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) $Fe_2(PO_4)_3$ d) $Fe_3(PO_4)_3$ e) $FePO_4$

5. For the isotope ${}^{59}_{27}X$ .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) C_2H_3O
b) C_2H_6O
c) $C_3H_5O_2$
d) C_2H_4O
e) C_2H_5O

Q1: answer: c) density

Q2: $(1.00 - 0.01) \times 2500 / 12.0$

$= 0.99 \times 2.500 / 12.0 = 2.475 / 12.0$

$= 0.20625$

$= 0.21$

Q3: $32 \times \frac{1609}{3600} = 14.3$ which is a

Q4: $FePO_4$ which is e

Q5: protons = 27, neutrons = 59 − 27 = 32

b) 27 and 32

Q6: answer: c) Dinitrogen trioxide

Q7: $\frac{4\ 0.08}{6.022 \times 10^{23}} = 6.656 \times 10^{23}$ which is b

Q8: mass percentage $Cl = \frac{2 \times 35.45}{2 \times 35.45 + 40.08} = 63.89\%$

mass $Cl_2 = 14.6 \times 0.6389 = 9.33\ g$ which is a

10. Balance the following equation:

$$a\ Be_2C + b\ H_2O \rightarrow c\ Be(OH)_2 + d\ CH_4$$

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 Li(s) was reacted with 14.85 g of $N_2(g)$ according to the equation: $N_2(g) + 6\ Li(s) \rightarrow 2\ Li_3N(s)$

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

Atomic masses: Li = 6.942 and 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) $(NH_4)_2CO_3$ d) Na_2S e) $AgNO_3$

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

a) $NaCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

b) $Cl_2(g) + 2HI(g) \rightarrow 2HCl(g) + I_2(g)$

c) $Ba(OH)_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaOH(aq)$

d) $CH_4(g) + 2O_2(g) \rightarrow 2H_2O(g) + CO_2(g)$

e) $Na_2CO_3(s) + 2\ HCl(aq) \rightarrow H_2O(l) + CO_2(g) + 2\ NaCl(aq)$

Q9: Q10

$Be_2C + 4H_2O \rightarrow 2Be(OH)_2 + CH_4$

$J=4 \rightarrow J=1 \Rightarrow$ answer: e) 4/1

Q9:

	C	H	O
moles in 100g:	4.54	9.02	2.28
ratio :	1.99	3.96	1.00

formula is d) C_2H_4O

Q 11:

moles $Li = \frac{13.5}{6.942} = 1.945$

moles $N_2 = \frac{14.85}{14.01 \times 2} = 0.530$

actual moles $Li_3N = \frac{11.6}{3 \times 6.942 + 14.01} = 0.333$

$2 \times 0.530\ N_2 \rightarrow 1.06$ moles Li_3N

$\frac{1}{3} \times 1.945\ Li \rightarrow 0.64822$ moles Li_3N

Li is limiting reactant $\rightarrow$ $Li_3N = 0.64822$ moles

percent yeild $= \frac{0.333}{0.64822} \times 100\% = 51.4\%$

Q12: answer is: b) $FeCO_3$

Q13: answer: e) $Na_2CO_{3(s)} + 2HCl_{(aq)} \rightarrow H_2O_{(l)} + CO_{2(g)} + 2NaCl_{(aq)}$

14. Balance the following redox reaction in acidic solution:

$$a\ H_2C_2O_4 + b\ MnO_4^- \rightarrow c\ CO_2 + d\ Mn^{2+}$$

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 1.500M H_3PO_4 to produce $Ba_3(PO_4)_2$?

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

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 $CaSO_4$ = 136.14 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}

Q14 : oxidation half : $H_2C_2O_4 \rightarrow CO_2$

C oxidized from +3 to +4

oxidation half	reduction half
$H_2C_2O_4 \rightarrow CO_2$	$MnO_4^- \rightarrow Mn^{+2}$
C : +3 → +4	Mn : +1 → +2
with oxygen: $H_2C_2O_4 \rightarrow 2CO_2$	$MnO_4^- \rightarrow Mn^{2+} + 4H_2O$
with hydrogen: $H_2C_2O_4 \rightarrow 2CO_2 + 2H^+$	$8H^+ + MnO_4^- \rightarrow Mn^{2+} + 4H_2O$
$H_2C_2O_4 \rightarrow 2CO_2 + 2H^+ + 2e^-$	$5e^- + 8H^+ + MnO_4^- \rightarrow Mn^{+2} + 4H_2O$

~~5x~~ ~~2x~~

$5H_2C_2O_4 \rightarrow 10CO_2 + 10H^+ + 10e^-$

and $10e^- + 16H^+ + 2MnO_4^- \rightarrow 2Mn^{+2} + 8H_2O$

$5H_2C_2O_4 + 2MnO_4^- + 6H \rightarrow 2Mn^{+2} + 10CO_2 + 8H_2O$

d/c = c) 2/20

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}; $^{o}C = (^{o}F - 32) \times (5/9)$.

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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)** °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,

$$x\,CCl_4 + SbF_3 \longrightarrow CCl_2F_2 + SbCl_3$$

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 $Ni(BrO_4)_2$ 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

Q1: $(3.28 + 2.8395) \times (1.00 + 4.5) / 23.95$

$= 6.1195 \times 5.5 / 23.95$

$= 6.1195 \times 0.2296$

$= 1.405 \rightarrow$ c) 1.4

Q2: $10 \times \frac{9}{5} + 32 \rightarrow$ a) 14

Q3: $34.968x + (1-x)36.956 = 35.46$

$x = 0.7525$ | answer: e) 75.25%

Q4: $3\,CCl_4 + 2\,SbF_3 \rightarrow 3\,CCl_2F_2 + 2\,SbCl_3$

Q5: answer: c) Nickel(II) perbromate

Q6: answer: a) Sulfur trioxide

Q7: $\text{moles} = \frac{9.96 \times 10^{-3}}{126.05} = 7.9 \times 10^{-5}$ moles

$2Na^+$ for each Na_2SO_3 atom

number of ions $= 2 \times 7.9 \times 10^{-5} \times 6.022 \times 10^{23} = 9.52 \times 10^{19}$

which is c

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 $Al_2(SO_4)_3$ 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- C_2H_6O b- CHO c- $C_4H_{13}O_2$ 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.

$$3\ NO_{2(g)} + H_2O_{(l)} \rightarrow 2\ HNO_{3(aq)} + NO_{(g)}$$

a- 38.0 g b- 10.9 g c- 4 3.4 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: N_2O_4 = 92.02g/mol, N_2H_4 = 32.05 g/mol.

$$N_2O_{4\,(l)} + 2\ N_2H_{4\,(l)} \rightarrow 3\ N_{2\,(g)} + 4\ H_2O_{(g)}$$

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

Q8: • %mass perc = $\frac{3 \times 32.065}{(26.98 \times 2 + 32.065 \times 3 + 16 \times 4 \times 3)} \times 100\%$

= a) 28.1%

Q9: moles in 100 g: C 4.34 | H 13.03 | O 2.17

ratio : 2 | 6 | 1

formula: a) C_2H_6O

Q10: atomic mass HNO_3 = 1 + 17 + 16×3 = 63

moles HNO_3 = $\frac{56.9}{63}$ = 0.9032

•

1 H_2O → 2 HNO_3

x H_2O → 0.9032 HNO_3

$x = \frac{1}{2} \times 0.9032 = 0.4516$ moles H_2O

grams H_2O = 0.4516 × 18 = 8.13 g

Q11: moles N_2O_4 = $\frac{46}{92.02}$ = 0.543, moles N_2H_4 = $\frac{45}{32.05}$ = 1.404

$N_2O_4 \rightarrow 3N_2$ 0.543 $N_2O_4 \rightarrow$ 1.629 N_2

0.543 → x

$2N_2H_4 \rightarrow 3N_2$

1.404 → x

$\Rightarrow x = 2.106$ N_2

answer is

d) LR is N_2O_4, 45.7 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- $Ba(OH)_2$

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

a- $BF_3 \rightarrow BF_4$ b- $SO_2 \rightarrow CaSO_3$

c- $H_2O_2 \rightarrow H_2O$ d- $H_{2(g)} \rightarrow H_{2(l)}$

e- $Ti^{3+} \rightarrow TiO^{+2}$

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

a- $HNO_{2\,(aq)} + LiOH_{(aq)} \rightarrow LiNO_{2\,(aq)} + H_2O_{(l)}$

b- $HNO_{2(aq)} + LiOH_{(aq)} \rightarrow Li^{+}_{(aq)} + NO_2^{-}{}_{(aq)} + H_2O_{(l)}$

c- $HNO_{2(aq)} + OH^{-}_{(aq)} \rightarrow NO_2^{-}{}_{(aq)} + H_2O_{(l)}$

d- $H^{+}_{(aq)} + NO^{2-}_{(aq)} + Li^{+}_{(aq)} + OH^{-}_{(aq)} \rightarrow Li^{+}_{(aq)} + NO_2^{-}{}_{(aq)} + H_2O_{(l)}$

e- $H^{+}_{(aq)} + OH^{-}_{(aq)} \rightarrow H_2O_{(l)}$

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

$$MnO_4^- + I^- \rightarrow MnO_2 + I_2$$

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

Q12: answer: a) Hg_2Cl_2

Q13: answer: a) $BF_3 \longrightarrow BF_4^-$

BF_3 : $+3 + 3(-1) = 0$ → BF_4^- : $+4 - 4 = 0$

B^{+3} ——————→ B^{+4}

Q14: answer is: c)

c) $HNO_{2(aq)} + OH^-_{(aq)} \rightarrow NO_2^-{}_{(aq)} + H_2O_{(l)}$

Q15:

$3\,(2I^- \rightarrow I_2 + 2e^-)$

$2\,(MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O)$

$6I^- + 2MnO_4^- + 8H^+ + 6e^- \rightarrow 3I_2 + 2MnO_2 + 4H_2O + 6e^-$

$6I^- + 2MnO_4^- + 8H^+ \rightarrow 3I_2 + MnO_2 + 4H_2O$

$6I^- + 2MnO_4^- + 8H^+ + 8OH^- \rightarrow 3I_2 + 2MnO_2 + 4H_2O + 8OH^-$

$6I^- + 2MnO_4^- + 8H_2O \rightarrow 3I_2 + 2MnO_2 + 4H_2O + 8OH^-$

$6I^- + 2MnO_4^- + 4H_2O \rightarrow 3I_2 + 2MnO_2 + 8OH^-$

answer: a) 6/8

Q16: moles $H_3PO_4 = 0.145 \times 25 \times 10^{-3} = 3.62 \times 10^{-3}$

moles $NaOH = 3.62 \times 10^{-3} \times 3 = 1.0875 \times 10^{-2}$

volume $NaOH = \frac{1.0875 \times 10^{-2}}{0.675} = 16.1 \times 10^{-3}$ liter

General Chem. 101
First Exam

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

Name: …….. Reg. No.: ……..
Instructor Name: …… Seat No.: ……..

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

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

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

$$(15.562 - 15.512) \times 100.0$$

a) 5 b) 5.0 c) 5.5 d) $5x10^{o}$ e) $5.0x10^{1}$

2. Convert $3.6x10^{-2}$ g/L to mg/cm^3.

a) $3.6x10^{2}$ b) $3.6x10^{-1}$ c) $3.6x10^{-2}$
d) $3.6x10^{-5}$ e) $3.6x10^{-3}$

3. The boiling point of a liquid substance is 77.0 K. What is this temperature in Fahrenheit?

a) -321 b) -289 c) -353 d) 139 e) 171

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

a) Cu_2PO_4 b) $Cu_3(PO_4)_2$ c) Cu_2PO_3
d) $Cu(PO_4)_2$ e) $Cu(PO_3)_2$

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

a) KBr b) HBr c) HBrO d) $HBrO_2$ e) $HBrO_3$

6. Calculate the number of moles of copper in 2.50 kg copper

a) 39.5 b) $3.93x10^{-2}$ c) 3.93 d) 39.7 e) 39.3

Q1: $(15.562 - 15.512) \times 100.0 = 0.050 \times 100.0$

$= 5.0$ which is b

Q2: $3.6 \times 10^{-2} \times \frac{1}{1} =$ c) 3.6×10^{-2}

Q3: $(77 - 273) \times \frac{9}{5} + 32 = -321\ F^\circ$ which is a

Q4: anwser is b) $Cu_3(PO_4)_2$

Q5: anwser is: d) $HBrO_2$

Q6: $\frac{32.5 \times 10^3}{63.546} = 39.3$ which is c

Q7:

	Cl	O
moles in 100 g	1.49	2.94
ratio	1	1.97

anwser: c) ClO_2

Q8: moles $H_2O = \frac{165}{18} = 9.167$,

2 meth $\longrightarrow$ 4 H_2O

$x \longrightarrow 9.167$

$x = \frac{1}{4} \times 9.167$

$= 4.5835$ moles CH_3OH

mass $CH_3OH = 4.5835 \times 32.043$

$= 147$

which is a

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

a) ClO b) Cl_2O c) ClO_2 d) Cl_2O_5 e) Cl_2O_3

8. Methanol burns up in air according to

$$2\ CH_3OH + 3\ O_2 \rightarrow 2\ CO_2 + 4\ H_2O$$

What mass of methanol should burn to produce 165 g H_2O?

a) 147 b) 165 c) 393 d) 73.3 e) $1.4x10^2$

9. According to the reaction

$$NO + O_3 \rightarrow O_2 + NO_2$$

If 0.670 g NO reacts with 0.740 g O_3, how many grams of NO_2 will be produced?

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

10. Given $6Li_{(s)} + N_{2(g)} \rightarrow 2\ Li_3N_{(s)}$. If 12.3 g of Li react with 33.6 g of N_2 to produce 14.0 g Li_3N 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) $CuCl_2$ will precipitate; Ba^{2+} and SO_4^{2-} are spectator ions.
b) $CuSO_4$ will precipitate; Ba^{2+} and Cl^- are spectator ions.
c) $BaSO_4$ will precipitate; Cu^{2+} and Cl^- are spectator ions.
d) $BaSO_4$ will precipitate; Cu^{2+} and SO_4^{2-} are spectator ions.
e) No precipitate will form.

Q8: moles $NO = \frac{0.67}{14+16} = 0.0223$, moles $O_2 = \frac{0.74}{16\times2} = 0.01542$

O_2 is limiting reactant

$0.01542\ O_2 \longrightarrow 0.01542\ NO_2$

grams $NO_2 = 0.01542 \times (14 + 16\times2) = 0.709$

Q10: moles $N_2 = \frac{33.6}{14\times2} = 1.2$, moles $Li = \frac{12.3}{6.941} = 1.772$

$N_2 \longrightarrow 2Li_3N \rightarrow 2.4$ moles Li_3N

$6Li \longrightarrow 2Li_3N \longrightarrow 0.591$ moles Li_3N

theoretical mass $Li_3N = 0.591 \times (3\times6.941 + 14) = 20.58$

yeild percent $= \frac{14.0}{20.58} \times 100 = 68.0$

Q11: $Ba^{2+} + 2Cl^- + Cu^{2+} + SO_4^{2-} \longrightarrow BaSO_{4(s)} + Cu^{2+} + 2Cl^-$

answer is c) $BaSO_4$ will precipitate;

Cu^{2+} and Cl^- are spectator ions

Q12: $1 + x - 2\times3 = 0 \Rightarrow$

$x - 5 = 0$

$x = 5$

answer is b) +5

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) $3\ Al + 6\ HCl \rightarrow 3\ H_2 + AlCl_3$
b) $2\ H_2O \rightarrow 2\ H_2 + O_2$
c) $2\ NaCl + Pb(NO_3)_2 \rightarrow PbCl_2 + 2\ NaNO_3$
d) $2\ NaI + Br2 \rightarrow 2\ NaBr + I_2$
e) $Cu(NO_3)_2 + Zn \rightarrow Zn(NO_3)_2 + Cu$

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?

$$MnO_4^- + I^- \rightarrow MnO_2 + IO_3^- \text{ (basic solution)}$$

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 $MgCl_2$ = 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 $Ba(OH)_2$ solution?

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

Q13: answer: c) $2NaCl + Pb(NO_3) \rightarrow PbCl_2 + 2NaNO_3$

Q14:

oxidation

$I^- \rightarrow IO_3^- + 6^-$

$I^- + 6OH^- \rightarrow IO_3^- + 6e^-$

$I^- + 6OH^- \rightarrow IO_3^- + 6e^- + 3H_2O$

~~$I^- + 6OH^- \rightarrow IO_3^-$~~

reduction

$MnO_4^- + e \rightarrow MnO_4^{2-}$

$MnO_4^- + e^- \rightarrow MnO_4^{2-}$

$6MnO_4^- + 6e^- \rightarrow 6MnO_4^{2-}$

$I^- + 6MnO_4^- + 6OH^- + 6e \rightarrow IO_3^- + 6MnO_4^{2-} + 6e + 3H_2O$

$I^- + 6MnO_4^- + 6OH^- \rightleftharpoons IO_3^- + 6MnO_4^{2-} + 3H_2O$

answer: e) none of these

Q15: $M = \frac{n}{L} \Rightarrow n = M \times L = 2.8 \times 0.5 = 1.4$

grams $MgCl_2 = 95.2 \times 1.4 = \underline{133}$

Q16: $2HNO_3 + Ba(OH)_2 \rightarrow Ba(NO_3)_2 + 2H_2O$

moles $Ba(OH)_2 = 125 \times 10^{-3} \times 0.012 = 0.0015$

1 $Ba(OH)_2 \rightarrow 2HNO_3$; $x = 0.0015 \times 2 = 0.003$

0.0015 $\rightarrow$ x

liters $HNO_3 = \frac{0.003}{0.276} = \underline{10.9 \text{ mL}}$

The University of Jordan
Department of Chemistry

General Chemistry I (0303101)
First Midterm Exam – Fall 2015/2016

Date: 7/11/2015 **Time: 60 min**

Name in Arabic: **Reg. No.:**

Instructor Name: **Section:**

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

ANSWER SHEET

1.	a	b	c	d	e
2.	a	b	c	d	e
3.	a	b	c	d	e
4.	a	b	c	d	e
5.	a	b	c	d	e
6.	a	b	c	d	e
7.	a	b	c	d	e
8.	a	b	c	d	e
9.	a	b	c	d	e
10.	a	b	c	d	e
11.	a	b	c	d	e
12.	a	b	c	d	e
13.	a	b	c	d	e
14.	a	b	c	d	e
15.	a	b	c	d	e
16.	a	b	c	d	e
17.	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
b) Separation of H_2O molecule into its atoms
c) Evaporation of liquid H_2O
d) Mixing H_2O with oil
e) Condensation of H_2O vapor

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}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) $(IO_5)_2$ 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 $Ca_3(PO_4)_2 3H_2O$ 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}

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:

$$Ca_3(PO_4)_2(s) + SiO_2(s) + C(s) \rightarrow CaSiO_3(s) + CO(g) + P_4(s)$$

a) $Ca_3(PO_4)_2(s) + 3SiO_2(s) + 8C(s) \rightarrow 3CaSiO_3(s) + 8CO(g) + 2P_4(s)$

b) $2Ca_3(PO_4)_2(s) + 6SiO_2(s) + 10C(s) \rightarrow 6CaSiO_3(s) + 10CO(g) + 4P_4(s)$

c) $2Ca_3(PO_4)_2(s) + 6SiO_2(s) + 10C(s) \rightarrow 6CaSiO_3(s) + 10CO(g) + P_4(s)$

d) $Ca_3(PO_4)_2(s) + 3SiO_2(s) + 8C(s) \rightarrow 3CaSiO_3(s) + 8CO(g) + P_4(s)$

e) $Ca_3(PO_4)_2(s) + 3SiO_2(s) + 14C(s) \rightarrow 3CaSiO_3(s) + 14CO(g) + P_4(s)$

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

$$3SCl_2(l) + 4NaF(s) \rightarrow SF_4(g) + S_2Cl_2(l) + 4NaCl(s)$$

a) 754 g b) 831 g c) 341 g d) 909 g e) 676 g

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

$$3Mg(s) + 2FeCl_3(s) \rightarrow 3MgCl_2(s) + 2Fe(s)$$

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

$$P_4(s) + 3O_2(g) \rightarrow P_4O_6(s)$$

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, $CH_3COOH(aq)$ c) methanol, $CH_3OH(aq)$
d) sulfuric acid, $H_2SO_4(aq)$ e) ammonia, $NH_3(aq)$

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

a) $CuSO_4$ b) $BaCO_3$ c) $CaCl_2$ d) $Pb(NO_3)_2$ e) $Ba(OH)_2$

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

$$2NaCl(aq) + Hg_2(NO_3)_2(aq) \rightarrow 2NaNO_3(aq) + Hg_2Cl_2(s)$$

a) $Hg_2(NO_3)_2(aq) \rightarrow Hg_2^{2+}(aq) + 2NO_3^-(aq)$
b) $Na^+(aq) + NO_3^-(aq) \rightarrow NaNO_3(aq)$
c) $Hg_2^{2+}(aq) + 2Cl^-(aq) \rightarrow Hg_2Cl_2(s)$
d) $Hg_2^{2+}(aq) \rightarrow Hg_2(s)$
e) $NaCl(aq) \rightarrow Na^+(aq) + Cl^-(aq)$

16

General Chem. 0303101
First Exam

Date: 03/04/2014
Time: 60 min...

Name: ..... Reg. No.: .....
Instructor Name: ..... Seat No.: .....

$N_A = 6.022 \times 10^{23}$, $^{\circ}F = (^{\circ}C \times \frac{9}{5}) + 32$, $K = {}^{\circ}C + 273$

ANSWER SHEET

1.	a	b	c	d	e	11.	a	b	c	d	e
2.	a	b	c	d	e	12.	a	b	c	d	e
3.	a	b	c	d	e	13.	a	b	c	d	e
4.	a	b	c	d	e	14.	a	b	c	d	e
5.	a	b	c	d	e	15.	a	b	c	d	e
6.	a	b	c	d	e	16.	a	b	c	d	e
7.	a	b	c	d	e	17.	a	b	c	d	e
8.	a	b	c	d	e	18.	a	b	c	d	e
9.	a	b	c	d	e	19.	a	b	c	d	e
10.	a	b	c	d	e	20.	a	b	c	d	e

1. Which one of these represents a *physical* change?

(a) apples, when exposed to air, turn brown
(b) water, when heated, forms steam
(c) bleach turns hair yellow
(d) sugar, when heated, becomes brown
(e) milk turns sour

0.0092 $91.95 \times 10^{-4} = 92.0 \times 10^{-4}$

2. The correct answer with the right number of significant figures for the following operation is:

$(1.50 \times 10^{-4} \times 61.3) + 2.01 =$

(a) 2.0192 (b) 2.019 (c) 2.0 (d) 2.02 (e) 2.019195

3. The SI prefixes *kilo* and *micro* represent, respectively:

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

4. Some molecules move with speed of 6.5 miles per second. What is this speed in cm/h? (1.00 mile = 1609 m)

(a) 3.8×10^{9} (b) 2.6×10^{9} (c) 2.0×10^{9} (d) 1.1×10^{6} (e) 4.1×10^{9}

$$\frac{6.5 \times 1609\ m}{\frac{1}{3600}\ h} =$$

5. Atoms of the same element with different mass numbers are called

(a) ions (b) neutrons (c) allotropes (d) chemical families (e) isotopes

6. The correct name for $Ba(OH)_2$ is

(a) barium hydrogen oxide. (b) boron hydroxide.
(c) beryllium hydroxide. (d) barium hydroxide.
(e) barium hydrate.

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

(a) Cu_2PO_4 (b) $Cu_3(PO_4)_2$ (c). Cu_2PO_3 (d). $Cu(PO_4)_2$ (e). $Cu(PO_3)_2$

8. The accurate atomic masses of the two stable isotopes of indium, $^{113}_{49}In$ and $^{115}_{49}In$ are 112.904061 and 114.90388 g/mol respectively. Knowing that the average atomic mass of indium is 114.818 g/mol, calculate the percentage of $^{113}_{49}In$.

(a) 93.7% (b) 57.0% (c) 1.80% (d) 10.3% (e) 4.29%

9. A compound was discovered whose composition by mass is 90.0% C and 10.0% H. Which of these choices could be the molecular formula of this compound?
The molar masses of H and C are (H=1.000, C=12.00)

(a) CH_4 (b) C_2H_4 (c) C_3H_4 (d) C_2H_6 (e) C_3H_8

10. What is the mass, in grams, of one copper atom (Mm= 63.55 $g.mol^{-1}$)?

(a) 1.06×10^{-22} (b) 9.3×10^{-23} (c) 7.5×10^{-23} (d) 8.04×10^{-21} (e) 1.24×10^{-22}

11. What is the mass percentage of aluminum in $KAl(SO_4)_2$?
The molar masses are (K=39.10, O=16.00, C=12.00, S=32.00)

(a) 15.38 (b) 10.43 (c) 24.73 (d) 49.46 (e) 128.0

12. A sample of Na_2CO_3 contains 3.50 moles of sodium. What is the mass of the sample (grams)? The molar masses are (O=16.00, C=12.00, Na=23.00)

(a) 6.40 (b) 132.5 (c) 185.5 (d) 13.25 (e) 23.85

13. Ammonia reacts with diatomic oxygen to form nitric oxide and water vapor:

$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

When 30.0 g NH_3 and 80.0 g O_2 are allowed to react, what is the amount of NO produced (grams)? The molar masses are (O=16.00, H=1.000, N=14.00)

(a) 52.9 (b) 26.5 (c) 11.2 (d) 29.5 (e) 37.5

14. Which of these compounds is a *nonelectrolyte*?

(a) NaF (b) HNO_3 (c) CH_3COOH (d) NaOH (e) $C_6H_{12}O_6$(glucose)

15. Based on the solubility rules, which one of these compounds should be *insoluble* in water?

(a) Na_2SO_4 (b) $CuSO_4$ (c) $MgSO_4$ (d) $BaSO_4$ (e) $ZnSO_4$

16. Which of these choices is the correct *net ionic equation* for the reaction that occurs when solutions of $Pb(NO_3)_2$ and NH_4Cl are mixed?

(a) $NH_4^+(aq) + NO_3^-(aq) \rightarrow 2NH_4NO_3(s)$
(b) $Pb^{2+}(aq) + 2Cl^-(aq) \rightarrow PbCl_2(s)$
(c) $Pb(NO_3)_2(aq) + 2NH_4Cl(aq) \rightarrow NH_4NO_3(aq) + PbCl_2(s)$
(d) $Pb^{2+}(aq) + 2NO_3^-(aq) + 2NH_4^+(aq) + 2Cl^- \rightarrow 2NH_4^+(aq) + 2NO_3^-(aq) + PbCl_2(s)$
(e) No reaction occurs when the solutions are mixed.

17. How many grams of sodium are in 500 mL of 0.600 M Na_2CO_3 (aq) solution? The molar masses are (Na=23.00, C=12.00, O=16.00)

(a) 6.90 (b) 13.1 (c) 11.9 (d) 10.4 (e) 13.8

18. Which one of these equations describes a *redox* reaction?

(a) $2KBr(aq) + Pb(NO_3)_2(aq) \rightarrow 2KNO_3(aq) + PbBr_2(s)$
(b) $CO_3^{2-}(aq) + HSO_4^-(aq) \rightarrow HCO_3^-(aq) + SO_4^{2-}(aq)$
(c) $2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$
(d) $CaBr_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HBr(g)$
(e) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

19. A 34.62 mL of 0.1510 M NaOH was needed to neutralize 75.0 mL of an H_2SO_4 solution. What is the concentration of the sulfuric acid solution (*M*)?

(a) 0.03478 (b) 0.075 (c) 0.131 (d) 0.209 (e) 0.0523

20. The temperature of a metal bar is 50°C, what is the temperature in °F?

(a) 230 (b) 0.075 (c) 86 (d) 122 (e) 194

16

General Chem. 101
First Exam

Date: 3/4/2013
Time: 60 min

Name: ..... Reg. No.: 0129415
Instructor Name: ..... Seat No.: .....

$N_A = 6.022 \times 10^{23}\ mol^{-1}$

(For molar masses always use the provided periodic table)

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
						17.	a	b	c	d	~~e~~

1. Perform the following operations and choose the answer with the correct number of significant figures

$$(5.673 \times 3.42) + 2.0$$

19.4 + 2.0

a) 20.4 b) 2.0×10^1 c) 21.41 d) 21.412 e) 21.4

2. Convert 3.78×10^5 mg to pound (lb). (1 lb = 453.6 g)

$3.78 \times 10^5 \text{ mg} \times \frac{1 \text{ lb}}{453.6 \text{ g}} \times \frac{1 \text{ g}}{10^3 \text{ mg}}$

③ $\frac{3.78 \times 10^2}{453.6} = 8.34 \times 10^{-1} = 0.833$

a) 0.0833 b) 0.833 c) 8.33 d) 83.3 e) 833

3. Sugar is an example of a(n):

a) element b) homogeneous mixture c) heterogeneous mixture
d) compound e) physical property

4. The name of Na_2HPO_4 is:

a) Sodium hydrogenphosphate b) Sodium phosphate c) Sodium (II) phosphate
d) Sodium perphosphate e) Disodium hydrogenphosphate

5. Write the formula of disulfur dinitride: S_2N_2

a) S_2N b) S_3N_2 c) S_2N_2 d) S_4N_2 e) $S_4(NO)_4$

ClO_2^- ite → ous

6. The name of $HClO_2$ is:

a) Hydrochloric acid
b) Chlorous acid
c) Chloric acid
d) Perchloric acid
e) Hypochlorous acid

7. An element (X) has two isotopes that exist in nature in the following masses and relative abundances: ^{28}X (mass= 27.977 amu, abundance= 92.223%) and ^{29}X (mass= 28.976 amu, abundance= 7.777%). The average atomic mass (in amu) of the element X is:

a) 27.977
b) 28.098
c) 28.976
d) 28.000
e) 28.055

8. Which of the following atoms has the same number of protons, neutrons and electrons?

a) $^{37}_{17}Cl$
b) $^{35}_{17}Cl$
c) $^{22}_{12}Mg$
d) $^{24}_{12}Mg$
e) $^{47}_{24}Cr$

9. What is the mass of one argon (^{36}Ar) atom in grams? Given that the atomic mass of argon is 35.968 amu and Avogadro's number is $6.02\times10^{23}\ mol^{-1}$.

a) 5.97×10^{-23}
b) 5.9748×10^{-22}
c) 5.97×10^{0}
d) 1.6737×10^{22}
e) 1.67×10^{22}

$n = \frac{mass}{m_m}$, $n = \frac{N.o}{At} = \frac{1}{6.02\times10^{23}} = 0.166\times10^{-23}\ mol$

$0.166\times10^{-23}\ (35.968) = 5.97\times10^{-23}$

% C = 64.3% → $\frac{64.3\text{ g}}{12.011}$ = 5.35 mol

% H = 7.14% → $\frac{7.14\text{ g}}{1.0079}$ = 7.08 mol

% O = 28.6% → $\frac{28.6\text{ g}}{15.999}$ = 1.79 mol

$\frac{C}{1.79}$ $\frac{H}{1.79}$ $\frac{O}{1.79}$

C_3 H_4 O_1

10. An unknown organic compound was analyzed and the mass percent of the constituent atoms were: 64.3% carbon; 7.14% hydrogen; 28.6% oxygen The empirical formula of this compound is

a) $C_3H_4O_2$ b) C_6H_3O c) C_3H_4O d) C_3H_6O e) $C_3H_6O_2$

1 mol CH_3OH → 1 mol HCHO

0.4575 → ?

= 0.4375 mol. × 30.0 = 13.125 g

11. Consider the following reaction:

$\frac{14.0}{32.0}$ = 0.219 1.12 $\frac{10.0}{32.0}$ = 0.3

	$2\,CH_3OH$	+	O_2	→	$2\,CH_2O$	+	$2\,H_2O$
	Methanol				Formaldehyde		
Molar mass (g/mol) =	32.0		32.0		30.0		18.0

In a test, 14.0 g of methanol and 10.0 g of oxygen were put into the reaction. The amount (in g) of formaldehyde that can be produced by this mixture is:

a) 13.1 b) 14.1 c) 6.55 d) 7.50 e) 15.0

12. Which of the following solutions has the **least** electrical conductance?

a) $KNO_3(aq)$ b) sucrose, $C_{12}H_{22}O_{11}(aq)$ c) $NaCl(aq)$
d) $LiOH(aq)$ e) $H_2SO_4(aq)$

13. In the following reaction, what are the spectator ions?

$$Pb(NO_3)_2(aq) + 2NaCl(aq) \rightarrow PbCl_2(s) + 2NaNO_3(aq)$$

a) $Na^+(aq)$, $Cl^-(aq)$ b) $Pb^{2+}(aq)$, $Cl^-(aq)$ c) $Pb^{2+}(aq)$, $NO_3^-(aq)$
d) $Na^+(aq)$, $NO_3^-(aq)$ e) $NO_3^-(aq)$, $Cl^-(aq)$

$Pb^{+2} + 2Na^+ + 2Cl^- \rightarrow PbCl_2 + 2Na^+ + 2NO_3^-$

$Pb^{+2} + 2Cl^- \rightarrow PbCl_2$

S = +6

2S = 12

2S + 2 + -14 = 0

2 + 2S + (-2)7 = 0

14. Calculate the oxidation number of sulfur, S, in the formula: $Na_2S_2O_7$.

a) –2 b) +2 c) +4 d) +5 e) +6

15. How much of 1.20 *M* NaOH will be needed to neutralize 168 mL of 3.0 *M* H_2SO_4?

$$H_2SO_4(aq) + 2NaOH(aq) \rightarrow 2H_2O(l) + Na_2SO_4(aq)$$

a) 1.8 L b) 0.42 L c) 0.84 L d) 0.90 L e) 1.1 L

1 H_2SO_4 → 2 NaOH 1 $M_{H_2SO_4}V$ = 2 $M_{NaOH}V$ 1.008

0.504 → 2.4 x V 0.504 = 2.4 V

16. The **oxidizing agent** in the following redox reaction is,

$$Hg^{2+}(aq) + Cu(s) \rightarrow Cu^{2+}(aq) + Hg(l)$$

a) Hg(*l*) b) $Hg^{2+}(aq)$ c) $Cu^{2+}(aq)$ d) Cu(*s*) e) $Hg^{2+}(aq)$ and $Cu^{2+}(aq)$

17. In balancing the following reaction in a acidic medium

$$H^+ + As_2O_3 + Zn \rightarrow AsH_3 + Zn^{2+} + H_2O$$

The of coefficients of As_2O_3 is

a) 12 b) 6 c) 2 d) 3 e) 1

$12e^- + 12H^+ + As_2O_3 \rightarrow 2AsH_3 + 3H_2O$

$6Zn + H^+ \rightarrow 6Zn^{+2} + 12e^-$

$12H^+ + As_2O_3 + 6Zn \rightarrow 2AsH_3 + 3H_2O + 6Zn^{+2}$ (12 = 12)

$12e^- + 12H^+ + As_2O_3 \rightarrow 2AsH_3 + 3H_2O$

$H_2O + Zn \rightarrow Zn^{+2} + 2H^+$