaction in acidic medium.



From the **balanced** equation, determine the ratio: $\frac{\text{coefficient of } H_2O}{\text{coefficient of } NO_3^-}$

- a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{2}{1}$ d) $\frac{3}{1}$ e) $\frac{6}{1}$

Chapter 1: Chemical Foundations:

Question 1: $\frac{15.415 - 14.515}{3.5} + 0.0402957$

Strategy: [1] We subtract $(15.415 - 14.515) \Rightarrow$ The final answer should have 3 decimal places

[2] The answer obtained in [1] should be divided on 3.5, the answer of this step should be rounded to 2 significant figure.

[3] The answer obtained in part 2 should be added to 0.0402957. Should contain two decimal places.

Solution: $= \frac{0.900}{3.5} + 0.0402957 = 0.26 + 0.0402957$
 $= 0.247438557$
 ≈ 0.30 Choice [4]

Question 2: Using Factor Label method

$8.00 \times 10^2 \frac{\text{m}}{\text{s}} \longrightarrow ?? \frac{\text{km}}{\text{h}}$ using given equations and data.

$8.00 \times 10^2 \frac{\text{m}}{\text{s}} \times \frac{1 \text{ km}}{1000 \text{ m}} \times \frac{60 \text{ s}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ h}} = 2.88 \times 10^3 \frac{\text{km}}{\text{h}}$ choice [C]

Question 3: According to significant figures rules

$0.002090 = 4 \text{ significant figures}$ choice [b]
 Not sign. \nearrow Sign. $\uparrow\uparrow\uparrow\uparrow$

example: How many significant figures are in the following:

(a) 30.00 (b) 0.00004 (c) 30.05 (d) 0.105050

Answer:

(a) 4 significant figures (b) 1 significant figure (c) 4 significant figures (d) 6 significant figures.

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Chapter 2: Naming Simple Compounds:

Question 4: N_2O_5 is named according to the following analysis:

- Is N a nonmetal or metal?, is O metal or non metal? Both N & O are non metals.
- Count no. of atoms of N adding prefix indicating the no. of atoms present, the same thing is done for O.
- 2: means di- and 5: means penta.
- We start naming from Left \rightarrow Right writing the suitable prefix before atom name.

Dinitrogen Pentoxide \Rightarrow Dinitrogen Pentoxide. choice [a]

two vowels, should omit e.

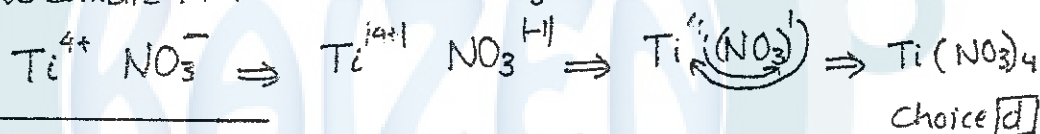
Question 5: Titanium (IV) nitrate.

Titanium: Ti

Nitrate: NO_3^-

but we have Ti^{4+} : 4+ comes from (IV)

\Rightarrow So, we combine the two ions, knowing that the total charge of compound = zero



choice [d]

Chapter 3: Stoichiometry

Question 6: Assume we decompose benzene (C_6H_6) into its constituents according to the following equation $C_6H_6 \rightarrow 6C + 6H_2$.

52.0g $\quad \quad \quad$?? mol.

$$\text{mass } C_6H_6 \rightarrow \text{mole } C_6H_6 \rightarrow \text{mol C}$$

$$52.0g \text{ } C_6H_6 \times \frac{1 \text{ mol } C_6H_6}{78.0g \text{ } C_6H_6} \times \frac{6 \text{ mol C}}{1 \text{ mol } C_6H_6}$$

= 4.00 mol C present. Choice [d]

Molar mass $C_6H_6 =$

$$(12) \times 6 + 6(1)$$

$$= 78.0g \text{ mol}^{-1}$$

Question 7: Sample weight = 0.40g, when it is burned, it produced 0.53g CO_2 .



$$\text{mass } CO_2 \rightarrow \text{mol } CO_2 \rightarrow \text{mol C} \rightarrow \text{mass C}$$

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Continuation of question [7]:

$$0.53 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44.0 \text{ g CO}_2} \times \frac{1 \text{ mol C}}{1 \text{ mol CO}_2} \times \frac{12.0 \text{ g C}}{1 \text{ mol C}} = 0.144 \text{ g C.}$$

$$\text{Mass Percent of X atom} = \frac{\text{mass of X produced}}{\text{mass of compound/sample that contain X element}} \times 100\%$$

$$= \frac{0.14 \text{ g}}{0.40} \times 100\% = 36\% \quad \text{Choice [e]}$$

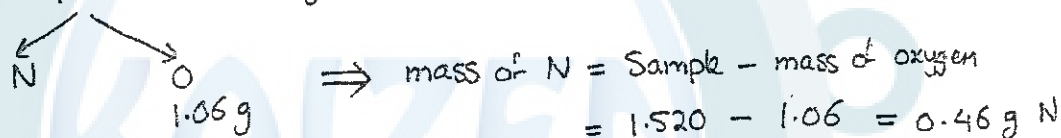
Question [8]: According to the balanced equation

Strategy: mole CH₄ \longrightarrow mole H₂O \longrightarrow molecules H₂O

$$0.600 \text{ mol CH}_4 \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol CH}_4} \times \frac{6.02 \times 10^{23} \text{ molecule H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 7.22 \times 10^{23} \text{ molecule H}_2\text{O}$$

Choice [c]

Question [9]: Sample mass = 1.520 g.



Now, I order to write the empirical formula, we should calculate no. of moles of N and O.

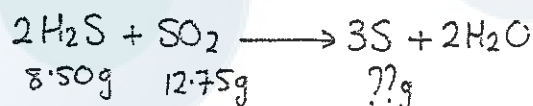
$$\text{moles N: } 0.46 \text{ g N} \times \frac{1 \text{ mol N}}{14.0 \text{ g N}} = 0.033 \text{ mol N.}$$

$$\text{moles O: } 1.06 \text{ g O} \times \frac{1 \text{ mol O}}{16.0 \text{ g O}} = 0.066 \text{ mol O.}$$

$$\text{N}_{0.033} \text{O}_{0.066} \Rightarrow \text{Divide on } 0.033$$

$$\Rightarrow \text{NO}_2 \quad \text{Choice [d]}$$

Question [10]: We have to balance the equation to start the calculation process



Strategy: We have to specify the limiting reactant, then

$$\text{mass} \longrightarrow \text{moles} \longrightarrow \text{moles of S} \longrightarrow \text{mass of S.}$$

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Detailed Answers For The (1st Hour Exam) Of (Chemistry 101)

Date of Exam: 19/11/2005.

Page 4.

Continuation of question [10] :

$$8.50 \text{ g H}_2\text{S} \times \frac{1 \text{ mol H}_2\text{S}}{34.09 \text{ g H}_2\text{S}} = 0.249 \text{ mol H}_2\text{S}.$$

$$12.75 \text{ g SO}_2 \times \frac{1 \text{ mol SO}_2}{64.07 \text{ g SO}_2} = 0.199 \text{ mol SO}_2.$$

The balanced Chemical Equation says that each 2 mol H₂S $\xrightarrow[\text{with}]{\text{react}}$ 1 mol SO₂

But we have actually in our reaction $0.249 \text{ mol H}_2\text{S} \longrightarrow X$

$$\Rightarrow 2x = 0.249 \Rightarrow x = 0.125 \text{ mol SO}_2$$

But we have 0.199 SO₂, this means that $0.199 \text{ mol} - 0.125 \text{ mol} = 0.075 \text{ mol}$

will be in excess, So, the limiting reactant is H₂S.

Now;

mass H₂S \longrightarrow moles H₂S \longrightarrow moles S \longrightarrow mass S.

$$0.249 \text{ mol H}_2\text{S} \times \frac{3 \text{ mol S}}{2 \text{ mol H}_2\text{S}} \times \frac{32.07 \text{ g S}}{1 \text{ mol S}} = 12.0 \text{ g S}$$

Choice [b]

Chapter 4: Chemical Reactions and Solution Stoichiometry :

Question [11] :

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{Liters of solution}} = \frac{(\text{mass/molar mass})}{\text{liters of solution}} = \frac{(0.50 \text{ g} / 20. \text{ g mol}^{-1})}{1.0 \times 10^2 \times 10^{-3} \text{ L}}$$

$$= 0.25 \text{ mol/L} = 0.25 \text{ M HF choice [b]}$$

Note: 1000 mL = 1L

Question [12] : According to the law of conservation of matter, so no. of moles of solute in certain solution keeps constant even though the volume of solution is changed.

So,

No. of moles before dilution = No. of moles after dilution

$$\text{MOLARITY}_1 \times \text{VOLUME}_1 = \text{MOLARITY}_2 \times \text{VOLUME}_2$$

$$M_1 = 18.0 \text{ M} \quad U_1 = ??$$

$$M_2 = 0.200 \text{ M} \quad U_2 = 10.0 \text{ L}$$

According to the law:

$$M_1 U_1 = M_2 U_2 \Rightarrow 18.0 \times U_1 = 0.200 \times 10.0 \text{ L}$$

$$\Rightarrow U_1 = \frac{0.200 \times 10.0 \text{ L}}{18.0} = 0.111 \text{ L} \Rightarrow 111 \text{ mL choice [d]}$$

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Question [13]: The balanced equation is



Strategy: mass AgCl \longrightarrow mole AgCl \longrightarrow mole MCl₂.

$$\text{then moles MCl}_2 = \frac{\text{mass MCl}_2}{\text{molar mass MCl}_2}$$

$$\text{molar mass of MCl}_2 = 1 \times M + 2(\text{Cl}) = M + 71$$

Now:

$$1.286 \text{ g AgCl} \times \frac{1 \text{ mol AgCl}}{143.5 \text{ g AgCl}} \times \frac{1 \text{ mol MCl}_2}{2 \text{ mol AgCl}} = 4.481 \times 10^{-3} \text{ mol MCl}_2$$

$$\text{molar mass of MCl}_2 = \frac{\text{mass MCl}_2}{\text{mole MCl}_2}$$

$$\Rightarrow M + 71 = \frac{1.286 \text{ g}}{4.481 \times 10^{-3} \text{ mol}} \Rightarrow M + 71 = 133.9$$

$$\Rightarrow M = 133.9 - 71.0 = 62.9 \text{ g mol}^{-1} \text{ choice [C]}$$

Question [14]: For Simplicity:



This means 1 mol of KHP (acid) reacts with 1 mol NaOH.

$$\text{No. of moles of KHP} = (\text{mass} / \text{molar mass})$$

$$\Rightarrow \text{moles KHP} = 0.528 \text{ g} / 204 \text{ g mol}^{-1} = 2.59 \times 10^{-3} \text{ mol KHP}$$

moles KHP \longrightarrow mol NaOH ; then we calculate the molarity .

$$2.59 \times 10^{-3} \text{ mol KHP} \times \frac{1 \text{ mol NaOH}}{1 \text{ mol KHP}} = 2.59 \times 10^{-3} \text{ mol NaOH.}$$

Now;

$$\text{Molarity} = \frac{\text{moles of NaOH}}{\text{volume of Solution (L)}} = \frac{2.59 \times 10^{-3} \text{ mol}}{36.78 \times 10^{-3} \text{ L}} = 0.0704 \text{ M}$$

Choice [e]

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Question [15] : Balance the following reaction in acidic medium :



1) balance each atom except for O, H



2) balance the oxygen by adding H₂O molecule instead of each O to the side which has lower no. of oxygen atoms.



3) balance the hydrogen by adding H⁺ ion instead of each H to side which has lower no. of H atoms.



4) Add No. of electrons the side which is more positive to equalize the less positive side



5) Cancel the electrons in each half reaction, even though we need to multiply 1 or 2 halves by a factor.



1)



2)



3)



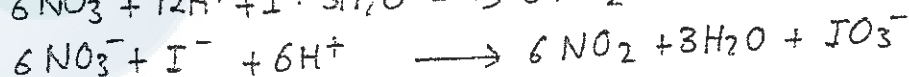
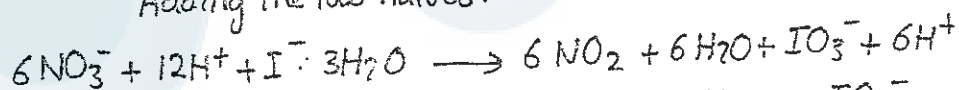
4)



5)



Adding the two halves.



$$\frac{\text{coefficient of H}_2\text{O}}{\text{coefficient of NO}_3^-} = \frac{3}{6} = \frac{1}{2} \quad \text{Choice [a]}$$

مع جزاك الله
مباركاً

The End of Exam

GOOD LUCK

طريق التميز
الكيمياء (1)

12

Name: Reg. No.:
Instructor Name: جواد الخليلي Seat No.: ...67.....
N = 6.022x10²³, H = 1.00, N = 14.0, O = 16.0, C = 12.0, Fe = 55.85
Mn = 54.94, Cl = 35.45, Ag = 107.9, Ca = 40.08

ANSWER SHEET الاجابة الصحيحة

1. a b c d ~~e~~ 9. a b c d ~~e~~
2. a b ~~c~~ d e 10. a ~~b~~ c d e
3. ~~a~~ b c d e 11. ~~a~~ b c d e
4. a b c d e 12. a b c d e
5. a b c d e 13. ~~a~~ b c d e
6. a b c d e 14. a b c d e
7. a b c d e 15. a b c d e
8. a b c d e 16. a b c ~~d~~ e

GOOD LUCK

Date: 14/11/2009

Reg. No.

Seat No.51.....

Use the following information: Atomic mass (amu): H = 1.00; C = 12.0; O = 16.0; S = 32.0; Al = 27.0; N = 14.0; Na = 23.0; Avogadro's no. = 6.022×10^{23} ; $^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times (5/9)$.

#####

ANSWER SHEET

- | | | | | | | | | | | | |
|----|--------------|--------------|---|--------------|--------------|-----|--------------|--------------|--------------|---|--------------|
| 1. | a | b | c | d | a | a | b | c | d | e | |
| 2. | a | b | c | d | e | 10. | a | b | c | d | e |
| 3. | a | b | c | d | e | 11. | a | b | c | d | e |
| 4. | a | b | c | d | e | 12. | a | b | c | d | e |
| 5. | a | b | c | d | e | 13. | a | b | c | d | e |
| 6. | a | b | c | d | e | 14. | a | b | c | d | e |
| 7. | a | b | c | d | e | 15. | a | b | c | d | e |
| 8. | a | b | c | d | e | 16. | a | b | c | d | e |

^{35}Cl

$100 - y$

$34,968$

^{37}Cl

y

$36,956$

$$35,46 = \frac{y}{100} \times 36,956 + \frac{(100-y)}{100} \times 34,968$$

$$35,46 = 0,36956y + 34,968 - 0,34968y$$

$$0,492 =$$



2Sb
2Sb
6F
6F

6+6

改善

KAIZEN
TEAM

1- Perform the following calculation and give the answer rounded to the correct number of significant figures.

$$\frac{6.12 + 5.50}{33.7 / 23.95} = \frac{11.62}{1.41} = 8.24$$

33.7 / 23.95 = 1.41

$$6.12 + 5.50 = 11.62$$

$$33.7 / 23.95 = 1.41$$

e 1.41

2- Convert $(-10)^{\circ}\text{C}$ to Fahrenheit scale of temperature.

a- 50

b- 23.3

c- 12.2

d 14

e- 32.3

$$-10^{\circ}\text{C} \times \frac{9^{\circ}\text{F}}{5^{\circ}\text{C}} + 32 = -18^{\circ}\text{F} + 32 = 14^{\circ}\text{F}$$

3- The atomic mass of ^{35}Cl and ^{37}Cl are 34.968 amu and 36.956 amu, respectively. Calculate the natural abundance of ^{37}Cl . Given that the average atomic mass of Cl is 35.46 amu.

a- 98.61%

b 24.75 %

c- 1.39%

d- 75.25%

e- 51.65%

75 25

$$\begin{matrix} 35 & 37 \\ \text{C} & \text{C} \\ 100 & 0 \\ 34.968 & 36.956 \end{matrix}$$

$$35.46 = \frac{y}{100} \times 36.956 + \frac{(100-y)}{100} \times 34.968$$

$$3546 = 0.36956y + 3496.8 - 0.34968y$$

$$0.01988y = 49.2$$

$$y = 24.75$$

4- After balancing the following reaction,



The ratio (x / y) is equal to

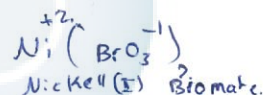
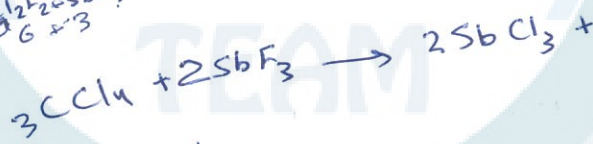
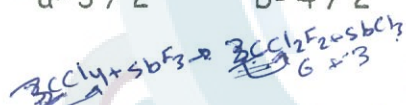
a- 3 / 2

b- 4 / 2

c- 2 / 2

d- 6 / 2

e 3 / 3



5- The correct name for $\text{Ni}(\text{BrO}_3)_2$ is: (Ni is a transition metal element)

a Nickel (II) bromate

b- Nickel (II) hypobromite

c- Nickel (II) perbromate

d- Nickel (IV) bromite

e- Nickel (II) hypobromite

6- The correct name for SO_3 is

a- Sulfur monoxide

b Sulfur trioxide

c- Sulfur (IV) oxide

d- Sulfur dioxide

e- Sulfur oxide

S → atoms ?!

9.96 mg Na_2SO_3
 126.05
 ,00996

$$,00996 \text{ g} \times \frac{1 \text{ mole}}{126.05 \text{ g}} \times \frac{1 \text{ mole}}{1 \text{ mole}} \times \frac{6.022 \times 10^{23}}{1 \text{ mole}}$$

1,475 $\times 10^{20}$



14x

$$4.50 \text{ g} \times \frac{1 \text{ mole}}{30 \text{ g}} \times \frac{3}{1 \text{ mole NO}} \times \frac{46}{1 \text{ mole}}$$

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$$50.0 \text{ g} \times \frac{1 \text{ mole N}_2\text{O}_4}{92.02} \times \frac{3 \text{ N}_2}{1 \text{ mole N}_2\text{O}_4} = \underline{1.63} \text{ mole}$$

N_2O_4

$$45.0 \times \frac{\text{mole}}{32.05 \text{ g}} \times \frac{3}{2} = 2.1$$

N_2O_4

$$\text{not } \text{N}_2 \times \frac{1.63 \text{ mole N}_2 \times 28}{1 \text{ mole}}$$

- 7- How many sulfur atoms are contained in 9.96 mg (milligram) of Na_2SO_3 ? The molar mass of Na_2SO_3 is 126.05 g/mol.
- Avogadro.*
- $$9.96 \text{ mg} \times \frac{1 \times 10^{-3} \text{ g}}{1 \text{ mg}} \times \frac{1 \text{ mole } \text{Na}_2\text{SO}_3}{126.05 \text{ g } \text{Na}_2\text{SO}_3} \times \frac{1 \text{ mole S}}{1 \text{ mole } \text{Na}_2\text{SO}_3} \times \frac{6.02 \times 10^{23}}{1 \text{ mole}}$$

- a- 4.76×10^{19} b- 4.76×10^{20} c- 9.51×10^{23} d- 1.05×10^{21} e- 9.52×10^{20}

- 8- The mass percent of oxygen in $\text{Al}_2(\text{SO}_4)_3$ is equal to
- a- 28.1% b- 9.37% c- 42.7% d- 21.4% e- 56.1%
- $\text{Al}_2 \times 2 + (5 \times 4)$
 $\frac{12 \times 16}{5 \times 32} = \frac{32}{16} = 2$
 $2 \times 2 = 4$

- 9- The empirical formula for a compound that contains 25.00% C, 8.33% H and 66.67% O is

- a- $\text{C}_2\text{H}_6\text{O}$ b- CHO c- $\text{C}_4\text{H}_{13}\text{O}_2$ d- CH_4O_2 e- CH_3O
- C: $25.00 \times \frac{1}{12} = 2.08$
H: $8.33 \times \frac{1}{1} = 8.33$
O: $66.67 \times \frac{1}{16} = 4.17$
- C: H: O
2.08 8.33 4.17
① 4: 2
 $\text{C}_4\text{H}_8\text{O}_2$
O: 16
N: 14

- 10- Consider the following balanced reaction. How many grams of NO_2 are required to form 4.50 g of $\text{NO}_{(g)}$? Assume that there is excess water present.



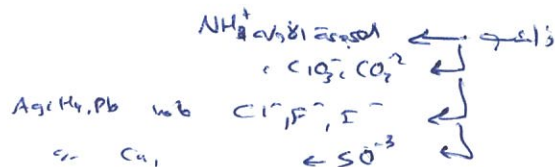
- a- 38.0 g b- 69.0 g c- 20.7 g d- 10.9 g e- 26.5 g

- 11- Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be produced from the reaction of 50.0 N_2O_4 with 45.0g N_2H_4 assuming 100% yield. The molar masses are as follows: $\text{N}_2\text{O}_4 = 92.02\text{g/mol}$, $\text{N}_2\text{H}_4 = 32.05\text{g/mol}$.

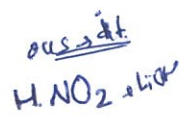
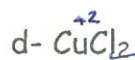
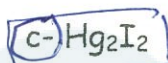


- a- LR is N_2O_4 , 105 g N_2 formed b- LR is N_2O_4 , 45.7 g N_2 formed
c- LR is N_2H_4 , 59.0 g N_2 formed d- LR is N_2H_4 , 13.3 g N_2 formed
e- Both reactants are in appropriate stoichiometric ratios and 45.0 g N_2 formed

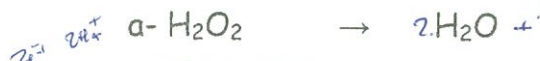
~~N_2O_4~~ $50 \text{ N}_2\text{O}_4 \times \frac{1 \text{ mole}}{92.02 \text{ g}} \times \frac{3 \text{ mole } \text{N}_2}{1 \text{ mole}} = \underline{1.6}$
 $45 \text{ N}_2\text{H}_4 \times \frac{1 \text{ mole}}{32.05 \text{ g}} \times \frac{3}{2} = \underline{2.1}$



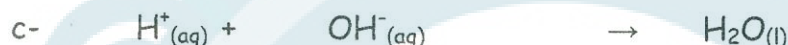
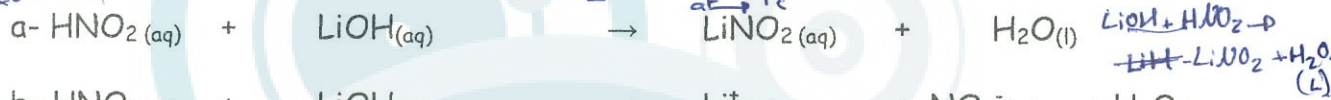
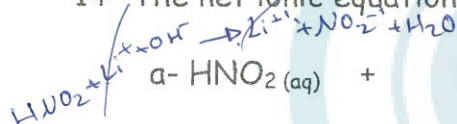
12- All of the following compounds are soluble in water **except**



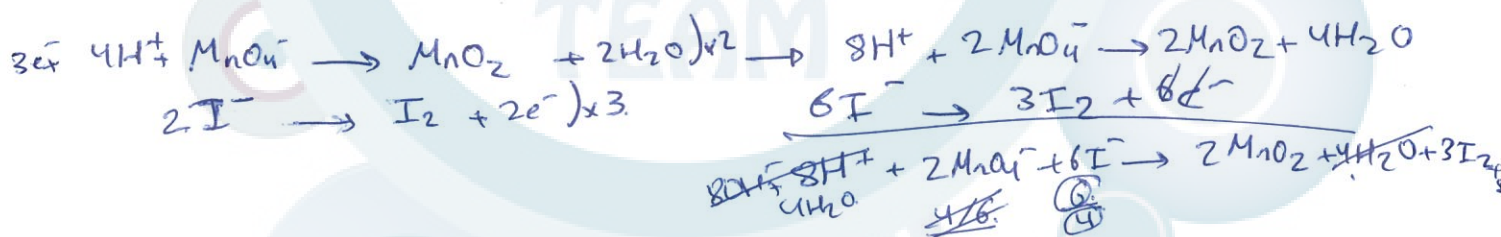
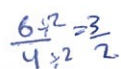
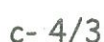
13- Which of the following conversions involves **oxidation**



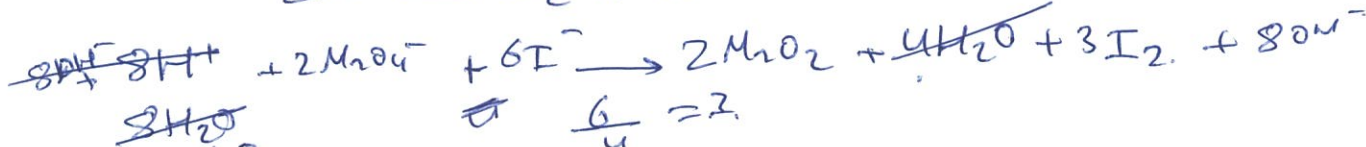
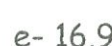
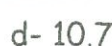
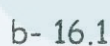
14- The net ionic equation for the reaction of **nitrous acid** with **lithium hydroxide** is



15- After balancing the following chemical reaction is in **Basic solution**, the correct ratio of ($\text{I}^- / \text{H}_2\text{O}$) is



16- The volume in milliliters (ml) of 0.675 M NaOH required to neutralize 35.0 ml of 0.145 M H_3PO_4 is equal to?



Date: 3/11/2007

Time: 70 min.

Student Name:

Reg. No.: 0072901.....

Instructor's Name: ...

Section: ...

Seat No.:

Answer Sheet1- a ~~b~~ ~~c~~ d e 11- a b c ~~d~~ e2- a b ~~c~~ d ~~e~~ 12- ~~a~~ ~~b~~ c d e3- a b c d ~~e~~ 13- a b ~~c~~ d ~~e~~4- a b c ~~d~~ e 14- a b c ~~d~~ e5- a b ~~c~~ d e 15- ~~a~~ b ~~c~~ d e6- ~~a~~ ~~b~~ c d e 16- a b ~~c~~ ~~d~~ e7- ~~a~~ ~~b~~ c d ~~e~~ 17- ~~a~~ b c d e8- a b c ~~d~~ e 18- a b c ~~d~~ ~~e~~ ✓9- a ~~b~~ c d e 19- ~~a~~ b c d e10- a b ~~c~~ d e 20- a b c ~~d~~ ~~e~~ ✓

Answer each of the following questions and put "X" on the correct choice on front page.

1. Perform the following calculation and give the answer rounded to the correct number of significant figures.

$$(24.562 - 24.062) \times 12.40$$

- a) 6.2000 b) 6.20 ~~c) 6.2~~ d) 6 e) 6.200

2. A spherical tank has a radius of 341 cm. Calculate its volume in gallons.

Given: $V_{\text{sphere}} = \frac{4}{3} \pi r^3$, one gallon = 277 in³, one in = 2.54 cm, $\pi = 3.142$.

- a) 2.05×10^4 b) 5.10×10^4 c) 3.66×10^4 d) 6.49×10^4 ~~e) 1.29×10^4~~

3. Which of the following changes is a physical change ?

- a) Sucrose is converted into ethanol.
b) Steel wool (Fe) was burned in air to produce iron oxide.
c) Calcium carbonate gives a gas when added to HCl.
d) Hydrogen sulfide is produced from zinc sulfide and HCl.
~~e) $\text{H}_2\text{O}_{(l)}$ is converted into vapor.~~

4. The temperature of an object is -22.0°F . Convert this to K.

- a) 232 b) 238 c) 227 ~~d) 243~~ e) 382

5. Given the following data for a sample of magnesium:

Isotope	Mass (amu)	Fractional abundance
^{24}Mg	23.9850	0.5841
^{25}Mg	24.9858	0.1000
^{26}Mg	25.9826	0.3159

Calculate the average atomic mass (atomic weight) of magnesium(in amu).

- a) 24.72 b) 24.30 ~~c) 24.80~~ d) 24.64 e) 24.44

6. Choose the correct name of the acid corresponding to the BrO_2^- oxoanion.

- a) hypobromous acid b) bromous acid c) hypobromic acid
d) bromic acid e) perbromic acid

7. Choose the correct name for CoBr_2 .

- ~~a) cobalt dibromide~~ b) dibromo cobalt c) cobalt bromide
d) cobalt(I) bromide ~~e) cobalt(II) bromide~~ ✓

8. Write the formula of tetraphosphorous trisulfide

- a) $\text{P}_2(\text{SO}_3)_4$ b) P_4S_4 c) PS_4 ~~d) P_4S_3~~ e) S_3P_4

9. Calculate the number of moles of CO_2 in 0.400 g CO_2 .

Atomic weights: C = 12.0 ; O = 16.0.

- a) 6.82×10^{-3} ~~b) 9.09×10^{-3}~~ c) 4.55×10^{-3}
d) 5.68×10^{-3} e) 7.95×10^{-3}

10. Calculate the mass percent of O in calcium phosphite, $\text{Ca}_3(\text{PO}_3)_2$.
(molar masses (g/mol): Ca = 40.1; P = 31.0 and O = 16.0, $\text{Ca}_3(\text{PO}_3)_2 = 278.3$)

- a) 34.5 b) 41.3 c) 72.8 d) 49.0 e) 56.1

11. Calculate the mass of one HNO_3 molecule.

(Atomic weights : $\text{H} = 1.0$; $\text{N} = 14.0$ and $\text{O} = 16.0$,

N (Avogadro's number = 6.02×10^{23})

- ~~a)~~ $3.82 \times 10^{-23} \text{ g}$ b) $7.81 \times 10^{-23} \text{ g}$ ~~c)~~ $1.40 \times 10^{-22} \text{ g}$
d) $1.05 \times 10^{-22} \text{ g}$ e) $1.36 \times 10^{-22} \text{ g}$

$$\frac{100 - 40.3}{35.5} = 1.61$$

12. A compound containing only chlorine and oxygen is 40.3 % oxygen by mass. What is the empirical formula of the compound?

(Atomic weights: $\text{Cl} = 35.5$, $\text{O} = 16.0$)

- ~~a)~~ Cl_2O b) Cl_2O_3 ~~c)~~ Cl_2O_5 d) Cl_2O_7 e) ClO_3

$$\frac{40.3}{16.0} = 2.518$$

13. Consider the unbalanced reaction:

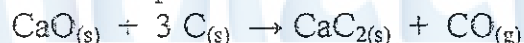


Calculate the mass (in g) of Al_2O_3 produced from the reaction mixture of 16.2 g Al with excess amount of oxygen.

(Molar masses (g/mol): $\text{Al} = 27.0$; $\text{O} = 16.0$)

- a) 15.3 b) 20.4 g ~~c)~~ 8.42 d) 25.5 e) 30.6

14. Consider the balanced equation:

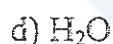
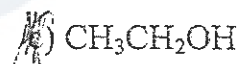
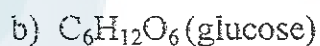


When a mixture of 5.61 g of CaO and 4.80 g of C was allowed to react, 4.49 g of CaC_2 were produced. Calculate the % yield of CaC_2 .

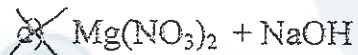
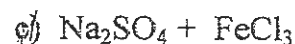
(Molar masses (g/mol): $\text{CaO} = 56.1$, $\text{C} = 12.0$; $\text{CaC}_2 = 64.1$)

- a) 80.0% b) 60.1% c) 70.0% ~~d)~~ 90.0% e) 39.9%

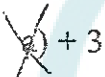
15. Which of the following compounds is a strong electrolyte?



16. Which of the following pairs of aqueous solutions produces a precipitate when mixed?



17. What is the oxidation number of P in $\text{Ca}_3(\text{PO}_3)_2$



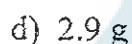
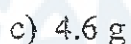
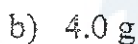
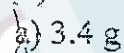
18. Balance the following redox reaction in acidic solution.



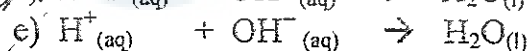
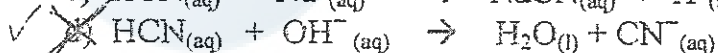
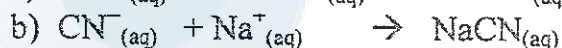
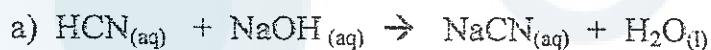
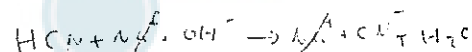
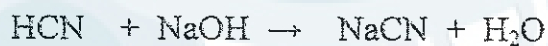
The ratio of coefficients of $\text{Br}^- / \text{H}_2\text{O}$ in the balanced equation is:



19. Calculate the mass of AgCl produced from the reaction of 120.0 mL of 0.20 M AgNO_3 and 120.0 mL of 0.15 M CaCl_2 solutions. (Atomic weights: $\text{Ag} = 107.9$; $\text{Cl} = 35.5$)



20. The net ionic equation for the following reaction is:



Question (1):

$$(24.562 - 24.062) \times 12.40$$

Here, we must proceed step by step. We start with the operation inside the parenthesis, then, we continue. You remember the rules of significant figures, which are summarized as the following:

1. All nonzeros are always significant figures.
2. Leading zeros are never significant figures.
3. Captive zeros are always significant figures.
4. Trailing zeros are significant in the presence of decimal point.
5. Exact no. limits the no. of significant figures in calculation.

انظر كتاب طريق التميز في الكيمياء (1) ص ٢٣

Now, when we subtract two numbers, we have to count no. of decimal places, as shown below:

$$\begin{array}{r} 24.562 - 24.062 = 0.500 \\ \uparrow \quad \quad \uparrow \quad \quad \uparrow \\ 3 \text{ decimal places} \end{array}$$

Then, we multiply the previous answer with 12.40, as shown below:

$$\begin{array}{cc} 0.500 \times 12.40 \\ 3 \text{ Significant Figures} & 4 \text{ Significant Figures} \end{array}$$

للمزيد انظر القواعد الموضحة والمفصلة في كتاب طريق التميز، الطبعة الاولى ص ٢٥

Finally, the answer should be rounded to three significant figures.

$$6.2 \xrightarrow[\text{to}]{\text{corrected}} \boxed{6.20} \text{ 3 Significant Figures Choice [b].}$$

COMMENT:

There is another solution; There is no need to perform the mathematical operation, because we can pick up the answer that contains 3 significant figures.

Question (2):

$$\text{radius} = 341 \text{ cm}, V_{\text{sphere}} = (4/3)\pi r^3, \text{ one gallon} = 277 \text{ in}^3$$

$$U = ?? \text{ (gallons).} \quad \text{one inch} = 2.54 \text{ cm}, \pi = 3.142$$

In order to calculate the volume (gallons), we have to use the radius in (in³)

So, we can convert the radius as shown below:

$$\text{cm} \longrightarrow \text{in} \longrightarrow \text{in}^3 \longrightarrow \text{gallon}$$

الأستاذ: إبراهيم ذياب

مؤلفاته: طريق التميز في الكيمياء (1) طريق التميز في الكيمياء العضوية

لندروس التفويضة: 0799888058 - 0788820609

Continued Question (2) :

$$341 \text{ cm} \times \frac{1 \text{ in}}{2.54 \text{ cm}} = 134.2519685 \text{ in}$$

Now, the volume is calculated using the previous law:

$$V_{\text{sphere}} = \frac{4}{3} \pi r^3 = \frac{4}{3} (3.142) (134.2519685 \text{ in})^3 \\ = 10136940.67 \text{ in}^3 = 10.13694067 \times 10^6 \text{ in}^3$$

$$10.13694067 \times 10^6 \text{ in}^3 \times \frac{1 \text{ gallon}}{277 \text{ in}^3} = 3.659545366 \times 10^4 \text{ gallon}$$

$$\xrightarrow[\text{to}]{\text{corrected}} 3.66 \times 10^4 \text{ gallon. Choice [C]}$$

بما مكانك المشرق على التميز في الامتحان والامتحانات فيما يتلوه بطرق التحول من ذلك
دراسات كتاب طريق التميز في الكيمياء (1) ، الطبعة الاولى ، ص 11 ، 10 ، 9 ، 8 ، 7 ، 6 ، 5 ، 4 ، 3 ، 2 ، 1 .

Question (3) :

All statements shown in question (3) represent a chemical change or chemical reaction except for choice (e) which represents a physical change.

Choice [E]

بما مكانك المشرق على المشرق بين التميز في الكيمياء (Chemical change) والتغير الفيزيائي من
بذلك دراسات كتاب طريق التميز في الكيمياء (1) ، الطبعة الاولى ، ص 11 ، 10 ، 9 ، 8 ، 7 ، 6 ، 5 ، 4 ، 3 ، 2 ، 1 .

Question (4) :

$$T(^{\circ}\text{F}) = -22.0^{\circ}\text{F} ; T(\text{K}) = ??$$

First of all, we have to convert the temperature from ($^{\circ}\text{F}$) into ($^{\circ}\text{C}$),
using $T(^{\circ}\text{C}) = T(^{\circ}\text{F}) - 32^{\circ}\text{F} \times \frac{5^{\circ}\text{C}}{9^{\circ}\text{F}}$ 1.7 ← طريق التميز ص 17

Then, we convert the temperature from ($^{\circ}\text{C}$) in (K) using:

$$T(\text{K}) = T(^{\circ}\text{C}) + 273 \text{ 1.4} \quad \leftarrow \text{طريق التميز ص 17}$$

الأستاذ : إبراهيم ذياب

مؤلفاته : طريق التميز في الكيمياء (1) طريق التميز في الكيمياء العضوية

للدروس والتقوية : 0799888058 - 0788820609

Continued of Question (4):

So;

$$T(^{\circ}\text{C}) = -22.0^{\circ}\text{F} - 32^{\circ}\text{F} \times \frac{5^{\circ}\text{C}}{9^{\circ}\text{F}} = -54.0^{\circ}\text{F} \times \frac{5^{\circ}\text{C}}{9^{\circ}\text{F}} = -30.0^{\circ}\text{C}$$

Then:

$$T(\text{K}) = -30 + 273 = 243 \text{ K.}$$

Choice **d**

Question (5):

We can calculate the average atomic mass of magnesium (in amu) using the following law:

$$\begin{aligned} \text{Average atomic mass of certain element (magnesium)} &= \left(\text{mass of 1st isotope } (^{24}\text{Mg}) \times \text{Fractional Abundance} \right) + \left(\text{mass of 2nd isotope } (^{25}\text{Mg}) \times \text{Fractional Abundance} \right) \\ &+ \left(\text{mass of 3rd isotope } (^{26}\text{Mg}) \times \text{Fractional Abundance} \right) + \dots \end{aligned}$$

طريق التميز ص ٤٤ [2.2]

Then:

$$\begin{aligned} \text{Average atomic mass of Mg} &= (23.9850 \text{ amu} \times 0.5841) + (24.9858 \text{ amu} \times 0.1000) \\ &+ (25.9826 \text{ amu} \times 0.3159) = 24.71612184 \xrightarrow{\text{rounded and corrected to}} \end{aligned}$$

24.72 Choice **a**

بإمكانك حساب الكتلة الذرية المتوسطة للذرات من خلال معرفة النسب المئوية لعدد ذرات كل نظير (الجدول ١) ص ٤٣-٤٥

Question (6):

BrO_2^- has an acid formula of HBrO_2 .

(Bromite, BrO_2^-)

Oxoacids are named by taking the root of anion followed by -ic or -ous. Then followed by the word acid.

Here, we will choose the suffix (-ous), because the common ion takes the suffix (-ic), BrO_3^- (bromate). Or
ate \rightarrow ic
ite \rightarrow ous

الأستاذ: إبراهيم ذياب

مؤلفاته: طريق التميز في الكيمياء (١) طريق التميز في الكيمياء العضوية

لدروس التقوية: 0799888058 - 0788820609

Continued of Question (6):

So, the correct name is: bromous acid

choice [b]

انظر موضوع تسمية الحموض في كتاب طريق التميز في الكيمياء (1) ص ٧٤، ٧٥، ٧٦.

Question (7):

The name of $\text{CoBr}_2 = ??$

First of all, Co is transition metal element, Therefore, this type (type II in route of excellence in Chemistry (1)) requires a Roman numeral specifies the charge of the cation. And because the no. of atoms is not equivalent, we can guess the charges as shown below:



Therefore:

Metal (Roman Numeral) Anion

Cobalt (II) bromide

choice (e)

انظر موضوع تسمية المركبات بشرح مفصل وسهل مع عدد كبير من الامثلة في كتاب طريق التميز في الكيمياء (1) ص ٥٩ - ٦٨.

Question (8):

Tetraphosphorus trisulfide: ??

Tetra means 4, and tri means 3, therefore the formula is P_4S_3

choice [a]

انظر موضوع ايجاد الصيغ الكيميائية من أسماء المركبات في كتاب طريق التميز في الكيمياء (1) CHAPTER (2)

Question (9):

mass of $\text{CO}_2 = 0.400 \text{ g CO}_2$; Atomic Weight C = 12.0 amu, 16.0 amu = O
moles of $\text{CO}_2 = ??$

Formula

Weight $\text{CO}_2 = 12 + 2(16) = 44.0 \text{ amu} \Rightarrow \text{molar mass} = 44.0 \text{ g/mol}$

Then

moles = mass / molar mass

... 3.4 @ Page 94 (Route of Excellence in CHEMISTRY (1))

الأستاذ: إبراهيم ذياب

مؤلفاته: طريق التميز في الكيمياء (1) طريق التميز في الكيمياء العضوية

للدروس والتقوية: 0799888058 - 0788820609

Continued 8E Question (9):

Then :

$$\text{moles CO}_2 = \frac{0.400 \text{ g CO}_2}{44.0 \text{ g/mol}} = 0.0090909 \longrightarrow 9.09 \times 10^{-3} \text{ mole CO}_2.$$

Choice [b]

Another solution:

$$0.400 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44.0 \text{ g CO}_2} = 9.09 \times 10^{-3} \text{ mol CO}_2$$

انتظر موضوع المسؤل في كتاب طريق التميز في الكيمياء (1) ص (19-47).
هناك مجموعة كبيرة من الانكار المتعددة والمائل ...

Question (10):

$$\text{mass percent of O in } = ? \quad \text{molar mass (g/mol)} \rightarrow \begin{matrix} \text{Ca} & \text{P} & \text{O} \\ 40.1 & 31.0 & 16.0 \end{matrix}$$



$$\rightarrow \text{Ca}_3(\text{PO}_3)_2 = 278.3$$

$$\% \text{ O} = \frac{\text{no. of Oxygen atoms} \times \text{molar mass of O}}{\text{molar mass of Ca}_3(\text{PO}_3)_2} \times 100\%$$

القانون الأساسي ... [3.6]

Route of Excellence
in Chemistry (I)
1st Edition, Page 99.

Then

$$\% \text{ O} = \frac{8 \times 16.0 \text{ g}}{278.3 \text{ g}} \times 100\% = 34.49514912\% = 34.5\%$$

Choice [a]

Question (11):

the mass of one HNO_3 molecule is ?? (g).

We have to find the weight using (amu), then we can convert it to (g).

$$\begin{aligned} \text{Formula weight of HNO}_3 &= 1(\text{H}) + 1(\text{N}) + 3(\text{O}) \\ &= 1(1.0) + 1(14.0) + 3(16.0) = 63.0 \text{ amu/molecule.} \end{aligned}$$

الأستاذ : إبراهيم ذياب

مؤلفاته : طريق التميز في الكيمياء (1) طريق التميز في الكيمياء العضوية

للدروس والتقوية : 0799388058 - 0788820609

Continue : Question 11:

Then: we know that $1 \text{ g} = 6.022 \times 10^{23} \text{ amu}$ [3.1] Route of Excellence
in CHEMISTRY (1)

Page 90 , 1st edition.

Therefore:

$$\frac{63.0 \text{ amu}}{\text{molecule}} \times \frac{1 \text{ g}}{6.022 \times 10^{23} \text{ amu}} = 1.0461640 \times 10^{-22} \text{ g/molecule.}$$
$$= 1.05 \times 10^{-22} \frac{\text{g}}{\text{molecule}} \text{ choice [d]}$$

Another solution:

$$\begin{aligned} \text{molar mass of HNO}_3 &= 1(\text{H}) + 1(\text{N}) + 3(\text{O}) \\ &= 1(1) + 1(14) + 3(16) = 63.0 \text{ g/mol.} \end{aligned}$$

Then:

$$\frac{63.0 \text{ g}}{\text{mole}} \times \frac{1 \text{ mole}}{6.022 \times 10^{23} \text{ molecule}} = 1.05 \times 10^{-22} \text{ g/molecule.}$$

Question 12):

Compound contains only Cl and O.

$$\% \text{O} = 40.3\% ; (\text{Atomic Weights Cl} = 35.5 ; \text{O} = 16.0)$$

Empirical Formula : ??

In order to write the empirical formula, we have to follow these steps:

- 1) We have to determine how many Elements are there in the formula
- 2) " " " Find the masses of the above elements.
- 3) We must convert the masses into moles using molar masses.
- 4) We write each element followed by the calculated number of moles, then we look for the simplest ratio of whole numbers. If we do not have small whole numbers, we divide all numbers on the smallest number (except 1) to obtain the simplest ratio of small whole numbers.

يمكنك رؤية هذه الخطوات بالعربية والمزيد عن الامثلة في كتاب طريق التميز في الكيمياء (1) : ص 10 - 10.4

الأستاذ : إبراهيم ذياب

مؤلفاته : طريق التميز في الكيمياء (1) طريق التميز في الكيمياء العضوية

لدروس التقوية : 0799888058 - 0788820609

Continue of Question (12):

1. We have only two elements : Cl and O.

the available data is $\% O = 40.3\%$, then $\% Cl = 100\% - \% O$

$$\Rightarrow \% Cl = 59.7\%$$

Now, we assume that we have 100 g of our compound, therefore

2. mass of O = 40.3 g and mass of Cl = 59.7 g.

$$3. \text{ moles of O} = \frac{40.3 \text{ g}}{16.0 \text{ g/mol}} = 2.51875 \text{ mol O}$$

$$\text{moles of Cl} = \frac{59.7 \text{ g}}{35.5 \text{ g/mol}} = 1.681690141 \text{ mol Cl.}$$

4. Then, we divide on 1.681690141, this leads to:

$$Cl_{1.00} O_{1.4977} \Rightarrow Cl_{1.00} O_{1.50}$$

5. We have to obtain integers by multiplying the previous formula by 2:

$$Cl_{1.00} O_{1.50} \times 2 \Rightarrow Cl_{2.00} O_{3.00} \Rightarrow Cl_2 O_3 \quad \text{choice (b)}$$

Question (13):

1. First of all, we have to balance the equation.

2. Then, we use the following diagram to obtain the mass of product:



Now; the balanced equation is:



$$\text{molar mass of } Al_2O_3 = 2(Al) + 3(O)$$

$$= 2(27.0 \text{ g/mol}) + 3(16.0 \text{ g/mol})$$

$$= 102 \text{ g/mol.}$$

طريقة كيف ترن بملحقات الكيمياء
انظر كتاب طريقة التحيز في الكيمياء (1)
الطبعة الاولى: ص ١٧٩

الأستاذ: إبراهيم ذياب

مؤلفاته: طريق التميز في الكيمياء (1) طريق التميز في الكيمياء المحسوبة

للدروس والتقوية: 0799888058 - 0788820609

Continued Question (13):

because I want to convert moles Al to moles of Al_2O_3 , moles of Al should be written in the denominator of the mole ratio, which is derived from the balanced equation as shown below:

$$\frac{2 \text{ moles of } Al_2O_3}{4 \text{ moles of Al}}$$

طريقة الميزان كيميائية
النسبة المولية (mole ratio)
اقرأ الموضوع ٣-٧ ص ١١
في كتاب طرق التحليل الكيميائي (١)
الطبعة الأولى

Now, we can go through calculation easily:

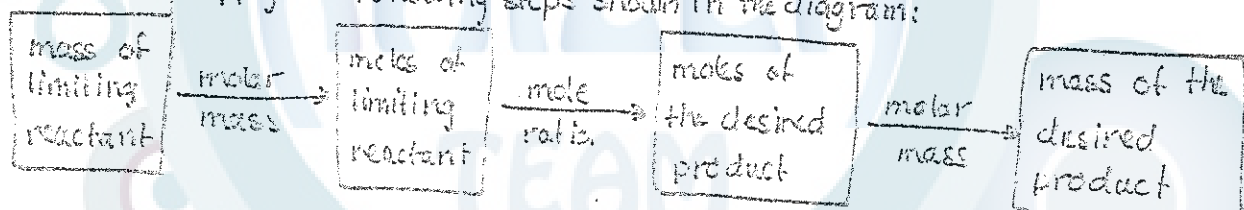
$$16.2 \text{ g Al} \times \frac{1 \text{ mol Al}}{27.0 \text{ g Al}} \times \frac{2 \text{ mol } Al_2O_3}{4 \text{ mol Al}} \times \frac{102 \text{ g } Al_2O_3}{1 \text{ mol } Al_2O_3} = 30.6 \text{ g}$$

molar mass mole ratio molar mass

Choice (e)

Question (14):

1. We check whether the equation is balanced or not, if not we balance it.
2. We determine the limiting reactant.
3. Then, we apply the following steps shown in the diagram:



- the chemical equation is balanced.
- now have to calculate no. of moles of each compound :

$$5.61 \text{ g CaO} \times \frac{1 \text{ mol CaO}}{56.1 \text{ g CaO}} = 0.100 \text{ mol CaO} \quad (\text{Actually present})$$

$$4.80 \text{ g C} \times \frac{1 \text{ mol C}}{12.0 \text{ g C}} = 0.400 \text{ mol C} \quad (\text{Actually present}).$$

الأستاذ : إبراهيم ذياب

مؤلفاته : طريق التميز في الكيمياء (١) طريق التميز في الكيمياء العضوية

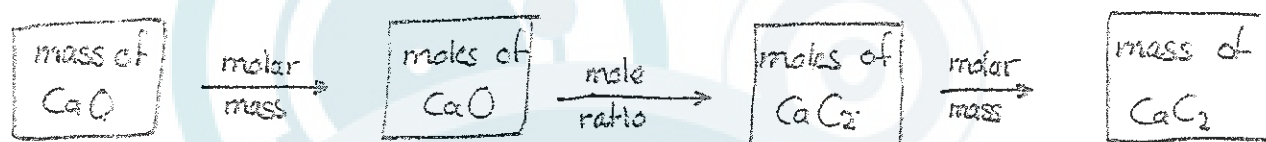
للدروس والتقوية : 0799888058 - 0788820609

Continue of Question 14:

now, we calculate how many moles are needed to react with actual compounds

$0.100 \text{ mol CaO} \times \frac{3 \text{ mol C}}{1 \text{ mol CaO}} = 0.300 \text{ mol C}$ is needed to react with 0.1 mol of CaO, do not forget that we have 0.400 mol C, so 0.100 mol C will remain as excess reactant. Consequently, the limiting reactant is CaO.

then, we can calculate the mass of CaC_2 using the following diagram:



Because we have calculated the moles of CaO, we will start with it.

$$0.100 \text{ mol CaO} \times \frac{1 \text{ mol CaC}_2}{1 \text{ mol CaO}} \times \frac{64.1 \text{ g CaC}_2}{1 \text{ mol CaC}_2} = 6.41 \text{ g CaC}_2 \text{ (theoretical mass)}$$

$$\text{Percentage Yield} = \frac{\text{actual mass}}{\text{theoretical mass}} \times 100\%$$

... [3.8] = Route of Excellence
in CHEMISTRY (I)
Page 121, 1st Edition

$$\% \text{ Yield} = \frac{4.49 \text{ g}}{6.41 \text{ g}} \times 100\% = 70.0\% \quad \text{Choice (c)}$$

عزيزي الطالب، هناك العديد من الامثلة التي نراها في الطبيعة على تفاعل المادة المحسنة
للتفاعلات الكيميائية في كتاب طريق التميز في الكيمياء (1)، ص 117 - 125، الطبعة الاولى.

Question (15):

Strong electrolytes involves strong acids, strong bases and salt.

Therefore, Na_2SO_4 is only the strong electrolyte, because it is a salt.

Choice (a)

(التمرين 15) : في الكيمياء (1)، ص 117 - 125، الطبعة الاولى، انظر كتاب طريق التميز، الطبعة الاولى، ص 117 - 125.

الأستاذ : إبراهيم ذياب

مؤلفاته : طريق التميز في الكيمياء (1) طريق التميز في الكيمياء العضوية

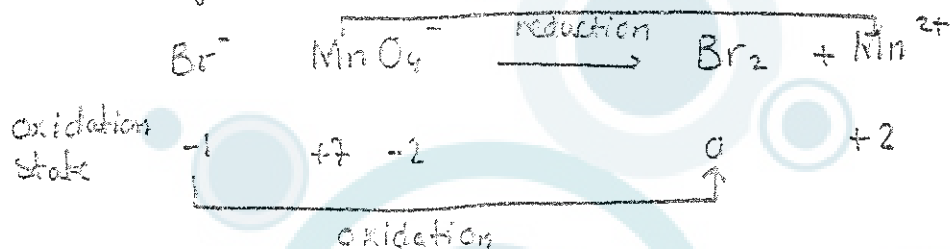
للدروس والتقوية : 0799888058 - 0788820609

Question (18):



Strategy:

1. Assign the oxidation state to each atom.



2. We separate equations for oxidation and reduction half-reactions.

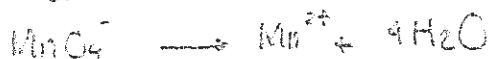


3. For each half-reaction:

a. we balance all atoms except for H & O:



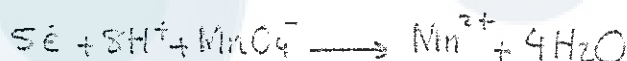
b. we balance oxygen atoms by adding H_2O molecules to side which has a lower no. of oxygen atoms:



c. we balance hydrogen atoms by adding H^+ ions to the side which has a lower no. of hydrogen atoms:



d. balance the charge by adding suitable no. of electrons to half reactions.



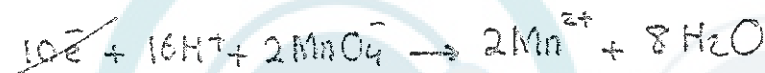
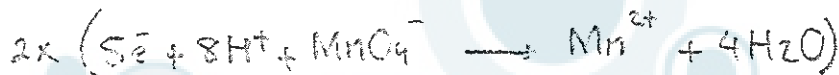
الأستاذ : إبراهيم ذياب

مؤلفاته : طريق التميز في الكيمياء (1) طريق التميز في الكيمياء العضوية

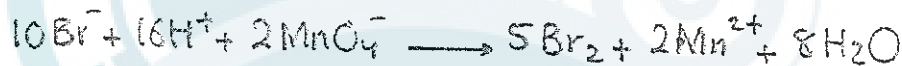
للدروس والتقوية : 0799888058 - 0788820609

Continue : Question (18):

4. Multiply one or both half-reactions, when needed, by an integer to equalize the no. of electrons transferred in the two half-reactions.



5. Add the two halves to each other, and cancel electrons and identical species.



6. Check that all atoms and charges are balanced.

10 Br

16 H

2 Mn

8 O

$$(10 \times -1) + (16 \times 1) + (2 \times -1) \stackrel{??}{=} (2 \times 2)$$

$$-10 + 16 - 2 \stackrel{??}{=} +4$$

$$+4 = +4$$

10 Br

16 H

2 Mn

8 O

$$(2 \times 2)$$

$$\stackrel{??}{=} +4$$

$$= +4$$

هناك التوازن الكهربي
والسرعة المتضمنة موازنة
المعادلات الكيميائية ومعادلات
التأكسد والاختزال في كتابنا بطريقتي
التقوية الكيميائية (1)، الصفحة الأولى
انصفحات 178 - 177.

Then the ratio coefficient of $\text{Br}^-/\text{H}_2\text{O}$ is $10/8 = 5/4$ [Choice c]

Question (19):

we must write a balanced equation, as shown below:



Then, we go through the following diagram:

Molarity and Volume \longrightarrow moles of AgNO_3
of AgNO_3

Molarity and Volume \longrightarrow moles of CaCl_2
of CaCl_2

Limiting \longrightarrow moles \longrightarrow mass
reactant AgCl AgCl

الأستاذ: إبراهيم ذياب

مؤلفاته: طريق التميز في الكيمياء (1) طريق التميز في الكيمياء العضوية

للدروس التقوية: 0799888058 - 0788820609

Now, we can calculate the moles of each reactant, as shown below:

$$\text{moles} = \text{Molarity (mol/L)} \times \text{Volume (L)} \Rightarrow$$

- moles of $\text{AgNO}_3 = 120.0 \text{ mL} \times \frac{1}{10^3 \text{ mL}} \times 0.20 \frac{\text{mol}}{\text{L}} = 0.024 \text{ mol AgNO}_3$ (Actually Present)
- moles of $\text{CaCl}_2 = 120.0 \text{ mL} \times \frac{1}{10^3 \text{ mL}} \times 0.15 \frac{\text{mol}}{\text{L}} = 0.018 \text{ mol CaCl}_2$

Let us start by moles of CaCl_2 :

$0.018 \text{ mol CaCl}_2 \times \frac{2 \text{ mol AgNO}_3}{1 \text{ mol CaCl}_2} = 0.036 \text{ mol AgNO}_3$ is needed to react with 0.018 mol CaCl_2 . But, we do not have enough amount to react. Therefore AgNO_3 is the limiting reactant.

Now, we can calculate the mass of AgCl after using the molar mass of AgCl.

$$\text{molar mass of AgCl} = \text{Ag} + \text{Cl} = 107.9 \text{ g/mol} + 35.5 \text{ g/mol} = 143.4 \text{ g/mol}.$$

Then:

$$0.024 \text{ mol AgNO}_3 \times \frac{2 \text{ mol AgCl}}{2 \text{ mol AgNO}_3} \times \frac{143.4 \text{ g AgCl}}{1 \text{ mol AgCl}} = 3.4416 \text{ g AgCl}$$

مركبات المتساوي التي لها نفس المولي
المميز في المعادلة (C) الخلية

mol ratio from
balanced equation

molar mass of
AgCl

corrected
and rounded

choice a

Question (20) :

In order to write the net ionic equation, we have to separate each compound except for solids, liquids, gases, weak acid and weak bases.

Now, HCN is considered as weak acid, so it is not ionized completely and H_2O is a liquid, therefore it cannot be ionized completely.

الأستاذ : إبراهيم ذياب

مؤلفاته : طريق التميز في الكيمياء (1) طريق التميز في الكيمياء العضوية

0788820609 - 0799888058 : لدروس التقوية

Continue: Question (20) :

Now, the molecular equation is:



the ionic equation is:



the net ionic equation is:



which is choice d.

عَيْنُكَ النَّظَرُ إِلَى هَذَا الْمَوْضُوعِ بِكَافَّةٍ تَضَامُّلِهِ فِي كِتَابِ طَرِيقِ التَّمْيِيزِ فِي الْكِيمْيَاءِ (1)
الطبعة الأولى، الصفحات ١٤٠ - ١٤٣ .

عزيزي الطالب :

بعد استهيننا ونجد انه تعالى قد حل هذا الخوض ج ، لذلك لاحظت أنني كنت بالاستشارة
إلى أنه هذه المراجعة مستمرة بكل دقة وعناية في كتاب طريق التميز ، والهدف من الاستشارة هي
الاستزادة وربط الكتاب بأسئلة السنوات السابقة .

• اهلاً مثل دخول جماعة الاختبار .
• كن دائماً لحظة استلام ورقة الاختبار .
• امسح باله تعالى ، وأترك ما لا تقره .
• عد إلى الأسئلة التي راجعتك بها محذرات ، وبعده الله تعالى ، لن نجد أي عيب
يوجب عليك حله .

إبراهيم ذياب

مع أمنيات النجاح للجميع

الأستاذ : إبراهيم ذياب

مؤلفاته : طريق التميز في الكيمياء (1) طريق التميز في الكيمياء العضوية

للدروس والتقوية : 0799888058 - 0788820609

General Chem. 101
First Exam

Date: 11/11/2006
Time: 60 min.

الاسم Student Name: Reg. No.:

Instructor's Name: Seat No.:

ANSWER SHEET

- 

1. a b c d e 9. a b c d e

2. a b c d e 10. a b c d e

3. a b c d e 11. a b c d e

4. a b c d e 12. a b c d e

5. a b c d e 13. a b c d e

6. a b c d e 14. a b c d e

7. a b c d e 15. a b c d e

8. a b c d e 16. a b c d e

مسألة 1

1. Perform the following calculation and give the answer rounded to the correct number of significant figures.

$$(6.56 + 5.679)(2.00 + 9.0) / 17.9$$

2 decimal 1 decimal

- a) 7.52 b) 7.523 c) 7.5 d) 7.5218 e) 8

Ibrahim Diab.

$$(12.239)(11.0) / 17.9$$

4 S.F 3 S.F 3 S.F

See Question 1
19/11/2005

2. Calculate the volume (in in^3 units) of an 0.640 lb object which has a density of 1.326 g/cm^3 . Given: $1 \text{ lb} = 454 \text{ g}$, $1 \text{ in} = 2.54 \text{ cm}$

- a) 15.5 b) 11.3 c) 17.6 d) 13.4 e) 36.2

density

$$1.326 \frac{\text{g}}{\text{cm}^3} \times \frac{1 \text{ lb}}{454 \text{ g}} \times 0.640 \text{ lb} \times \frac{1 \text{ in}^3}{(2.54 \text{ cm})^3}$$

$$0.640 \text{ lb} \times \frac{454 \text{ g}}{1 \text{ lb}} \times \frac{1 \text{ cm}^3}{1.326 \text{ g}} \times \frac{1 \text{ in}^3}{(2.54 \text{ cm})^3}$$

Ibrahim Diab.

3. Which of the following statements defines a compound:

- a) A substance that can not be separated into simpler substance by chemical changes.
 b) A substance composed of two or more elements chemically combined.
 c) A homogeneous mixture of two or more substances.
 d) A heterogeneous mixture of two or more substances.
 e) None of the above

4. There are two naturally occurring isotopes of copper, ^{63}Cu (mass 62.93 amu) and ^{65}Cu (mass = 64.93 amu). If the fractional abundance of ^{63}Cu is 0.515, then the average atomic mass of Cu (in amu units) in this sample is:

- a) 63.3 b) 63.7 c) 63.5 d) 63.1 e) 63.9

Ibrahim Diab

$$\begin{aligned} \text{Average atomic mass of Cu} &= \text{mass of } ^{63}\text{Cu} \times \text{natural Abundance} + \text{mass of } ^{65}\text{Cu} \times \text{natural Abundance} \\ &= 62.93 \text{ amu} \times 0.515 + 64.93 \text{ amu} \times (1 - 0.515) \\ &= 32.508 + 31.49 = 63.99 \end{aligned}$$

5. Which of the following combinations of name-formula is not correct?

a) Ammonium bicarbonate, NH_4HCO_3

b) Nitric acid, HNO_3

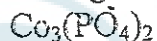
c) Sodium chlorate, NaClO_2 \rightarrow This is Sodium Chlorite

d) Calcium hydride, CaH_2

e) Dichlorine trioxide, Cl_2O_3

Ibrahim
Diab

6. Which of the following is the correct name for the compound:



Cobalt is type II element.

PO_4 is called Phosphate.

a) Cobalt phosphate.

b) Cobalt(II) phosphate.

c) Cobalt(II) diphosphate.

d) Cobalt(II) phosphite.

e) Tricobalt diphosphate.

Ibrahim
Diab

7. How many sulfur S atoms are there in 25 g of Al_2S_3 ?

($N = 6.02 \times 10^{23}$, molar masses (g/mol) : Al = 27.0 ; S = 32.1).

a) 4.2×10^{23}

b) 5.4×10^{23}

c) 6.8×10^{21}

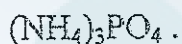
d) 3.0×10^{23}

e) 1.8×10^{23}

Ibrahim
Diab

$$25 \text{ g Al}_2\text{S}_3 \times \frac{1 \text{ mol Al}_2\text{S}_3}{(2 \times 27.0 + 3 \times 32.1) \text{ g Al}_2\text{S}_3} \times \frac{3 \text{ mol S}}{1 \text{ mol Al}_2\text{S}_3} \times \frac{6.022 \times 10^{23} \text{ atoms S}}{1 \text{ mol S}} = 3.0 \times 10^{23}$$

8. Calculate the mass percent of N in ammonium phosphate,



(molar masses(g/mol): N = 14.0; H = 1.0 ; P = 31.0 and O = 16.0)

a) 28.2

b) 43.0

c) 21.2

d) 48.5

e) 32.7

Ibrahim
Diab

$$\% \text{ N} = \frac{\text{Number of atoms of N} \times \text{molar mass of N}}{\text{molar mass of } (\text{NH}_4)_3\text{PO}_4} \times 100\%$$

$$= \frac{3 \times 14.0 \text{ g/mol}}{[3(14 + (4 \times 1.0)) + 31 + (4 \times 16.0)]} \times 100\% = \frac{42}{149} \times 100\% = 28.18\%$$

See
Question
Q 8
3/4/2005

9. A sample of 0.960 g of a compound containing carbon, oxygen and hydrogen was combusted (burnt) with excess oxygen to produce 1.32 g CO₂ and 1.08 g H₂O. The empirical formula of the compound is:

(molar masses (g/mol): C = 12.0, H = 1.0, O = 16.0)

Ibrahim
Diab

- a) CHO b) CH₃O c) CHO₂ d) CH₂O e) CH₄O

$$1.32 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{(12.0 + 2 \times 16.0) \text{ g CO}_2} = 0.03 \text{ mol C}$$

$$1.08 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{(2 \times 1.0 + 16) \text{ g H}_2\text{O}} \times \frac{2 \text{ mol H}}{1 \text{ mol H}_2\text{O}} = 0.12 \text{ mol H}$$

$$0.03 \text{ mol C} \times \frac{12 \text{ g C}}{1 \text{ mol C}} = 0.36 \text{ g C}$$

$$0.12 \text{ mol H} \times \frac{1 \text{ g H}}{1 \text{ mol H}} = 0.12 \text{ g H}$$

$$\text{mass O} = 0.960 \text{ g} - (0.36 \text{ g} + 0.12 \text{ g}) = 0.48 \text{ g}$$

$$0.48 \text{ g O} \times \frac{1 \text{ mol O}}{16 \text{ g O}} = 0.03 \text{ mol O}$$

$$\text{C} : \text{H} : \text{O} = 0.03 : 0.12 : 0.03 = 1 : 4 : 1 = \text{CH}_4\text{O}$$

10. Consider the balanced equation:



A sample of 8.50 g NH₃ was combusted with excess oxygen. The reaction produced 12.0 g of NO. Calculate the percentage yield of NO: (molar masses (g/mol): N = 14.0, H = 1.0; O = 16.0)

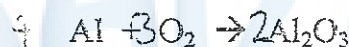
Ibrahim
Diab

- a) 100% b) 80.0% c) 60.0% d) 40.0% e) 20.0%

$$8.50 \text{ g NH}_3 \times \frac{1 \text{ mol NH}_3}{(14 + 3 \times 1) \text{ g NH}_3} \times \frac{4 \text{ mol NO}}{4 \text{ mol NH}_3} \times \frac{(14 + 16) \text{ g NO}}{1 \text{ mol NO}} = 15.0 \text{ g NO Theoretical}$$

$$\% \text{ yield} = \frac{\text{actual mass}}{\text{Theoretical mass}} \times 100\% = \frac{12.0 \text{ g}}{15.0 \text{ g}} \times 100\% = 80\%$$

11. Consider the unbalanced reaction:



Calculate the mass of Al₂O₃ (in g) produced from the reaction mixture of 5.40 g Al and 3.42 g O₂.

(molar masses (g/mol): Al = 27.0; O = 16.0)

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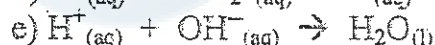
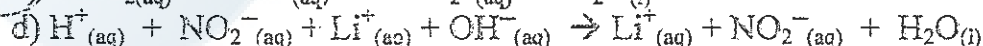
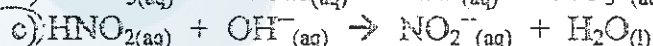
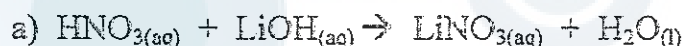
- a) 8.12 b) 8.95 c) 7.67 d) 12.4 e) 7.27

We have to determine the limiting reactant.

$$5.40 \text{ g Al} \times \frac{1 \text{ mol Al}}{27 \text{ g Al}} = 0.2 \text{ mol Al (actually found)}$$

$$3.42 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{32 \text{ g O}_2} = 0.107 \text{ mol O}_2 \text{ (actually found)}$$

12. The net ionic equation for the reaction of nitrous acid with lithium hydroxide is



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$$0.2 \text{ mol Al} \times \frac{3 \text{ mol O}_2}{4 \text{ mol Al}} = 0.15 \text{ mol O}_2 \text{ is needed, but we have } 0.107 \text{ mol O}_2$$

Therefore, O₂ is the limiting reactant.

$$0.107 \text{ mol O}_2 \times \frac{2 \text{ mol Al}_2\text{O}_3}{3 \text{ mol O}_2} \times \frac{(2 \times 27 + 3 \times 16) \text{ g Al}_2\text{O}_3}{1 \text{ mol Al}_2\text{O}_3} = 7.27 \text{ g}$$

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b) K_2SO_4 and $Fe(ClO_4)_3$ —

d) Na_2S and FeCl_2

d) AgNO_3 and HCl

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b) Cl^-

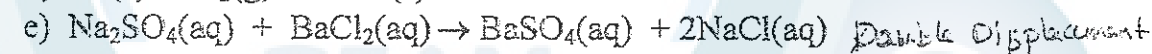
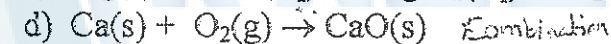
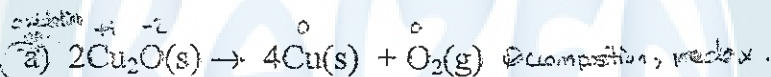
c) Sn

d) NO_3^-

e) H_2O

reducing agent.

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Club.

b) 0.269

c) 0.234

d) 0.327

e) 0.251

$$1.467 \text{ g BaCO}_3 \times \frac{1 \text{ mol BaCO}_3}{(137.3 + 3(12) + 4(16)) \text{ g BaCO}_3} \times \frac{2 \text{ mol Cl}^-}{1 \text{ mol BaCl}_2} = 0.0125 \text{ mol Cl}^-$$

$$\text{Molarity} = \frac{\text{moles}}{\text{volume}} = \frac{0.0125 \text{ mol Cl}^-}{0.0500 \text{ L}} = 0.251$$

1. Perform the following calculation and give the answer rounded to the correct number of significant figures

$$(15.562 - 15.512) \times 1000.0 = 50.0$$

- a) 5 b) 5.0 c) 5.5 d) 5×10^0 e) 5.0×10^1

Kilo 10^3
Deci 10^{-1}
Centi 10^{-2}

2. Convert 3.6×10^{-5} g/L to mg/cm³.

- a) 3.6×10^2 b) 3.6×10^{-1} c) 3.6×10^{-2}
d) 3.6×10^{-5} e) 3.6×10^{-3}

$$3.6 \times 10^{-5} \text{ g/L}$$

$$0.36$$

$$3.6 \times 10^{-5} \text{ g/L} \times \frac{1000 \text{ mg}}{1 \text{ g}} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1 \text{ mL}}{1 \text{ cm}^3} = 3.6 \times 10^{-2} \text{ mg/cm}^3$$

3. The boiling point of a liquid substance is 95.0 K. What is this temperature in Fahrenheit?

- a) -321 b) -288 c) -353 d) 139 e) 171

$$F^{\circ} = 32 + C^{\circ} \times \frac{9}{5}$$

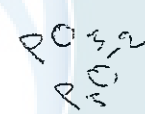
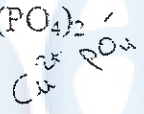
$$K = C^{\circ} + 273.15$$

$$95.0 = C^{\circ} + 273.15$$

$$C^{\circ} = -178.15$$

4. Which is the correct formula for copper(II) phosphite?

- a) Cu_2PO_3 b) $\text{Cu}_3(\text{PO}_4)_2$ ~~c) Cu_2PO_3~~
d) $\text{Cu}(\text{PO}_3)_2$ e) $\text{Cu}_3(\text{PO}_3)_2$



5. Which of these choices is the formula for hydrobromic acid?

- a) KBr b) HBr c) HBrO d) HBrO₂ e) HBrO₃

$$1 \text{ kg} = 1000 \text{ g}$$

$$2.50 \times 10^{-3} \text{ kg} = 2.5 \text{ g}$$

6. Calculate the number of moles of copper in 2.50×10^{-3} kg copper

- a) 39.5 b) 3.93×10^{-2} c) 3.93 ~~d) 39.7~~ e) 39.3

$$\frac{3.6 \times 10^{-5} \text{ g}}{1 \text{ L}} \times \frac{1000 \text{ mg}}{1 \text{ g}} \times \frac{1 \text{ L}}{1 \text{ dm}^3} \times \frac{1 \text{ dm}^3}{1000 \text{ mL}} = 3.6 \times 10^{-2} \text{ mg/mL}$$

$$1 \text{ L} = 1000 \text{ mL}$$

$$1 \text{ mL} = 1 \text{ cm}^3$$

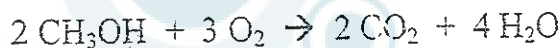
$$n = \frac{\text{mass}}{\text{MM}} = \frac{2.50 \times 10^{-3} \text{ kg}}{63.55 \text{ g/mol}} = 3.9 \times 10^{-2} \text{ mol}$$

$$\frac{3.6 \times 10^{-5} \text{ g}}{1 \text{ L}} \times \frac{1000 \text{ mg}}{1 \text{ g}} = 3.6 \times 10^{-2} \text{ mg/mL}$$

7. A compound containing only oxygen and chlorine is 47.4 % oxygen by mass. What is the empirical formula?

a) ClO b) Cl₂O **c) ClO₂** d) Cl₂O₃ e) Cl₂O₅

8. Methanol burns up in air according to



What mass of methanol should burn to produce 185 g H₂O?

a) 147 **b) 164** c) 393 d) 73.3 e) 1.4×10^2

$$185 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.015 \text{ g}} \times \frac{2 \text{ mol CH}_3\text{OH}}{4 \text{ mol H}_2\text{O}} \times \frac{32.04 \text{ g}}{1 \text{ mol CH}_3\text{OH}} = 164 \text{ g}$$

9. According to the reaction



If 0.670 g NO reacts with 1.240 g O₃, how many grams of NO₂ will be produced?

a) 1.41 b) 0.709 **c) 1.03** d) 0.709 e) 0.740

10. Given $6\text{Li}_{(s)} + \text{N}_{2(g)} \rightarrow 2\text{Li}_3\text{N}_{(s)}$. If 12.3 g of Li react with 33.6 g of N₂ to produce 11.3 g Li₃N calculate the percent yield

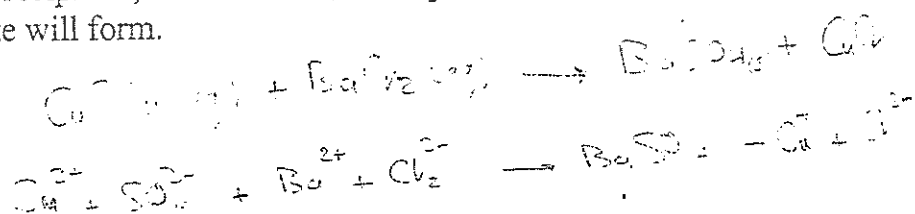
a) 16.7 **b) 85.0** c) 68.0 d) 55.0 e) 54.0

$$12.3 \text{ g Li} \times \frac{1 \text{ mol Li}}{6.94 \text{ g}} \times \frac{2 \text{ mol Li}_3\text{N}}{6 \text{ mol Li}} \times \frac{34.0 \text{ g}}{1 \text{ mol Li}_3\text{N}} = 32.87 \text{ g}$$

0.73

11. Based on the solubility rules, which of these processes will occur if solutions of CuSO_{4(aq)} and BaCl_{2(aq)} are mixed?

a) BaSO₄ will precipitate; Cu²⁺ and Cl⁻ are spectator ions.
 b) CuSO₄ will precipitate; Ba²⁺ and Cl⁻ are spectator ions.
 c) CuCl₂ will precipitate; Ba²⁺ and SO₄²⁻ are spectator ions.
 d) BaSO₄ will precipitate; Cu²⁺ and SO₄²⁻ are spectator ions.
 e) No precipitate will form.



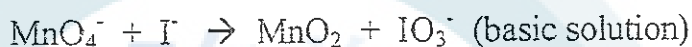
12. The oxidation number of S in Na_2SO_4 is

- a) +6 b) +5 c) +3 d) -3 e) -5

13. Which of these equations does *not* represent an oxidation-reduction reaction?

- a) $3\text{Al} + 6\text{HCl} \rightarrow 3\text{H}_2 + 2\text{AlCl}_3$
 b) $2\text{NaCl} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{PbCl}_2 + 2\text{NaNO}_3$
 c) $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
 d) $2\text{NaI} + \text{Br}_2 \rightarrow 2\text{NaBr} + \text{I}_2$
 e) $\text{Cu}(\text{NO}_3)_2 + \text{Zn} \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{Cu}$

14. Complete and balance the following redox equation in a basic medium. What is the coefficient of H_2O when the equation is balanced using the set of smallest whole-number coefficients?



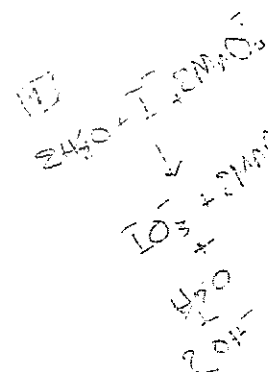
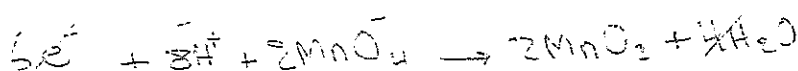
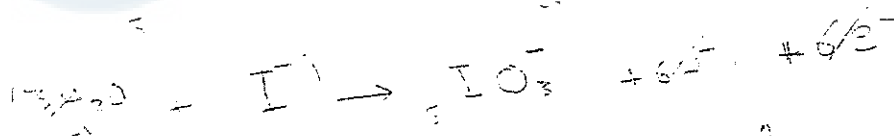
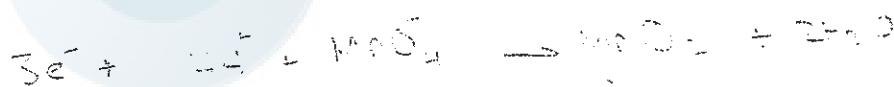
- a) 10 b) 4 c) 2 d) 1 e) none of these

15. Calculate the mass of MgCl_2 in grams required to prepare 5.00×10^2 mL of a 1.78 M MgCl_2 solution.
 (Molar mass of $\text{MgCl}_2 = 95.2$ g/mol)

- a) 133 b) 160 c) 106 d) 66.5 e) 84.7

16. How many milliliters (mL) of a 0.552 M HNO_3 are needed to neutralize completely 125 mL of 0.0120 M $\text{Ba}(\text{OH})_2$ solution?

- a) 35.5 b) 15.0 c) 1.15 d) 5.43 e) 10.9



Circle the right answer for each of the following questions and put "X" on the corresponding choice on the front page:-

1. How many significant figures are there in 1.307010

- a) 3 b) 4 c) 5 d) 6 **(e) 7**

2. Calculate the following arithmetic and express the result to the correct number of significant figures.

$$\frac{3.027 + 13.70}{8.221}$$

- a) 2.03 b) 2.15 **(c) 2.035** d) 2.06 e) 2.059

3. The average distance from earth to the sun is 7.3×10^7 miles. How many kilometers is this distance? (1 mile = 1760 yard, 1 m = 1.094 yard)

$$7.3 \times 10^7 \text{ miles} \times \frac{1760 \text{ yard}}{1 \text{ mile}} \times \frac{1 \text{ meter}}{1.094 \text{ yard}} = 11744 \times 10^7 \text{ m}$$

- (a) 1.2×10^8** b) 7.3×10^7 c) 5.3×10^6 d) 1.5×10^8 e) 8.5×10^6

4. A metal melts at 701.0°C . What temperature is this in $^\circ\text{F}$?

$$\frac{TF + 40}{TC + 40} \times \frac{9}{5}$$

$$666.9 = 5 \times 40 + 5TF$$

- a) 753.8 **(b) 1294** c) 566.4 d) 933.8 e) 1114

5. The chemical formula of Calcium phosphate is:

- a) CaPO_4 b) Ca_3P_2 c) $\text{Ca}_2(\text{PO}_4)_3$ **(d) $\text{Ca}_3(\text{PO}_4)_2$** e) $\text{Ca}_3(\text{PO}_3)_2$

6. The name of the chemical substance with the formula CrSO_3 is:

- (a) chromium(II) sulfite** b) chromium(II) sulfate c) chromium sulfide
d) chromium(III) sulfite e) chromium sulfur oxide

7. The element oxygen consists of three naturally occurring isotopes: ^{16}O , ^{17}O and ^{18}O . The atomic mass of oxygen is 16.0 amu. What can you learn about the relative abundances of these isotopes? (Atomic mass for ^{16}O = 16.0, ^{17}O = 17.0, ^{18}O = 18.0 amu)

- a) More than 50% of all oxygen isotopes are ^{17}O .
- ☒ b) The abundances of ^{17}O and ^{18}O are very small.
- c) Almost all oxygen atoms are ^{17}O .
- d) All isotopes have equal abundance of 33.3%.
- e) Almost all oxygen atoms are ^{18}O .

8. When 0.952 g of an organic compound containing C, H and O is burned completely in an excess of oxygen, 1.35 g of CO_2 and 0.826 g of H_2O are produced. What is the empirical formula of the compound?

Handwritten calculations for Question 8:

0.952 g $\text{C}_x\text{H}_y\text{O}_z \rightarrow 1.35 \text{ g } \text{CO}_2 + 0.826 \text{ g } \text{H}_2\text{O}$

$\text{C: } 27.2\%$
 $\text{H: } 9.5\%$
 $\text{O: } 63.3\%$

$1.35 \text{ g } \text{CO}_2 \rightarrow 0.369 \text{ g C}$
 $0.826 \text{ g } \text{H}_2\text{O} \rightarrow 0.091 \text{ g H}$

$0.952 \text{ g} - 0.369 \text{ g} - 0.091 \text{ g} = 0.492 \text{ g O}$

$\text{C: } \frac{0.369}{12} = 0.03075 \text{ mol}$
 $\text{H: } \frac{0.091}{1} = 0.091 \text{ mol}$
 $\text{O: } \frac{0.492}{16} = 0.03075 \text{ mol}$

$\text{Ratio: } \text{C} : \text{H} : \text{O} = 0.03075 : 0.091 : 0.03075 = 1 : 3 : 1$

Empirical formula: $\text{C}_2\text{H}_6\text{O}$

Options: a) $\text{C}_2\text{H}_6\text{O}$ b) $\text{C}_3\text{H}_5\text{O}_2$ c) CH_3O d) $\text{C}_4\text{H}_7\text{O}_4$ e) $\text{C}_3\text{H}_5\text{O}_3$

9. The percentage composition of a chemical compound is: 32.01 % C, 4.03 % H and 63.96 % O. Given that the molecular mass of this compound is 300 amu, what is its molecular formula?

Handwritten calculations for Question 9:

$32.01\% \text{ C} \rightarrow \frac{32.01}{12} = 2.6675 \text{ mol C}$
 $4.03\% \text{ H} \rightarrow \frac{4.03}{1} = 4.03 \text{ mol H}$
 $63.96\% \text{ O} \rightarrow \frac{63.96}{16} = 4.0 \text{ mol O}$

$\text{Ratio: } \text{C} : \text{H} : \text{O} = 2.6675 : 4.03 : 4.0 = 1 : 1.5 : 1.5$

Empirical formula: $\text{C}_2\text{H}_3\text{O}_3$

$\text{Molecular mass} = 300$
 $\text{Empirical mass} = 2(12) + 3(1) + 3(16) = 75$
 $n = \frac{300}{75} = 4$

Molecular formula: $\text{C}_8\text{H}_{12}\text{O}_{12}$

Options: a) CH_2O_6 b) $\text{C}_2\text{H}_3\text{O}_3$ c) $\text{C}_4\text{H}_6\text{O}_6$ d) $\text{C}_6\text{H}_9\text{O}_9$ e) $\text{C}_8\text{H}_{12}\text{O}_{12}$

10. The average mass (in grams) of one hundred iron (Fe) atoms is

- a) $6.02 \times 10^{23} \text{ g}$
- ☒ b) $9.28 \times 10^{-21} \text{ g}$
- c) $9.28 \times 10^{23} \text{ g}$
- d) 55.85 g
- e) $5.585 \times 10^{-23} \text{ g}$

Detailed Answers For The (1st Hour Exam) Of (Chemistry 101)

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Page 1.

Question [1] : 1.307010 = 7 significant figures. choice [e]

Remember that (i) zeroes between nonzeros are significant.

(ii) to the right of no. are significant if they preceded by decimal point.

(iii) zeroes located between (0.00) decimal point & the 1st non zero no. are not significant.

Question [2] :
$$\begin{array}{r} 3.027 + 13.70 \\ \hline 8.221 \end{array}$$

1) We must the two no. , keep in mind that the answer should have 2 decimal places.

2) The answer in 1) should be divided on 8.221 , The answer would have 4 significant figures

$$\Rightarrow 3.027 + 13.70 = 16.727 \approx 16.73$$

$$\Rightarrow 16.73 / 8.221 = 2.035 \text{ choice [c]}$$

Question [3] : using factor label method:

$$7.3 \times 10^7 \text{ mile} \longrightarrow ?? \text{ km.}$$

$$7.3 \times 10^7 \text{ mile} \times \frac{1760 \text{ yard}}{1 \text{ mile}} \times \frac{1 \text{ m}}{1.094 \text{ yard}} \times \frac{1 \text{ km}}{1000 \text{ m}}$$

$$= 1.2 \times 10^8 \text{ km choice [a]}$$

Question [4] : $T_F = (T_C \times \frac{9^\circ\text{F}}{5^\circ\text{C}}) + 32^\circ\text{F}$

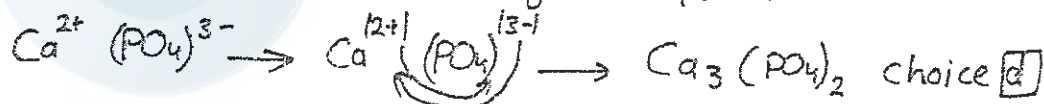
$$\Rightarrow T_F = 701.0^\circ\text{C} \times \frac{9^\circ\text{F}}{5^\circ\text{C}} + 32^\circ\text{F} = 1294^\circ\text{F.}$$

Question [5] : Calcium Phosphate.

Ca takes fixed charge = 2+

PO₄ " " " = 3-

We combine them, but the total charge must equal to zero.



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Question [6] : CrSO_3

- (a) Cr : means Chromium
- (b) SO_3 : means sulfite anion with a charge of -2.
- (c) because the ratio between the two components is 1:1.
- (d) Cr^{2+} must be 2+ , because the overall charge must equal to zero.
- (e) Cr is transition Metal Element , oxidation no. should be put between two brackets.
- (f) The name starts from cation (Left) to Anion (Right)

Chromium (II) sulfite choice [a]

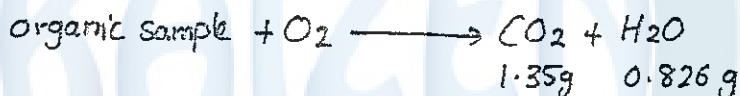
Question [7] : Oxygen consists of 3 different isotopes ^{16}O , ^{17}O , ^{18}O

The average atomic mass of oxygen = 16 amu.

It is clear that Relative Percent abundances of ^{17}O & ^{18}O are very very small because the average is almost equal to 16.

The answer is choice [b]

Question [8] : mass of organic sample = 0.952 g

From CO_2 , we can find the mass of C.From H_2O , " " " " " of H.

Then, mass of sample - (C + H) = mass of oxygen

After that, we have to calculate no. of moles of each, then find the empirical formula.



$$1.35 \text{ g} \times \frac{1 \text{ mol CO}_2}{44.0 \text{ g CO}_2} \times \frac{1 \text{ mol C}}{1 \text{ mol CO}_2} \times \frac{12.01 \text{ g}}{1 \text{ mol C}} = 0.368 \text{ g C.}$$



$$0.826 \text{ g of H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.0 \text{ g H}_2\text{O}} \times \frac{2 \text{ mol H}}{1 \text{ mol H}_2\text{O}} \times \frac{1.00 \text{ g H}}{1 \text{ mol H}} = 0.0918 \text{ g H.}$$

$$\text{Mass of O} = \text{total mass of organic} - (\text{mass of C} + \text{mass of H}) = (0.952 - (0.368 + 0.0918)) = 0.492 \text{ g O.}$$

Detailed Answers For The (1st Hour Exam) Of (Chemistry 101)

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Page 3.

If you looked carefully, you would find that we have calculated no. of moles of C and H.

$$\text{moles of C} = 1.35 \text{ g of CO}_2 \times \frac{1 \text{ mol CO}_2}{44.0 \text{ g CO}_2} \times \frac{1 \text{ mol C}}{1 \text{ mol CO}_2} = 0.0307 \text{ mol C.}$$

$$\text{moles of H} = 0.826 \text{ g of H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.0 \text{ g H}_2\text{O}} \times \frac{2 \text{ mol H}}{1 \text{ mol H}_2\text{O}} = 0.0918 \text{ mol H.}$$

$$\text{moles of O} = 0.492 \text{ g of O} \times \frac{1 \text{ mol O}}{16.0 \text{ g O}} = 0.0308 \text{ mol O}$$

Now;

$$\text{C H O} \Rightarrow \text{C}_{0.0307} \text{H}_{0.0918} \text{O}_{0.0318} \quad \therefore \text{divide on } 0.0307$$

$$\text{C}_1 \text{H}_3 \text{O}_1 \quad \text{choice [C]}$$

Question [9]: Assume we have 100g sample, therefore all percentages will be converted to masses.

$$\% \text{C} = 32.01 \quad , \quad \% \text{H} = 4.03 \quad , \quad \% \text{O} = 63.96$$

So the masses are:

$$\text{mass of C} = 32.01 \text{ g} \quad , \quad \text{mass of H} = 4.03 \text{ g} \quad , \quad \text{mass of O} = 63.96 \text{ g.}$$

$$32.01 \text{ g of C} \times \frac{1 \text{ mol C}}{12.0 \text{ g C}} = 2.667 \text{ mol C.}$$

$$4.03 \text{ g of H} \times \frac{1 \text{ mol H}}{1.008 \text{ g H}} = 4.000 \text{ mol H.}$$

$$63.96 \text{ g of O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 4.000 \text{ mol O.}$$

$$\text{C}_{2.667} \text{H}_{4.000} \text{O}_{4.000}$$

$$\text{C}_8 \text{H}_{12} \text{O}_{12} \quad \text{After multiply by 3}$$

$$\text{C}_8 \text{H}_{12} \text{O}_{12}$$

$$\begin{aligned} \text{Molar mass of } \text{C}_8\text{H}_{12}\text{O}_{12} &= 8(\text{C}) + 12(\text{H}) + 12(\text{O}) = 8(12) + 12(1) + 12(16) \\ &= 300 \text{ amu.} \end{aligned}$$

$$n = \frac{\text{molar mass of real compound}}{\text{molar mass of empirical formula}} = \frac{300}{300} = 1$$

The molecular formula = $n \times$ the empirical formula.

The molecular formula = $\text{C}_8 \text{H}_{12} \text{O}_{12}$ choice [E]

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Question [10] Strategy:

atom \longrightarrow mol \longrightarrow mass

$$100 \text{ Fe atom} \times \frac{1 \text{ mol Fe}}{6.02 \times 10^{23} \text{ atom}} \times \frac{55.85 \text{ g}}{1 \text{ mol Fe}} = 9.28 \times 10^{-21} \text{ g Fe.}$$

UNFORTUNATELY, the 3rd page of exam is lost, therefore, there is no solutions.

مع واجب الكسب
بالجهد للجميع

KAIZEN
TEAM

أستاذة فاطمة
المرابط

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طريق التميز في
الكيمياء (1)

Good Luck

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للاستفسار ودروس التقوية:

~~16~~

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ANSWER SHEET

- | | | | | | | | | | | | |
|----|----------|----------|----------|----------|----------|-----|----------|----------|----------|----------|----------|
| 1. | a | b | <u>c</u> | d | e | 9. | a | b | <u>c</u> | d | e |
| 2. | <u>a</u> | b | c | d | e | 10. | <u>a</u> | b | <u>c</u> | d | e |
| 3. | a | b | c | <u>d</u> | e | 11. | <u>a</u> | <u>b</u> | c | d | e |
| 4. | <u>a</u> | b | c | d | e | 12. | a | b | c | <u>d</u> | <u>e</u> |
| 5. | a | b | c | <u>d</u> | e | 13. | a | b | c | <u>d</u> | e |
| 6. | a | b | c | d | <u>e</u> | 14. | <u>a</u> | b | c | d | e |
| 7. | a | <u>b</u> | c | d | e | 15. | a | <u>b</u> | c | d | e |
| 8. | <u>a</u> | b | c | d | e | 16. | a | b | <u>c</u> | d | e |

Answer each of the following questions and put "X" on the correct choice on front page:

1. The number of significant figures in the value (0.0020300) is:

- a) 3 b) 4 ☒ c) 5 d) 6 e) 7

2. Perform the following calculation and report the result to the correct number of significant figures:

$$(1.57 \times 10^{-4} + 2.710 \times 10^{-3}) \times 2.4246$$

- ☒ a) 6.951×10^{-3} b) 6.95133×10^{-3} c) 6.95×10^{-3}
d) 7.0×10^{-3} e) 6.9513×10^{-3}

3. If the density of an object is 5.62 g/cm^3 , calculate the mass (in pounds) of the same object whose volume is 2.00 ft^3 . (Given: one pound = 454 g, one ft = 30.5 cm).

- a) 452 b) 446 c) 827 ☒ d) 702 e) 577

4. The correct name for $\text{Al}(\text{HSO}_4)_3$ is:

- ☒ a) aluminum hydrogen sulfate. b) aluminum sulfate.
c) aluminum(III) hydrogen sulfate. d) aluminum hydrogen sulfite.
e) aluminum hydrogen sulfide

5. Which of the following combinations of name and formula is wrong ?

- a) hydrosulfuric acid ; $\text{H}_2\text{S}_{(\text{aq})}$.
b) dichlorine pentoxide ; Cl_2O_5 .
c) mercury(I) peroxide ; Hg_2O_2 .
☒ d) iron nitrate ; $\text{Fe}(\text{NO}_3)_3$.
e) sodium hydrogen phosphate; Na_2HPO_4

6. Mg has three stable isotopes. Given a sample of Mg with the following masses and percent abundances:

^{24}Mg : 23.9850 amu , 70.42%

^{25}Mg : 24.9858 amu , 15.22%

^{26}Mg : 25.9826 amu , 14.36%

The average atomic mass (in amu) is:

- a) 24.31 b) 24.66 c) 24.82 d) 24.54 e) 24.42

7. Aspirin has the molecular formula $\text{C}_9\text{H}_8\text{O}_4$ (molar mass = 180.15 g/mol). Calculate the number of carbon atoms in 300. mg sample of aspirin.

(mg = 10^{-3} g , Avogadro's number = 6.02×10^{23})

- a) 1.20×10^{22} b) 9.02×10^{21} c) 1.80×10^{22}
d) 1.50×10^{22} e) 2.41×10^{22}

8. A compound containing only carbon and hydrogen is 82.8 % carbon by mass. If the molar mass of the compound is 58.0 g/mol, calculate the molecular formula of the compound?

- a) C_4H_{10} b) C_5H_{14} c) C_7H_{16} d) C_5H_{12} e) C_8H_{18}

9. A sample of compound contains 7.20 g carbon, 1.20 g hydrogen and 4.20 g nitrogen. The empirical formula of the compound is:

- a) CH_3N b) CH_6N_2 c) $\text{C}_2\text{H}_4\text{N}$ d) $\text{C}_2\text{H}_8\text{N}_3$ e) CH_3N_3

10. Consider the reaction:



When 23.9 g sample of CHCl_3 was reacted with excess Cl_2 , 25.2 g of CCl_4 were produced. Calculate the percentage yield of CCl_4 .
(Molar masses ; CHCl_3 : 119.5 g/mol ; CCl_4 : 153.8 g/mol.)

- a) 72.2 b) 94.9 c) 81.9 d) 88.4 e) 62.8

11. Calculate the mass of sulfur, S, produced from the reaction of 18.6 g H_2S and 6.52 g O_2 according to the unbalanced equation:



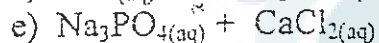
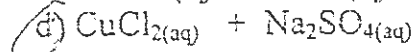
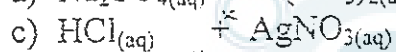
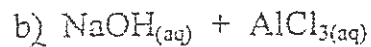
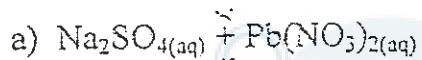
(Molar masses (in g/mol) ; H_2S = 34.08 ; O_2 : 32.00 ; S : 32.06)

- a) 13.1 g b) 11.5 g c) 13.5 g d) 18.4 g e) 15.4 g

12. Calculate the mass of K_3PO_4 (molar mass = 212.27 g/mol) needed to prepare 250.0 mL of an aqueous solution in which PO_4^{3-} concentration is 0.0220 M.

- a) 2.33 g b) 4.26 g c) 2.92 g d) 1.17 g e) 1.75 g

13. Which of the following pairs of aqueous solutions would not produce a precipitate when mixed?



14. If 45.87 mL of 0.254 M NaOH were required to completely neutralize 18.42 mL of H_2SO_4 solution (to produce Na_2SO_4). Calculate the molar concentration of H_2SO_4 solution.

☒ a) 0.316

b) 0.624

c) 0.229

d) 0.269

e) 0.398

15. The oxidation number of carbon in $\text{C}_2\text{H}_6\text{O}$ is:

a) -1

☒ b) -2

c) 0

d) +1

e) +3

16. Balance the following reaction (in acidic medium)



The ratio $\text{H}_2\text{O} / \text{SO}_4^{2-}$ in the balanced equation is:

a) 5/8

b) 5/3

☒ c) 5/2

d) 5/4

e) 5/1

Question II: We have 5 significant figures, because the zeros to the right end of the number (Trailing zeros) and the captive zeros (zeros between non zeros numbers).

So, 0.0020300 : 5 significant figures. ☐ choice C

Question I: $(1.57 \times 10^{-4} + 2.710 \times 10^{-3}) \times 2.4246$

(a) we add the numbers between two brackets, keep in mind we must have only two

decimal places

$$\Rightarrow 28.67 \times 10^{-4} \times 2.4246$$

(b) Now, we multiply the two numbers, also keep in mind, the total number of significant figures equal to 4 significant figures.

$$\Rightarrow 69.513282 \times 10^{-4} \Rightarrow 6.951 \times 10^{-3} \quad \text{choice A}$$

Question III: Volume = 2.00 ft³, Density = 5.62 g/cm³, (Given 1 pound = 454g, 1 ft = 30.5 cm)

Calculate mass (in pounds).

using factor label method and using the following procedure

$$\text{Volume (ft}^3\text{)} \rightarrow \text{Volume (cm}^3\text{)} \rightarrow \text{mass (g)} \rightarrow \text{mass (pounds)}$$

$$2.00 \text{ ft}^3 \times \frac{(30.5)^3 \text{ cm}^3}{1 \text{ ft}^3} \times \frac{5.62 \text{ g}}{1 \text{ cm}^3} \times \frac{1 \text{ pound}}{454 \text{ g}} = 702.44 \text{ pounds}$$

The answer should be rounded to 3 significant figures, because all values given have 3 significant figures

Answer = 702 pounds ☐ choice d

Question 4: Al(HSO₄)₃

According to Naming/ Nomenclature Rules:

(a) Al forms an ionic compounds normally. \Rightarrow anions number is not mentioned in name (b) Al is a representative group element. \Rightarrow cation does not have any (Number) like transition Elements.

So, According to the specific requirements now, we start with the cation name followed by the anion name.

\Rightarrow Al(HSO₄)₃ : Aluminum Hydrogen Sulfate ☐ choice B

Keep in mind:

SO₄²⁻: Sulfate

SO₃²⁻: Sulfite

S²⁻: Sulfide.

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الإدارة العامة للتعليم في ولاية الكويت

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Question 5:

(a) hydrosulfuric acid : H_2S : It is correct name because

(a) It is an acid

(b) It does not have an oxygen \Rightarrow we add hydro.

(c) we add anion root \Rightarrow sulfur : sulfur

(d) we add syllabus (ic) to the root anion \Rightarrow sulfuric



So, hydrosulfuric acid.

(b) dichlorine pentoxide : It is correct name because

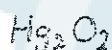


(a) It is a covalent compound

(b) Normally, we start from left (the more positive normally) adding prefix indicating the number of atoms, then the right element (the more negative normally) also adding prefix indicating the number of atoms.

Dichloropentoxide \Rightarrow Dichloropentoxide.

(c) mercury (I) peroxide



: It is correct name because

(a) It is an ionic compound

(b) Hg is transition element \Rightarrow should take (Number)

(c) O atom has an oxidation No. = -1 \Rightarrow peroxide.

$\text{Hg}_2\text{O}_2 \Rightarrow$ we ignore the Number of atoms

Mercury (I) peroxide.

(d) iron nitrate



: It is wrong name because choice (a)

it has Fe atom, which is transition metal element, so it must take (Number) indicates the oxidation Number of Fe which is equal to +3

So, Iron (III) Nitrate.

(e) Sodium Hydrogen phosphate : It is correct name because



(a) It is an ionic compound (cation: Na, anion: HPO_4^{2-})

(b) Na is representative metal element \Rightarrow No need to write the oxidation No. of Na.

(c) we ignore the No. of atoms involved in compound

$\Rightarrow \text{Na}_2\text{HPO}_4$: Sodium Hydrogen Phosphate

from left (positive ion) \rightarrow Right (negative ion)

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Continuation of Question [8]:

We are given molar mass of the compound (actual) = 58.0 g/mol

$$\text{Molecular Formula} = n \times (\text{Empirical Formula})$$

$$\text{where } n = \frac{\text{molar mass of actual compound}}{\text{molar mass of Empirical formula.}}$$

$$\Rightarrow n = \frac{58.0 \text{ g/mol (Given as a data)}}{29.0 \text{ g/mol (Calculated previously)}} = \frac{2}{1}$$

$$\text{Molecular Formula} = 2 \times \text{Empirical Formula}$$

$$= 2 \times \text{C}_2\text{H}_5 = \text{C}_4\text{H}_{10} \Rightarrow \text{choice [A]}$$

Question [9]: The sample procedure in Question [8]:

We have mass of C = 7.20 g ; mass of H = 1.20 g ; mass of nitrogen = 4.20 g
Now, we will calculate no. of moles of each atom.

$$7.20 \text{ g C} \times \frac{1 \text{ mol C}}{12 \text{ g C}} = 0.6 \text{ mol C} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \quad 1.20 \text{ g of H} \times \frac{1 \text{ mol H}}{1 \text{ g H}} = 1.20 \text{ mol.}$$

$$4.20 \text{ g N} \times \frac{1 \text{ mol N}}{14 \text{ g N}} = 0.3 \text{ mol N}$$

Now,

$$\text{C}_{0.6} \text{N}_{0.3} \text{H}_{1.2} \Rightarrow \text{getting rid of decimal places}$$

$$\text{C}_6 \text{N}_3 \text{H}_{12} \Rightarrow \text{dividing by the lowest No.} = 3$$

$$\text{C}_2 \text{N H}_4 \Rightarrow \text{C}_2\text{H}_4\text{N} \quad \text{choice [C]}$$

Question [10]: $\text{CHCl}_3 + \text{Cl}_2 \longrightarrow \text{CCl}_4 + \text{HCl}$

the equation is balance

Now, we want to calculate the percentage yield of CCl_4 .We are given the mass of $\text{CHCl}_3 = 23.9 \text{ g}$ (Limiting Reactant).the actual mass of $\text{CCl}_4 = 25.2 \text{ g}$.

$$\text{Percentage Yield} = \frac{\text{Actual mass}}{\text{Theoretical mass}} \times 100\%$$

We can calculate the theoretical mass of CCl_4 using:

$$\text{mass of CHCl}_3 \longrightarrow \text{mole CHCl}_3 \longrightarrow \text{mol CCl}_4 \longrightarrow \text{mass CCl}_4.$$

$$23.9 \text{ g} \times \frac{1 \text{ mol CHCl}_3}{119.5 \text{ g}} \times \frac{1 \text{ mol CCl}_4}{1 \text{ mol CHCl}_3} \times \frac{153.8 \text{ g}}{1 \text{ mol CCl}_4} = 30.8 \text{ g CCl}_4$$

theoretically produced

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Continuation of Question [10]:

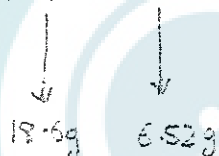
$$\text{Percentage yield} = \frac{\text{The Actual mass}}{\text{The Theoretical mass}} \times 100\%$$

$$= \frac{25.2 \text{ g}}{30.8 \text{ g}} \times 100\% = 81.9\% \quad \text{Choice [C]}$$

Question [11] : using the equation after balancing it:



Now we have



and we want to obtain the mass of sulfur, so we must specify the limiting reactant.

$$18.6 \text{ g of H}_2\text{S} \times \frac{1 \text{ mol H}_2\text{S}}{34.08 \text{ g H}_2\text{S}} = 0.546 \text{ mol H}_2\text{S really found.}$$

$$6.52 \text{ g of O}_2 \times \frac{1 \text{ mol O}_2}{32.00 \text{ g}} = 0.204 \text{ mol O}_2 \text{ really found.}$$

$$\begin{array}{lcl} \text{Theoretically: } 2 \text{ mol of H}_2\text{S} & \xrightarrow[\text{with}]{\text{needed to react}} & 1 \text{ mol O}_2 \\ \text{we have : } 0.546 & \xrightarrow{\text{needs}} & x \end{array}$$

$$x = \frac{1 \times 0.546}{2} = 0.273 \text{ mol of O}_2 \text{ is needed to react with } 0.546$$

BUT, we have only 0.204 mol O₂ which is less than what is required to react 0.273 mol.

⇒ So, the O₂ is the limiting reactant.

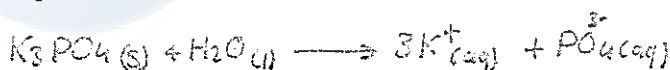
$$\text{mass O}_2 \longrightarrow \text{moles O}_2 \longrightarrow \text{moles S} \longrightarrow \text{mass S}$$

$$6.52 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{32.00 \text{ g O}_2} \times \frac{2 \text{ mol S}}{1 \text{ mol O}_2} \times \frac{32.06 \text{ g S}}{1 \text{ mol S}} = 13.08$$

$$\approx 13.1 \text{ g S}$$

Choice [A]

Question [12]: K₃PO₄ dissolves into water in accordance with



$$[\text{PO}_4^{3-}] = 0.022 \text{ M} \quad ; \text{ The Volume is } 250.0 \text{ mL}$$

$$\text{moles of PO}_4^{3-} = \text{M} \times \text{V} = 0.022 \frac{\text{mol}}{\text{L}} \times 250.0 \times 10^{-3} \text{ L} = 5.5 \times 10^{-3} \text{ mol PO}_4^{3-}$$

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Continuation of Question [12]:

$$\text{moles of } \text{PO}_4^{3-} = 5.5 \times 10^{-3} \text{ mol.}$$

$$5.5 \times 10^{-3} \text{ mol } \text{PO}_4^{3-} \times \frac{1 \text{ mol } \text{K}_3\text{PO}_4}{1 \text{ mol } \text{PO}_4^{3-}} \times \frac{212.27 \text{ g } \text{K}_3\text{PO}_4}{1 \text{ mol } \text{K}_3\text{PO}_4} = 1167.485 \times 10^{-3}$$

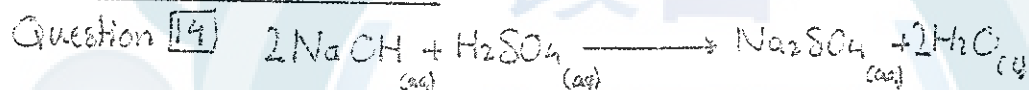
$$= 1.167485$$

$$\approx 1.17 \text{ g of } \text{K}_3\text{PO}_4$$

Choice [d]

Question [13]: According to Solubility Rules Listed in your book, you find that

- (a) $\text{Na}_2\text{SO}_4(\text{aq}) + \text{Pb}(\text{NO}_3)_2(\text{aq}) \longrightarrow 2\text{NaNO}_3(\text{aq}) + \text{PbSO}_4(\text{s})$
- (b) $3\text{NaOH}(\text{aq}) + \text{AlCl}_3(\text{aq}) \longrightarrow 3\text{NaCl}(\text{aq}) + \text{Al}(\text{OH})_3(\text{s})$
- (c) $\text{HCl}(\text{aq}) + \text{AgNO}_3(\text{aq}) \longrightarrow \text{HNO}_3(\text{aq}) + \text{AgCl}(\text{s})$
- (d) $\text{CuCl}_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \longrightarrow \text{CuSO}_4(\text{aq}) + \text{NaCl}(\text{aq})$ *** Choice [d]
- (e) $2\text{Na}_3\text{PO}_4(\text{aq}) + 3\text{CaCl}_2(\text{aq}) \longrightarrow 6\text{NaCl}(\text{aq}) + \text{Ca}_3(\text{PO}_4)_2(\text{s})$



I write here full balanced equation, thus

We have

$$V_{\text{NaOH}} = 45.87 \text{ mL} \quad M_{\text{NaOH}} = 0.254$$

$$V_{\text{H}_2\text{SO}_4} = 18.42 \quad M_{\text{H}_2\text{SO}_4} = ??$$

$$\begin{aligned} &\text{Volume NaOH (L)} \longrightarrow \text{mole NaOH} \longrightarrow \text{mol H}_2\text{SO}_4 \longrightarrow \text{Molarity H}_2\text{SO}_4 \\ &= 45.87 \text{ mL NaOH} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.254 \text{ mol NaOH}}{1 \text{ L NaOH}} \times \frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol NaOH}} \\ &= 0.00583 = 5.83 \times 10^{-3} \text{ mol. H}_2\text{SO}_4 \end{aligned}$$

$$M_{\text{H}_2\text{SO}_4} = \frac{\text{mole H}_2\text{SO}_4}{\text{Volume}} = \frac{5.83 \times 10^{-3} \text{ mol}}{18.42 \times 10^{-3} \text{ L}} = 0.316 \text{ M. Choice [a]}$$

Question [15]: oxidation No. of Carbon in $\text{C}_2\text{H}_6\text{O} =$

oxidation No. of H = +1

oxidation No. of O = -2

$$\text{C}_2\text{H}_6\text{O} = 2x + 6(+1) + 1(-2) = \text{zero} \Rightarrow 2x + 6 - 2 = \text{zero}$$

$$\Rightarrow 2x + 4 = \text{zero} \Rightarrow 2x = -4 \Rightarrow x = -2 \quad \text{Choice [b]}$$

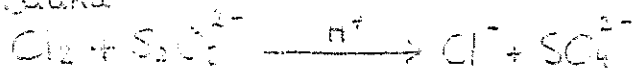
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Question 16: Balance



Separate the equation into 2 different equations.



a) balance each atom but O, H



b) balance the oxygen atoms each that the side which has lower No. of O atoms to add H_2O molecules to each O not available



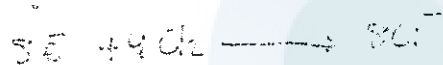
c)



d) Now, add e^- to the side which more positive to make it equal to the less positive one.



e) Cancel the electrons in each side and the two half reaction to be one reaction, sometimes, we need to multiply by character to eliminate the electrons.



the red equation:



Now, The Ratio $\text{H}_2\text{O}/\text{SO}_4^{2-} = (5/2)$ choice (C)

نصف

(الاستاذ)



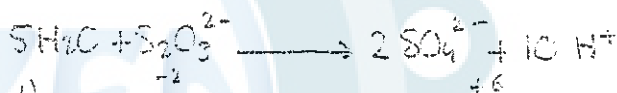
g) balance each atom but H, O



b)



c) balance H atoms by adding H^+ to the side which has lower No. of H atoms



e)



The End of Exam

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Question [6] : using the law:

The average atomic mass of an element (in amu) = $\left[\text{mass of 1st isotope} \times \text{Percent Abundance} \right] + \left[\text{mass of 2nd isotope} \times \text{Percent Abundance} \right] + \dots$

Applying the given data in the above law: \rightarrow

$$\begin{aligned} \text{The average atomic mass of Mg in (amu)} &= \left[\text{mass of } {}^{24}_{12}\text{Mg} \times \% \right] + \left[\text{mass of } {}^{25}_{12}\text{Mg} \times \% \right] + \left[\text{mass of } {}^{26}_{12}\text{Mg} \times \% \right] \\ &= \left[23.9850 \text{ amu} \times \frac{75.42}{100} \right] + \left[24.9858 \text{ amu} \times \frac{15.22}{100} \right] + \left[25.9826 \text{ amu} \times \frac{14.36}{100} \right] \\ &= 16.89 \text{ amu} + 3.803 \text{ amu} + 3.731 \text{ amu} \\ &= 24.424 \Rightarrow \text{rounded to two decimal places} \\ &= 24.42 \Rightarrow \text{Choice [E]} \end{aligned}$$

Question [7] : using the following procedure and applying factor Label Method:

$$\begin{aligned} \text{mass of aspirin (mg)} &\rightarrow \text{mass of aspirin (g)} \rightarrow \text{moles of aspirin (mol)} \rightarrow \text{moles of carbon (mol)} \rightarrow \text{No. of atoms of carbon} \\ &= 300 \text{ mg Aspirin} \times \frac{10^{-3} \text{ g Aspirin}}{1 \text{ mg Aspirin}} \times \frac{1 \text{ mol Aspirin}}{180.15 \text{ g Aspirin}} \times \frac{9 \text{ mol of C}}{1 \text{ mol Aspirin}} \times \frac{6.02 \times 10^{23} \text{ atom C}}{1 \text{ mol of C}} \\ &= 90.22 \times 10^{21} \Rightarrow \text{rounded to 3 significant figures and writing the no. in scientific notation} \\ &= 9.02 \times 10^{21} \quad \text{Choice [b]} \quad \text{Note: } 1 \text{ C}_9\text{H}_8\text{O}_4 \rightarrow 9 \text{ C} + 8 \text{ H} + 4 \text{ O} \end{aligned}$$

Question [8] : Compound \rightarrow C, H only

$$\text{C}\% = 82.8\% \quad \text{So } \text{H}\% = 100 - \text{C}\% = 17.2\%$$

Assume we have 100g of Sample compound \Rightarrow so

$$\text{mass of carbon} = 82.8 \text{ g} \quad , \quad \text{mass of Hydrogen} = 17.2 \text{ g}$$

calculating moles of C, H:

$$82.8 \text{ g C} \times \frac{1 \text{ mol C}}{12 \text{ g C}} = 6.89 \text{ mol C} \quad , \quad 17.2 \text{ g H} \times \frac{1 \text{ mol H}}{1 \text{ g H}} = 17.2 \text{ mol H}$$

Empirical Formula calculations: $\text{C}_{6.89} \text{H}_{17.2}$, dividing by 6.89 (lowest no.)

$\Rightarrow \text{C}_1 \text{H}_{2.5}$, the No. should be an integer No.'s \Rightarrow multiplying by 2

$\Rightarrow \text{C}_2 \text{H}_5$ (Empirical Formula). \Rightarrow Molecular mass of Empirical formula = 29.0 g/mol

$$\text{Molecular mass of } \text{C}_2\text{H}_5 = 2 \times \text{M.wt(C)} + 5 \times \text{M.wt(H)} = 29.0 \text{ g/mol.}$$

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General Chemistry 101

First Semester 2011/2012

First Exam.

Date: 30/10/2011

Time: 60 min.

Student Name: Reg. No.:

Instructor's Name: Section: Seat No.:



Answer Sheet

1- a b c d e

9- a b c d e

2- a b c d e

10- a b c d e

3- a b c d e

11- a b c d e

4- a b c d e

12- a b c d e

5- a b c d e

13- a b c d e

6- a b c d e

14- a b c d e

7- a b c d e

15- a b c d e

8- a b c d e

16- a b c d e

Answer each of the following questions and put "X" on the correct choice on front page.

1- Which of the following is an intensive property?

- a) length b) area c) density d) energy e) weight

2. Carry out the following operation and report the result to the correct number of significant figures:

$$[(1.00 - 0.01) \times 2.500] \div 12.0$$

- a) 0.20625 b) 0.2063 c) 0.206 d) 0.21 e) 0.2

3. The speed of a car is 32.0 mile/hr. What is its speed in m/s?

(given: 1 mile = 1609 m)

- a) 14.3 b) 16.1 c) 18.8 d) 20.6 e) 71.6

4. The formula of iron(III) phosphate is:

- a) Fe_2PO_4 b) FePO_3 c) $\text{Fe}_2(\text{PO}_4)_3$ d) $\text{Fe}_3(\text{PO}_4)_3$ e) FePO_4

5. For the isotope $^{59}_{27}\text{X}$. The number of protons and neutrons in that isotope are:

- a) 27 and 59 b) 27 and 32 c) 32 and 27 d) 59 and 27 e) 32 and 59

6 The correct name of the compound N_2O_3 is:

- a) Nitrogen(III) oxide.
- b) Nitrogen trioxide.
- c) Dinitrogen trioxide
- d) Dinitrogen(III) trioxide.
- e) Nitrogrn(III) trioxide.

7. What is the mass of one calcium atom ?

(Atomic mass of calcium = 40.08, Avogadro's number = 6.022×10^{23})

- a) 9.274×10^{-23} g
- b) 6.656×10^{-23} g
- c) 5.324×10^{-23} g
- d) 4.037×10^{-23} g
- e) 3.346×10^{-22} g

8. What is the mass of chlorine in 14.6 g CaCl_2 ?

(atomic masses: Cl = 35.45 and Ca = 40.08)

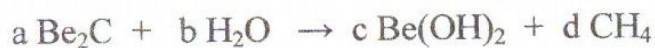
- a) 9.33 g
- b) 6.77g
- c) 4.24 g
- d) 8.05 g
- e) 10.6 g

9. What is the empirical formula of a compound with the following composition by mass: C: 54.5% ; H: 9.09% and O: 36.4% ?

Atomic masses : C = 12.01 ; H= 1.008 and O = 16.00.

- a) $\text{C}_2\text{H}_3\text{O}$
- b) $\text{C}_2\text{H}_6\text{O}$
- c) $\text{C}_3\text{H}_5\text{O}_2$
- d) $\text{C}_2\text{H}_4\text{O}$
- e) $\text{C}_2\text{H}_5\text{O}$

10. Balance the following equation:



The ratio of coefficients b / d in the balanced equation is:

- a) $1/2$ b) $2/1$ c) $1/4$ d) $3/1$ e) $4/1$

11. 13.5 g of $\text{Li}(\text{s})$ was reacted with 14.85 g of $\text{N}_2(\text{g})$ according to the equation: $\text{N}_2(\text{g}) + 6 \text{Li}(\text{s}) \rightarrow 2 \text{Li}_3\text{N}(\text{s})$

If the actual yield is 11.6 g, what is the percent yield of this reaction ?

Atomic masses: $\text{Li} = 6.942$ and $\text{N} = 14.01$.

- a) 51.4 b) 28.6 c) 66.3 d) 41.8 e) 70.2

12. Which of the following compounds is insoluble in water?

- a) Na_2CO_3 b) FeCO_3 c) $(\text{NH}_4)_2\text{CO}_3$ d) Na_2S e) AgNO_3

13. Which of the following reactions is an acid-base reaction?

- a) $\text{NaCl}(\text{aq}) + \text{AgNO}_3(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$
b) $\text{Cl}_2(\text{g}) + 2\text{HI}(\text{g}) \rightarrow 2\text{HCl}(\text{g}) + \text{I}_2(\text{g})$
c) $\text{Ba}(\text{OH})_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{NaOH}(\text{aq})$
d) $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g}) + \text{CO}_2(\text{g})$
e) $\text{Na}_2\text{CO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) + 2\text{NaCl}(\text{aq})$

14. Balance the following redox reaction in acidic solution:



The ratio of coefficients d / c in the balanced equation is:

- a) $10 / 2$ b) $7 / 3$ c) $2 / 10$ d) $2 / 5$ e) $5 / 2$

15. What is the volume of 0.910 M Ba(OH)_2 solution needed to titrate 25.0 mL of $1.500 \text{ M H}_3\text{PO}_4$ to produce $\text{Ba}_3(\text{PO}_4)_2$?

- a) 79.2 mL b) 92.2 mL c) 52.0 mL d) 61.8 mL e) 69.4 mL

16. When excess Na_2SO_4 solution was added to 20.0 mL of an unknown solution containing Ca^{2+} ion, 0.0472 g of CaSO_4 precipitated. What is the molar concentration of Ca^{2+} in the unknown solution?

(Molar mass of $\text{CaSO}_4 = 136.14 \text{ g/mol}$)

- a) 1.36×10^{-2} b) 1.73×10^{-2} c) 2.10×10^{-2} d) 2.47×10^{-2} e) 3.83×10^{-2}

General Chem. 101
First Exam

Time: 60 min.

Date: 14/11/2009

Student's Name:

Reg. No.

Section No.

Seat No.

#####@@@@@@@@@@@@@@@@@@@@

Use the following information: Atomic mass (amu): C = 12.0; H = 1.00; O = 16.0; S = 32.0; Al = 27.0; N = 14.0; Na = 23.0; Avogadro's no. = 6.022×10^{23} ; $^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times (5/9)$.

@@@@@@@@@@@@@@@@@@@@#####

ANSWER SHEET

1. a b **c** d e 9. **a** b c d e

2. **a** b c d e 10. a b c d **e**

3. a b c d **e** 11. a b c **d** e

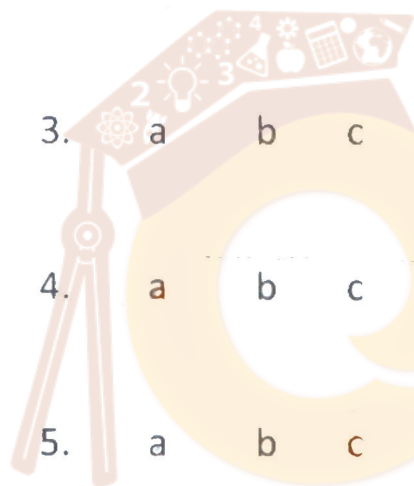
4. a b c d e 12. **a** b c d e

5. a b **c** d e 13. a b c d **e**

6. **a** b c d e 14. a b **c** d e

7. a b **c** d e 15. **a** b c d e

8. **a** b c d e 16. **a** b c d e



1-Perform the following calculation and give the answer rounded to the correct number of significant figures

$$(3.28 + 2.8395) (1.00 + 4.5) / 23.95$$

- a- 1.4054 b - 2 c- 1.4 d- 1.420 e- 1.42

2- Convert $(-10)^{\circ}\text{C}$ to Fahrenheit scale of temperature.

- a- 14 b- 23.3 c- 263.15 d- 42.2 e- 32.3

3- The atomic mass of ^{35}Cl and ^{37}Cl are 34.968 amu and 36.956 amu, respectively. Calculate the natural abundance of ^{35}Cl . Given that the average atomic mass of Cl is 35.46 amu.

- a- 24.75 % b- 98.61% c- 1.39% d- 51.65% e- 75.25%

4- After balancing the following reaction,



The ratio (x / y) is equal to

- a- 3 / 2 b- 4 / 2 c- 2 / 2 d- 6 / 2 e- 2 / 6

5- The correct name for $\text{Ni}(\text{BrO}_4)_2$ is: (Ni is a transition metal element)

- a- Nickel (II) bromate b- Nickel (II) bromite c- Nickel (II) perbromate
d- Nickel (IV) perpromate e- Nickel dibromate

6- The correct name for SO_3 is

- a- Sulfur trioxide b- Sulfur (IV) oxide c- Sulfur monoxide
d- Sulfur dioxide e- Sulfur oxide

7- How many sodium ions are contained in 9.96 mg (milligram) of Na_2SO_3 ? The molar mass of Na_2SO_3 is 126.05 g/mol.

- a- 1.52×10^{27} b- 4.76×10^{20} c- 9.52×10^{19}
d- 1.05×10^{21} e- 9.52×10^{20}

8- The mass percent of sulfur in $\text{Al}_2(\text{SO}_4)_3$ is equal to

- a- 28.1% b- 9.37% c- 42.7% d- 21.4% e- 36.0%

9- The empirical formula for a compound that contains 52.14% C, 13.13% H and 34.73% O is

- a- $\text{C}_2\text{H}_6\text{O}$ b- CHO c- $\text{C}_4\text{H}_{13}\text{O}_2$ d- CH_4O_2 e- CH_3O

10- Consider the following balanced reaction. How many grams of water are required to form 56.9 g of HNO_3 ? Assume that there is excess NO_2 present.



- a- 38.0 g b- 10.9 g c- 43.4 g d- 21.7 g e- 8.13 g

11- Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be produced from the reaction of 50.0 N_2O_4 with 45.0g N_2H_4 assuming 100% yield. The molar masses are as follows: $\text{N}_2\text{O}_4 = 92.02\text{g/mol}$, $\text{N}_2\text{H}_4 = 32.05\text{g/mol}$.



- a- LR is N_2H_4 , 59.0 g N_2 formed b- LR is N_2O_4 , 105 g N_2 formed
c- LR is N_2H_4 , 13.3 g N_2 formed d- LR is N_2O_4 , 45.7 g N_2 formed
e- Both reactants are in appropriate stoichiometric ratios and 45.0 g N_2 formed

12- All of the following compounds are soluble in water except

- a- Hg_2Cl_2 b- KCl c- NH_4Cl d- CuCl_2 e- $\text{Ba}(\text{OH})_2$

13- Which of the following conversions involves oxidation

- a- $\text{BF}_3 \rightarrow \text{BF}_4$ b- $\text{SO}_2 \rightarrow \text{CaSO}_3$
c- $\text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O}$ d- $\text{H}_{2(g)} \rightarrow \text{H}_{2(l)}$
e- $\text{Ti}^{3+} \rightarrow \text{TiO}^{+2}$

14- The net ionic equation for the reaction of nitrous acid with lithium hydroxide is

- a- $\text{HNO}_2(\text{aq}) + \text{LiOH}(\text{aq}) \rightarrow \text{LiNO}_2(\text{aq}) + \text{H}_2\text{O}(\text{l})$
b- $\text{HNO}_2(\text{aq}) + \text{LiOH}(\text{aq}) \rightarrow \text{Li}^+(\text{aq}) + \text{NO}_2^-(\text{aq}) + \text{H}_2\text{O}(\text{l})$
c- $\text{HNO}_2(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{NO}_2^-(\text{aq}) + \text{H}_2\text{O}(\text{l})$
d- $\text{H}^+(\text{aq}) + \text{NO}_2^-(\text{aq}) + \text{Li}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{Li}^+(\text{aq}) + \text{NO}_2^-(\text{aq}) + \text{H}_2\text{O}(\text{l})$
e- $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$

15- After balancing the following chemical reaction is in Basic solution, the correct ration of (I^- / OH^-) is



a- 6/8

b- 8/10

c- 4/3

d- 4/2

e- 2/3

16- The volume in milliliters (ml) of 0.675 M NaOH required to neutralize 25.0 ml of 0.145 M H_3PO_4 is equal to

- a- 16.1 b- 10.7 c- 13.2 d- 5.37 e- 16.9

General Chem. 101
First Exam

Date: 28/3/2009
Time: 60 min.

Name: Reg. No.:

Instructor Name: Seat No.:



$$^{\circ}\text{F} = (^{\circ}\text{C} \times \frac{9}{5}) + 32 \quad , \quad \text{K} = ^{\circ}\text{C} + 273$$



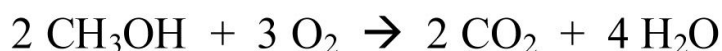
ANSWER SHEET

- | | |
|----------------------------------|-----------------------------------|
| 1. a b c d e | 9. a b c d e |
| 2. a b c d e | 10. a b c d e |
| 3. a b c d e | 11. a b c d e |
| 4. a b c d e | 12. a b c d e |
| 5. a b c d e | 13. a b c d e |
| 6. a b c d e | 14. a b c d e |
| 7. a b c d e | 15. a b c d e |
| 8. a b c d e | 16. a b c d e |

7. A compound containing only oxygen and chlorine is 53.0 % oxygen by mass. What is the empirical formula?

- a) ClO b) Cl₂O c) ClO₂ d) Cl₂O₅ e) Cl₂O₃

8. Methanol burns up in air according to



What mass of methanol should burn to produce 165 g H₂O?

- a) 147 b) 165 c) 393 d) 73.3 e) 1.4×10^2

9. According to the reaction



If 0.670 g NO reacts with 0.740 g O₃, how many grams of NO₂ will be produced?

- a) 1.41 b) 0.709 c) 1.07 d) 0.709 e) 0.740

10. Given $6\text{Li}_{(s)} + \text{N}_{2(g)} \rightarrow 2 \text{Li}_3\text{N}_{(s)}$. If 12.3 g of Li react with 33.6 g of N₂ to produce 14.0 g Li₃N calculate the percent yield

- a) 16.7 b) 85.0 c) 68.0 d) 55.0 e) 54.0

11. Based on the solubility rules, which of these processes will occur if solutions of CuSO_{4(aq)} and BaCl_{2(aq)} are mixed?

- a) CuCl₂ will precipitate; Ba²⁺ and SO₄²⁻ are spectator ions.
b) CuSO₄ will precipitate; Ba²⁺ and Cl⁻ are spectator ions.
c) BaSO₄ will precipitate; Cu²⁺ and Cl⁻ are spectator ions.
d) BaSO₄ will precipitate; Cu²⁺ and SO₄²⁻ are spectator ions.
e) No precipitate will form.

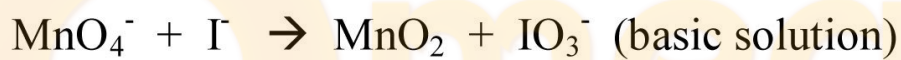
12. The oxidation number of N in NaNO_3 is

- a) +6 b) +5 c) +3 d) -3 e) -5

13. Which of these equations does **not** represent an oxidation-reduction reaction?

- a) $3 \text{Al} + 6 \text{HCl} \rightarrow 3 \text{H}_2 + \text{AlCl}_3$
b) $2 \text{H}_2\text{O} \rightarrow 2 \text{H}_2 + \text{O}_2$
c) $2 \text{NaCl} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{PbCl}_2 + 2 \text{NaNO}_3$
d) $2 \text{NaI} + \text{Br}_2 \rightarrow 2 \text{NaBr} + \text{I}_2$
e) $\text{Cu}(\text{NO}_3)_2 + \text{Zn} \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{Cu}$

14. Complete and balance the following redox equation in a basic medium. What is the coefficient of OH^- when the equation is balanced using the set of smallest whole-number coefficients?



- a) 1 b) 2 c) 4 d) 10 e) none of these

15. Calculate the mass of MgCl_2 in grams required to prepare 5.00×10^2 mL of a 2.80 M MgCl_2 solution.
(Molar mass of $\text{MgCl}_2 = 95.2$ g/mol)

- a) 133 b) 160 c) 106 d) 66.5 e) 84.8

16. How many milliliters (mL) of a 0.276 M HNO_3 are needed to neutralize completely 125 mL of 0.0120 M $\text{Ba}(\text{OH})_2$ solution?

- a) 35.5 b) 15.0 c) 1.15 d) 5.43 e) 10.9

Instructor Name: الدكتور يوسف
رقم الجلوس 45

Section: 2-3
٢ , ٣ , ٤

Useful data: $N_A = 6.02 \times 10^{23}/\text{mol}$; $T(\text{K}) = T(^{\circ}\text{C}) + 273$.

ANSWER SHEET

- | | |
|---------------------------|----------------------------|
| 1. a (b) c d e | 10. a b (c) d e |
| 2. a b c d (e) | 11. a (b) c d e |
| 3. a (b) c d e | 12. a (b) c d e |
| 4. a b c d (e) | 13. a b c d (e) |
| 5. a b c (d) e | 14. a b c (d) e |
| 6. (a) b c d e | 15. (a) b c d e |
| 7. a b c (d) e | 16. a b c d (e) |
| 8. a b c d (e) | 17. a (b) c d e |
| 9. a (b) c d e | 18. a b (c) d e |

Q1) Which of the following represents a chemical change:

- a) Melting of solid H_2O
- c) Evaporation of liquid H_2O
- e) Condensation of H_2O vapor
- ☒ b) Separation of H_2O molecule into its atoms
- d) Mixing H_2O with oil

Q2) The result of $(3.8621 \times 1.5630) - 5.98$ is properly written as:

- ☒ a) 0.06
- b) 0.05646
- c) 0.056462
- d) 0.0565
- ☒ e) 0.056

Q3) how many centiliters (cL) are there in 35 microliters.

- a) 3.5×10^{-4} cL
- ☒ b) 3.5×10^5 cL
- c) 3.5 cL
- d) 3.5×10^{-3} cL
- ☒ e) 3.5×10^4 cL

Q4) The agreement of a particular value of measurement with the true value is called

- a) significance
- b) certainty
- c) precision
- d) error
- ☒ e) accuracy

Q5) How many protons, neutrons, and electrons, respectively, are present in an $^{27}_{13}\text{Al}$ isotope?

- a) 27, 14, 13
- b) 13, 13, 14
- c) 13, 27, 13
- ☒ d) 13, 14, 13
- e) 13, 14, 10

Q6) What is the name of MnSO_4 ?

- ☒ a) manganese(II) sulfate
- b) manganese(IV) sulfate
- c) manganese sulfate
- d) manganese(I) sulfate
- e) manganese disulfate

Q7) Which one of the following combinations of names and formulas is *incorrect*?

- a) CaCO_3 calcium carbonate
- b) NaClO_3 sodium chlorate
- c) Al_3PO_4 aluminum phosphate
- ☒ d) KNO_2 potassium nitrate
- e) MgO magnesium oxide

Q8) What is the chemical formula of diiodine pentaoxide?

- a) 2IO_5
- b) I_5O_2
- c) IO_5
- d) $(\text{IO}_5)_2$
- ☒ e) I_2O_5

Q9) How many grams of potassium are in 23.8 g of potassium dichromate, $K_2Cr_2O_7$?

a) 2.02 g

☒ b) 6.33 g

c) 4.04 g

d) 3.32 g g

e) 5.18 g

Q10) The number of oxygen atoms in 10.0 g of $Ca_3(PO_4)_2 \cdot 3H_2O$ is (molar mass = 364.3 g/mol):

a) 2.68×10^{23}

b) 6.78×10^{23}

☒ c) 1.82×10^{23}

d) 3.56×10^{23}

e) 7.38×10^{23}

Handwritten calculation for Q10:

$$10.0 \text{ g} \times \frac{1 \text{ mol}}{364.3 \text{ g}} \times \frac{13 \text{ mol O}}{1 \text{ mol}} \times \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol}} = 1.82 \times 10^{23} \text{ atoms}$$

Q11) A compound of bromine and fluorine contains 58.37 mass percent bromine. Determine its empirical formula.

a) BrF_2

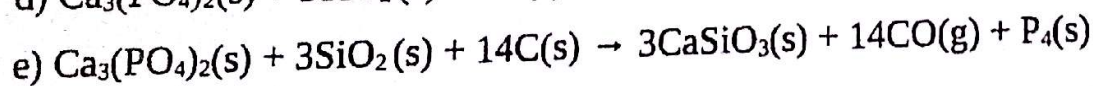
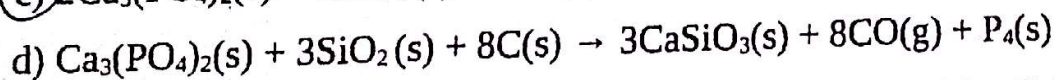
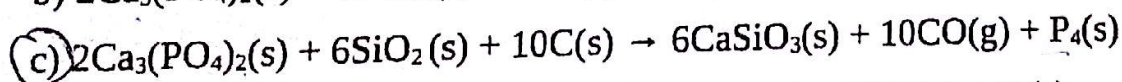
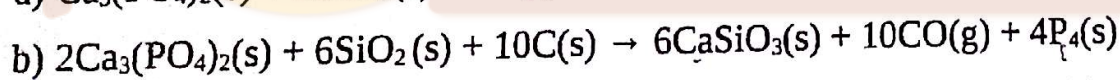
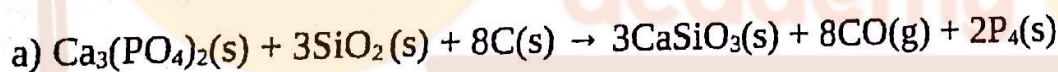
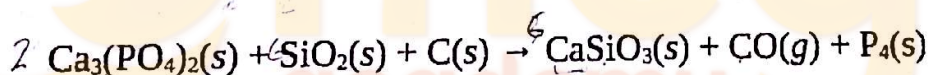
☒ b) BrF_3

c) Br_2F_3

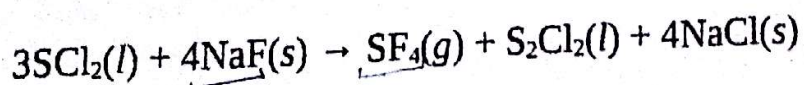
d) Br_3F

e) BrF

Q12) Balance the following equation:



Q13) How many grams of sodium fluoride (NaF) are needed to form 435 g of sulfur tetrafluoride (SF_4)?



a) 754 g

b) 831 g

c) 341 g

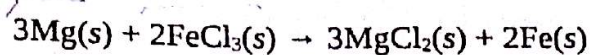
d) 909 g

☒ e) 676 g

Handwritten calculation for Q13:

$$435 \text{ g SF}_4 \times \frac{1 \text{ mol}}{108.07 \text{ g}} \times \frac{4 \text{ mol NaF}}{1 \text{ mol SF}_4} \times \frac{41.99 \text{ g}}{1 \text{ mol}} = 676 \text{ g NaF}$$

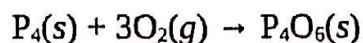
Q14) Magnesium reacts with iron(III) chloride to form magnesium chloride and iron.



A mixture of 41.0 g of magnesium (molar mass = 24.31 g/mol) and 145 g of iron(III) chloride (molar mass = 162.2 g/mol) is allowed to react. What mass of magnesium chloride, MgCl_2 , (molar mass = 95.21 g/mol) is formed

- a) 136 g b) 161 g c) 146 g **(d) 128 g** e) 154 g

Q15) Tetraphosphorus hexaoxide, P_4O_6 , (molar mass = 219.9 g/mol) is formed by the following reaction



If a mixture of 38.7 g of oxygen (molar mass = 32 g/mol) and excess phosphorus actually produce 54.3 g of P_4O_6 , what is the percent yield for the reaction?

- (a) 61.3%** b) 48.8% c) 26.3% d) 77.5% e) 37.6%

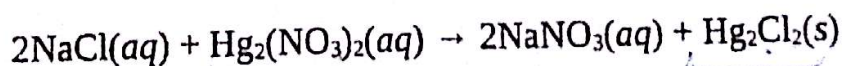
Q16) Which of the following compounds is a nonelectrolyte?

- a) KOH(aq) b) acetic acid, $\text{CH}_3\text{COOH(aq)}$ c) methanol, $\text{CH}_3\text{OH(aq)}$
d) sulfuric acid, $\text{H}_2\text{SO}_4\text{(aq)}$ **(e) ammonia, $\text{NH}_3\text{(aq)}$**

Q17) Which of the following salts is insoluble in water?

- a) CuSO_4 **(b) BaCO_3** c) CaCl_2 d) $\text{Pb(NO}_3)_2$ e) Ba(OH)_2

Q18) Select the net ionic equation for the reaction between sodium chloride and mercury(I) nitrate.



- a) $\text{Hg}_2\text{(NO}_3)_2\text{(aq)} \rightarrow \text{Hg}_2^{2+}\text{(aq)} + 2\text{NO}_3^-\text{(aq)}$
b) $\text{Na}^+\text{(aq)} + \text{NO}_3^-\text{(aq)} \rightarrow \text{NaNO}_3\text{(aq)}$
(c) $\text{Hg}_2^{2+}\text{(aq)} + 2\text{Cl}^-\text{(aq)} \rightarrow \text{Hg}_2\text{Cl}_2\text{(s)}$
d) $\text{Hg}_2^{2+}\text{(aq)} \rightarrow \text{Hg}_2\text{(s)}$
e) $\text{NaCl(aq)} \rightarrow \text{Na}^+\text{(aq)} + \text{Cl}^-\text{(aq)}$

First

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انيسه ابوراشد
على حل الاسئله

Q₁ :-

⑤ Separation of H₂O molecule into its atom .

Q₂ :-

⑥ 0.06

Q₃ :-

$$35 \times 10^{-6} \text{ L} \times \frac{\text{CL}}{10^{-2} \text{ L}} = 35 \times 10^{-4} \text{ CL}$$

⑥ 3.5×10^{-3}



Q₄ :-

① accuracy

Q₅ :-

⑥ 13, 14, 13

Q₆ :-

(b) manganese (II) Sulfate

Q₇ :-

(c) KNO₃ potassium nitrate

Q₈ :-

(a) I₂O₅



Q₉ :-

$$12.5 \text{ g} \times \frac{2(39) \text{ g/mol}}{2(39) + 2(52) + 7(16) \text{ g/mol}}$$

(c) 3.32

Q₁₀ :-

$$10.0 \text{ g} * \frac{1 \text{ mol (comp.)}}{364.3 \text{ g}} * \frac{11 \text{ mol (O}_2\text{)}}{1 \text{ mol (comp.)}} * 6.02 \times 10^{23}$$

Ⓐ 1.82×10^{23}

Q₁₁ :-

Suppose that total mass = 100 g

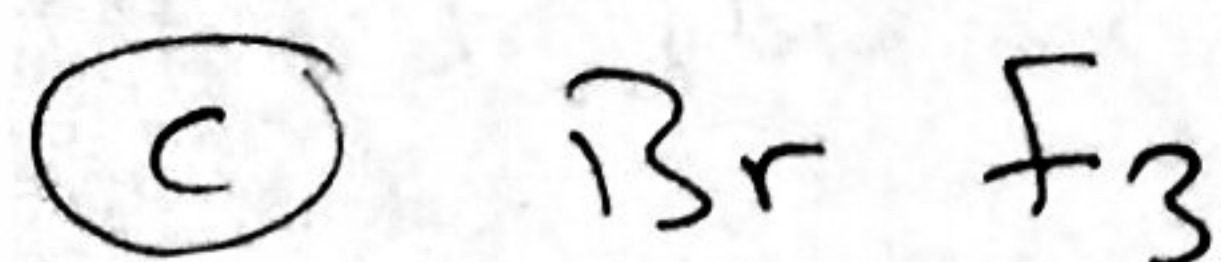
$$58.37 \text{ g (Br)} * \frac{\text{mol}}{80.00 \text{ g}} = 0.7296 \text{ mol}$$

$$41.63 \text{ g (F)} * \frac{\text{mol}}{19.00 \text{ g}} = 2.191 \text{ mol}$$

Br : F

$$\begin{array}{r} 0.7296 : 2.191 \\ \hline 0.7296 : 0.7296 \end{array}$$

1 : 3



Q₁₂ :-

(d)

Q₁₃ :-

M : molar mass

$$M(\text{NaF}) \approx 42 \text{ g/mol}$$

$$M(\text{SF}_4) \approx 108 \text{ g/mol}$$

$$485 \text{ g} \times \frac{\text{mol}(\text{SF}_4)}{108 \text{ g}} \times \frac{4 \text{ mol}(\text{NaF})}{(\text{mol}(\text{SF}_4))} \times \frac{42 \text{ g}}{\text{mol}(\text{NaF})}$$

(a) 754 g



Q₁₄ :-

$$175 \text{ g} \times \frac{\text{mol}}{162.2 \text{ g}} = 1.07 \text{ mol} \Rightarrow \text{Limiting Reactant} (\text{FeCl}_3)$$

$$40 \text{ g} \times \frac{\text{mol}}{24.31} = 1.68 \text{ mol} \Rightarrow (\text{Mg})$$

$$1.07 \text{ mol}(\text{FeCl}_3) \times \frac{3 \text{ mol}(\text{MgCl}_2)}{2 \text{ mol}(\text{FeCl}_3)} \times \frac{95.21 \text{ g}}{\text{mol}(\text{MgCl}_2)}$$

(e) 154 g

Q₁₅ :-

$$\% \text{ yield} = \frac{\text{Actual}}{\text{Calculated}} \times 100 \%$$

$$38.7 \text{ g } (\text{O}_2) \times \frac{\text{mol}(\text{O}_2)}{32 \text{ g}} \times \frac{1 \text{ mol } (\text{P}_4\text{O}_6)}{3 \text{ mol } (\text{O}_2)} \times \frac{219.9 \text{ g}}{\text{mol}(\text{P}_4\text{O}_6)} = 88.6 \text{ g}$$

$$\% \text{ yield} = \frac{43.3}{88.6} \times 100 \% = \textcircled{b} 48.8 \%$$



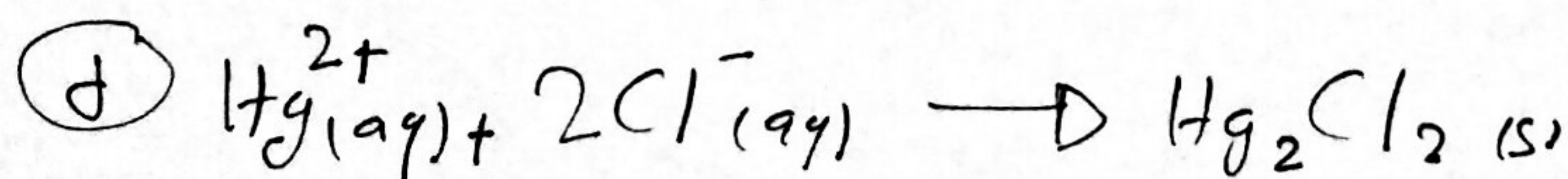
Q₁₆ :-

Ⓐ methanal, $\text{CH}_3\text{OH}(\text{aq})$

Q₁₇ :-

Ⓒ BaCO_3

Q₁₈ :-



First

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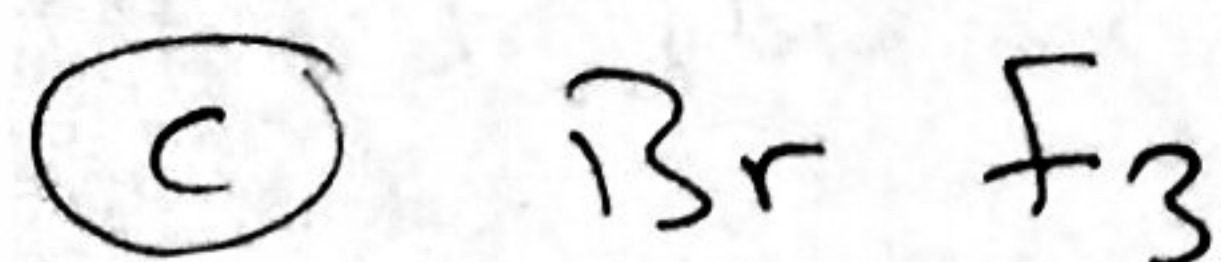
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