# ANSWERS: YEAR — END REVIEW

SCH3UE_07-08

## Answers to Multiple Choice

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| C | D | C | A | D | D | A | C | C | C |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| B | C | D | A | C | A | B | D | E | D |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| A | E | A | D | B | E | D | B | C | B |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| C | D | D | A | B | C | E | B | A | B |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| A | A | D | C | B | C | C | D | D | C |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| A | D | B | B | C | B | A | B | A | D |
| 61 | 62 | 63 | 64 | 65 | | | | | |
| A | D | D | B | C | | | | | |

## Answers to Problems

1. State the electron configuration for each of the following:

a. Mn b. Br c. S d. $Fe^{+3}$ e. $P^{-3}$ f. $S^{-2}$ Mg. $Co^{+2}$

**Answer**

a. Mn: [Ar] $3d^5\ 4s^2$

b. Br: [Ar] $3d^{10}\ 4s^2\ 4p^5$

c. S: [Ne] $3s^2\ 3p^3$

d. $Fe^{+3}$: [Ar] $3d^5$

e. $P^{-3}$: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ (Note: $P^{-3}$ and $S^{-2}$ are isoelectronic)

f. $S^{-2}$: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

g. $Co^{+2}$: [Ar] $3d^7$

2. Using the periodic table, explain the following:

a. Why potassium is more reactive than sodium

b. Why noble gases are assigned a value of zero for electronegativity.

c. Why silicon has a higher ionization energy than sodium.

d. Why aluminium has a lower ionization energy than magnesium.

e. Why aluminium has a higher ionization energy than gallium.

f. Why sodium ion is smaller than the sodium atom.

g. Why $P^{-3}$ ion is larger than P atom.

3. For each of the following molecules:

$CF_4$, $PH_3$, $PH_2^{-1}$, $PH_4^{+1}$, $H_2Te$, $BF_3$, $BeCl_2$, $SO_2$

a. Draw the Lewis structure. b. State the name of the 3– D shape

c. State and explain if the molecule is polar and or non-polar.

d. State and explain the type of IMFA's experienced by each molecule.

**Answer**

| Molecule | Lewis structure | 3-D Shape | Polar/ Non-polar | Type of IMFA |
|---|---|---|---|---|
| $CF_4$ | | tetrahedral | non-polar | LDF, (van-der-Waal) |
| $PH_3$ | | pyramidal | polar | D-D |
| $PH_2^{-1}$ | | non-linear | polar | D-D |
| $PH_4^{+1}$, | | tetrahedral | non-polar | LDF, (van-der-Waal) |
| $H_2Te$ | | non-linear | polar | D-D |
| $BF_3$ | | triangular planar | non-polar | LDF, (van-der-Waal) |
| $BeCl_2$ | | linear | non-polar | LDF, (van-der-Waal) |
| $SO_2$ | | non-linear | polar | |

4. For each of the following:

. give the reaction type
- give a balanced equation
- give phases for each substance
- state the precipitate
- write a total dissociated equation
- write a net-ionic equation

a. Magnesium sulfate reacts with ammonium hydroxide
b. Lead (II) nitrate solution reacts with sodium iodide solution
c. Acetic acid reacts with sodium hydroxide.
d. Strontium chloride reacts with potassium phosphate.
e. Potassium hydroxide reacts with sulphuric acid.

**Answer**

a. $MgSO_{4(aq)} + 2\ NH_4OH_{(aq)} \longrightarrow Mg(OH)_{2(s)} + (NH_4)_2SO_{4(aq)}$
$Mg^{+2}_{(aq)} + 2\ OH^{-1}_{(aq)} \longrightarrow Mg(OH)_{2(s)}$

b. $Pb(NO_3)_{2(aq)} + 2\ NaI_{(aq)} \longrightarrow PbI_{2(s)} + 2\ NaNO_{3(aq)}$
$Pb^{+2}_{(aq)} + 2\ I^{-1}_{(aq)} \longrightarrow PbI_{2\ (s)}$

c. $CH_3COOH_{\ (aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$
$H^{+1}_{(aq)} + OH^{-1}_{(aq)} \longrightarrow H_2O_{(l)}$

d. $3SrCl_{2(aq)} + 2K_3PO_{4(aq)} \longrightarrow Sr_3(PO_4)_{2(s)} + 6\ KCl_{(aq)}$
$3Sr^{+3}_{(aq)} + 2\ PO_4^{-3}{}_{(aq)} \longrightarrow Sr_3(PO_4)_{2(s)}$

e. $2\ KOH_{(aq)} + H_2SO_{4\ (aq)} \longrightarrow K_2SO_{4\ (aq)} + 2\ H_2O_{(l)}$
$OH^{-1}_{(aq)} + H^{+1}_{(aq)} \longrightarrow H_2O_{(l)}$

5. An organic compound was found by analysts to contain 40.45% C; 7.86% H and 15.73% N. The remainder was an element commonly found in nature and all organic acids … like acetic acid. (Think !!!)
A separate experiment determined the molecular mass of the compound to be 89.0g $mol^{-1}$.

(a) Determine the empirical formula of the compound.
(b) What is the molecular formula of the compound?

**Answer**

a. Empirical Formula: $C_3H_7NO_2$ b. Molecular Formula: $C_3H_7NO_2$

6. Tin (II) iodide, $SnI_2$, can be prepared by adding a solution of potassium iodide, $KI_{(aq)}$ to a solution of tin (II) chloride, $SnCl_{2\ (aq)}$ , and precipitating the insoluble iodide.

2.280 g of $SnCl_2$ were dissolved in 25.0 $cm^3$ of water and mixed with 10.0 $cm^3$ of 1.40 mol $L^{-1}$ $KI_{(aq)}$ to precipitate the tin (II) iodide.

(i) Determine which of the reagents is present in excess.
(ii) Calculate the maximum mass of tin (II) iodide that could be formed
(iii) In an experiment carried out as described above, 1.89 g of tin (II) iodide was obtained. Determine the percentage yield.

**Answer**

(i) Limiting reagent : KI Excess reagent: $SnCl_2$
(ii) The maximum mass of tin (II) iodide that could be formed: 2.61 g
(iii) % yield = 72.4 %

7. A 0.496 g of an unknown hydrocarbon, (a compound containing just carbon and hydrogen) was completely burned in oxygen. The sample produced 1.5 6g of carbon dioxide and 0.638g of water.

(a) (i) How many moles of carbon dioxide were formed?
(ii) How many moles of water were formed?
(iii) What is the empirical formula of the hydrocarbon?

(b) A 1.12 g sample of the hydrocarbon occupied 448 $cm^3$ at 0 ºC and 101.3 kPa pressure. What is the molecular mass of the compound? (1.00 mol of any gas occupies 22.4 L at 0ºC and 101.3 kPa, a.k.a.: STP)

(c) What is the molecular formula of the compound?

**Answer**

a.

i. moles of carbon dioxide were formed = 0.03545

ii. many moles of water were formed = 0.03545
(.: mols of hydrogens in the hydrocarbon = 2 x 0.03545 = 0.0709)

iii. empirical formula of the hydrocarbon = $CH_2$

b. molecular mass of the compound = 56.0 g $mol^{-1}$

c. molecular formula of the compound = 4 ($CH_2$) = $C_4H_8$

8. Lead (II) nitrate, $Pb(NO_3)_2$ , reacts with sodium iodide, NaI. One of the products is a yellow precipitate. How much precipitate would be produced if 6.00 g of sodium iodide was used with sufficient NaI?

**Answer**

$Pb(NO_3)_{2(aq)} + 2\ NaI_{(aq)} \longrightarrow PbI_{2(s)} + 2\ NaNO_{3(aq)}$

Mass of precipitate,($PbI_{2(s)}$ ), formed = 9.22 g

9. If hydrogen gas occupies 44. 8 L at STP, at what pressure will the sample occupy 112 L when the temperature is fixed at 30 $^0$C ?

**Answer**: Pressure of the gas = 45 kPa

10. What is the volume occupied by 4.4 g carbon dioxide gas at a temperature of 30.0 $^O$C and a pressure of 99.6 kPa?

**Answer**: Volume occupied by the gas = 2.53 L

11. What is the density of sulphur dioxide gas, $SO_2$, if 6.40 g exerts a pressure of 98.8 kPa at a temperature of 23.5 $^O$C ?

**Answer:** Density of sulphur dioxide gas = 2.50 g / L

12. Calcium oxide, CaO, reacts with carbon dioxide to produce calcium carbonate, $CaCO_3$. If 10.0 L of carbon dioxide at 5.00 $^0$C and 121.2 kPa reacts with the calcium oxide, what mass of calcium carbonate will be produced?

**Answer**

$CaO + CO_2 \longrightarrow CaCO_3$

Mass of calcium carbonate that will be produced = 52.4 g

13. What mass of sodium phosphate, $Na_3PO_4$, was used to produce 250 mL of 0.100 mol/L solution?

**Answer** mass of sodium phosphate, $Na_3PO_4$, used = 4.10 g

14. A 145.0 mL sample of sulphuric acid reacts completely with zinc metal to produce 125.0 mL of hydrogen gas at 22.0 $^{O}C$ and a pressure of 102.3 kPa.
What is the molar concentration of the sulphuric acid?

**Answer**

$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$

mol $(H_{2(g)})$ = mol $H_2SO_4$ = $5.214 \times 10^{-3}$

molar concentration of the sulphuric acid = 0.0360 mol / L

15. Tums, essentially calcium carbonate, $CaCO_3$, on the market are sold as an antacid. A tablet of Tums was crushed and reacted with hydrochloric acid, $HCl_{(aq)}$. 28.50 mL of 0.200 mol $L^{-1}$ hydrochloric acid was required to completely neutralize one of the Tums tablet.

a. Write a balanced equation for the reaction of the Tums tablet, $(CaCO_{3\,(s)})$ with hydrochloric acid, $HCl_{(aq)}$.
b. Write a net-ionic equation.
c. Determine the mols of hydrochloric acid consumed.
d. Determine the mols of Tums consumed.
e. Determine the mass of the $CaCO_{3(s)}$ in each of the Tums tablet.

**Answer**

a. $CaCO_{3(s)} + 2\,HCl_{(aq)} \longrightarrow CaCl_{2\,(aq)} + CO_{2(g)} + H_2O_{(l)}$

b. $CaCO_{3(s)} + 2\,H^{+1}_{(aq)} \longrightarrow Ca^{+2} + 2Cl^{-1}_{(aq)} + CO_{2(g)} + H_2O_{(l)}$

c. mols of hydrochloric acid consumed = $5.70 \times 10^{-3}$

d. mols of Tums consumed = ½ $5.70 \times 10^{-3}$ = $2.85 \times 10^{-3}$

e. mass of the $CaCO_{3(s)}$ in each of the Tums tablet = 0.285 g

16. How much 15.4 mol/L nitric acid is needed so that the dilution results in 150 mL of 0.200 mol/L solution of the nitric acid.

**Answer**: Volume of 15.4 mol/L nitric acid needed = 1.95 mL

17. A chemist makes nitroglycerin, $C_3H_5(NO_3)_3$ from glycerol $C_3H_5(OH)_3$ and $HNO_3$.
The balanced chemical reaction is listed below:

$C_3H_5(OH)_{3(l)} + 3\,HNO_{3\,(aq)} \longrightarrow C_3H_5(NO_3)_{3\,(l)} + 3\,H_2O_{\,(l)}$

If 4.1 g of glycerol and 13.5 g of $HNO_3$ are used to produce 8.80 g of nitroglycerin:

a. What is the limiting reagent?
b. What is the theoretical yield of nitroglycerin?
c. What is the actual yield of nitroglycerin?
d. What is the percentage yield of nitroglycerin?

**Answer**

A. the limiting reagent = $C_3H_5(OH)_{3(l)}$
B. theoretical yield of nitroglycerin = 10.1 g
C. actual yield of nitroglycerin = 8.80 g
D. percentage yield of nitroglycerin = 87.1 %

18. If 26.55 mL of LiOH are required to neutralize 21.70 mL of 0.500 mol/L $HBr_{(aq)}$ what is the concentration of the base?

**Answer**

$LiOH_{(aq)} + HBr_{(aq)} \longrightarrow LiBr_{(aq)} + H_2O_{(l)}$

Concentration of the base, $LiOH_{(aq)}$ = 0.409 mol / L

19. How many grams of table sugar $C_{12}H_{22}O_{11}$ are contained in 50.0 mL of a 0.400 mol/L solution of sugar in water?

**Answer** Grams of table sugar $C_{12}H_{22}O_{11}$ = 6.84 g

20. What is the molar mass of a vapour, 0.842 g of which occupies 450 mL at a pressure of 100 kPa and a temperature of 100 $^0$C?

**Answer** Molar mass of the vapour = 58.0 g $mol^{-1}$

21. How many litres of hydrogen gas at 23.0 °C and 103.0 kPa can be obtained by the reaction of 75.0 g of aluminium with excess sulfuric acid?

$2\ Al(s) + 3\ H_2SO_4(aq) \longrightarrow A1_2(S0_4)_3(aq) + 3\ H_2(g)$

**Answer**

mol(Al) = 2.777 .: mol ($H_2$) = 4.1666

using PV = nRT volume of $H_2$ = 99.6 L

22. A gas occupies 0.045 L at 240K and 100 kPa. When the pressure is changed, the volume becomes 0.015 L at a temperature of 300K. What is the new pressure?

**Answer**

Using: $P_1V_1/T_1 = P_2V_2/T_2$

The new pressure = 375 kPa

23. 8.0 L of a gas is kept at constant pressure. The temperature is changed to 580 K, and the gas now occupies 20.0 L. What was the initial temperature?

**Answer**

The initial temperature : 232 K

24. A gas occupies 1.0 L container at 20 $^O$C and 50.0 kPa, it is transferred into a 250 mL container and is subjected to a pressure of 200.0 kPa, what will be the new temperature of the gas?

**Answer**

The new temperature of the gas = 293 K = 20 $^O$C