ST. LAWRENCE HIGH SCHOOL

A JESUIT CHRISTIAN MINORITY INSTITUTION

First Term Examination – 2018

Class : 10

SUB : Physical Science **F.M.: 75**

DURATION: 2 Hrs30Mins **DATE:26.04.2018**

GROUP A [29]

Choose the correct answer : [1x10=10]

(1) Which one of the following is not unit of pressure:
   a. atm
   b. lb
   c. mm of Hg
   d. torr

(2) The absolute temperature corresponding to 127°C is :
   a. 400 K
   b. 300 K
   c. 200 K
   d. 127 K

(3) If the pressure is doubled for a fixed mass of ideal gas at a constant temperature, its volume becomes :
   a. 4 times
   b. 0.5 times
   c. 2 times
   d. same

(4) PV vs P plot for an ideal gas is :
   a. parabolic
   b. straight line parallel to X - axis
   c. hyperbolic
   d. straight line passing through the origin

(5) The magnitude of thermal conductivity of the following substances are in the order :
   a. Silver > Aluminium > Glass > Wood
   b. Aluminium > Silver > Glass > Wood
   c. Silver > Aluminium > Wood > Glass
   d. Aluminium > Silver > Wood > Glass

(6) α, β, γ are related as follows:
   a. $\alpha : \beta : \gamma = 3 : 2 : 1$
   b. $\alpha = \frac{\beta}{2} = \frac{\gamma}{3}$
   c. $\gamma : \beta : \alpha = 1 : 2 : 3$
   d. $\frac{\alpha}{3} = \frac{\beta}{2} = \gamma$

(7) Which one of the following has the highest atomic radius :
   a. Potassium
   b. Hydrogen
   c. Lithium
   d. Sodium

(8) Which one is not a covalent compound:
   a. Sugar
   b. Common salt
   c. ethanol
   d. glucose

(9) Which one is not an ionic compound:
   a. CO_2
   b. C_2H_2
   c. C_2H_4
   d. C_2H_6

(10) The shape of NaCl crystal is :
   a. Tetrahedral
   b. Octahedral
   c. Hexagonal
   d. Icosohedral

Answer the following questions: [1x9=9]

(11) State Boyle's Law.

(12) Write Avogadro's Law.

(13) State Gay Lussac's Law.

(14) What is an ideal gas?

(15) What is the unit of SI unit of thermal conductivity?

(16) On what basis did Mendeleev arrange the elements in his periodic tabel?

(17) On what basis are the elements arranged in modern form of periodic table?

(18) Between N_2 and CH_4 which mole has multiple covalent bond.

(19) Between NaCl and CH_4 which dissolves in benzene.

Fill in the blanks: [1x8=8]

(20) Ionic compounds are soluble in _____ solvents.

(21) Theory of ionic bond formation is proposed by _____.

(22) The long form of periodic table based on _____.

(23) Second period of periodic tabel contains _____ elements.

(24) Halogens are strong _____ agents.

(25) Covalent radius of atoms is _____ than Vanderwaal's radius.

(26) There are _____ groups in a long form of periodic table.

(27) The volume of CO_2 produced at STP from1 mole of calcium carbonate is _____.

State whether True or False: [1x5=5]

(28) In crystalline state NaCl conducts electricity.

(29) Generally melting and boiling points of ionic compounds are high.

(30) Chlorine is an element of period 2 and group VII A.

(31) Hydrogen and halogens are diatomic non-metallic elements.

(32) Ionisation energy of elements along a period from left to right decreases.

GROUP – B

2. Answer the following questions: **MARKS: 1X22=22**

2.1group 3 and 12 contain elements known as_____ elements.

2.2 What is the S.I. unit of thermal conductivity?

2.3 Can temperature in Kelvin scale be negative?

2.4Write down the relation among the linear, surface and volume expansion coefficients of solid.

2.5 K (i.e. coefficient of thermal conduction) is the characteristic of the material of the solid substance. (True or False)

2.6 12g carbon on complete combustion produces how much volume of CO_2 at STP?

2.7 Mention the dimension of universal gas constant"R".

2.8 What is the term used to represent the formula which represents the simple ratio of atoms in a compound?

2.9 Fill in the brackets:

Theory of ionic bond formation proposed by. _____ (Kossel/Lewis)

2.10 Write the electron dot and dash structure of N_2 molecule.

2.11"Ionic compounds are good conductors of electricity"- explain.

2.12 Mention the increasing order of radius for the following-

Covalent radius, Ionic radius and vanderwaal's radius

2.13 In the modern periodic table transuranic elements belong to which period?

2.14 State Newland law of octave.

2.15 State Gay Lussac's law.

2.16 Mention the conditions for deviation of a real gas from ideal behavior.

2.17 Define coefficient of thermal conductivity of a substance.

2.18 What is coefficient of real or absolute expansion of a liquid?

2.19 What is thermal resistivity?

2.20 Place the following element in increasing order of electron affinity:

F, Br, I, Cl

2.21 State the law of conservation of mass in chemical reactions.

2.22 Write down the electronic configuration of Sodium cation and Chloride anion.

Group – C

3. **Short answer type question. (Answer all the questions)** 9x2=18

(Explanations and diagrams are needed if applicable)

i) Define thermal conductivity.

ii) State Charles' law. Write down the mathematical form of Charles' law in °C scale.

iii) Write down two important assumptions of molecular theory of ideal gas.

iv) Define coefficient of linear expansion of solid.

v) 2 gm ions of H^+ make how many molecules of phosphoric acid [H_3PO_4]?

vi) Explain which one is more basic, $Mg(OH)_2$ or $Al(OH)_3$?

vii) 5.6g of quicklime is dissolved in 100 ml water. 10ml of this solution is then treated with 20ml of an unknown HCl solution. Find the weight of HCl in 1 litre of the solution.

viii) The phrase " sodium chloride molecule" is actually meaningless. Comment.

ix) What is the total weight of water formed when 5g of H_2 reacts with 16g of O_2 under heat?

4. **Long answer type question. (Answer any five).** 5x5=25

(Explanations and diagrams are needed if applicable)

i) Establish the combined form of Charles' and Boyle's law. The volume of certain amount of ideal gas at STP is 10 lit. What will be its volume at temperature 27°C and at pressure 750mm of Hg column? 3+2

ii) Explain how you can arrive to the concept of absolute zero temperature from Charles' law. Define coefficient of real and apparent expansion of liquid. 3+1+1

iii) Define coefficient of surface expansion of solid. Give its mathematical form. An iron rod of unknown initial length is heated to 1000°C from 0°C and its length is increased by 6cm. Determine the initial length of the rod (Given coefficient of linear expansion of iron is $= 12 \times 10^{-6}/°C$). 1+2+2

iv) Write a short note on Dobereiner triad.
Which elements occupy the peak of Lother Mayers atomic volume Curve?
What is electronegetivity? 3+1+1

v) 25g of limestone sample(chemically calcium carbonate) which is impure is treated with 0.4 moles of pure nitric acid for complete reaction. Find the percentage purity of the $CaCO_3$ sample.
30 moles of N_2 is treated with 30 moles of H_2 when the yield of the reaction is 50%. Find the volume of ammonia gas formed and the volume of gases remaining after reaction. 2+3

vi) Write Lewis dot structures for the molecules ethyne and water.
Why do ionic compounds possess higher melting points than covalent compounds? 4+1

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Model Answer

FOR GOD AND COUNTRY

Sub: Physical Science | **Class: X** | **F.M - 75**
Duration – 2 hrs 30min | **Date– 26.04.18**

Group – A

1. b) lb 2. a)400k 3. b) 0.5times 4. B) straight line parallel to x– axis.

5. a) Silver > Aluminum > Glass > Wood 6. B) $\alpha = \frac{\beta}{2} = \frac{\gamma}{3}$ 7. A) Potassium 8. B) Common salt

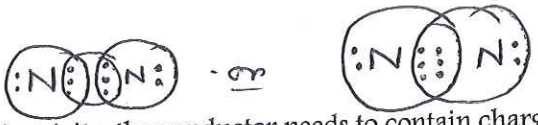
9. c) KCl 10. B) Octahedral

Group – B

2.1 Transition 2.2 J/m-K-sec or Watt/m-K 2.3 No it's not possible. 2.4 $\alpha = \frac{\beta}{2} = \frac{\gamma}{3}$

2.5 True 2.6 22.4 lit 2.7 $ML^2T^{-2}K^{-1}\,mol^{-1}$ 2.8 Emperical Formula 2.9 Kossel

2.10 Lewis Dot structure



2.11 To be a conductor of electricity, the conductor needs to contain charge carriers. Ionic compounds get ionized if electric potential is applied hence produce charge carriers as positive and negative ions. So they can conduct electrically.

2.12 Covalent radius < Ionic radius < Van der Waals or Ionic radius < Covalent radius < Van der Waals

2.13 Actinide Series or 7^{th} period

2.14 When elements are arranged in order of increasing atomic weights then, every eighth element has property similar to 1^{st} element.

2.15 Under same condition of temperature and pressure, gases combine with each other in simple integral ratios of their volumes and the volumes of the products formed if gaseous, also bear simple integral ratios to those of the volumes of the reactants.

2.16 At low temperature and at high pressure the real gas doesn't behave ideally.

2.17 The amount of heat flows during one sec through a uniform body of unit crossectional area and of unit length, when temperature difference of its ends is 1^0C or 1K.

2.18 Real expansion coefficient – The coefficient of real expansion of a liquid is the fraction of its volume by which it actually expands per degree rise in temperature.

2.19 The reciprocal of thermal conductivity of any substance is known as thermal resistivity of it.

2.20 $I < Br < Cl < F$

2.21 In a chemical change the total mass of the reactants is equal to the total mass of products i.e. matter can neither be created nor can be destroyed.

2.22 Electronic configuration of Na^+: 2,8 or $1s^2\ 2s^2\ 2p^6$

Electronic configuration of Cl^-: 2,8,8 or $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

Group – C

3.

i. The amount of heat flows during one sec through a uniform body of unit cross sectional area and of unit length, when temperature difference of its ends is 1^0C or 1K.

ii. At constant pressure the volume of a fixed amount of gas increases or decreases by $\frac{1}{273}$times of its volume at 0^0C per degree Celsius rise or fall in temperature.

$V_t = V_0\left(1 \pm \frac{t}{273}\right)$.

iii. 1. The gas molecules are identical and spherical in shape and their volumes are negligible compared to the volume of container.

2. No intermolecular force of attraction is present among the molecules and in between the molecules and the wall of the container.

iv. The amount of increase in length of a linear body over the unit initial length for 1^0C change in temperature is known as 'coefficient of linear expansion' of it.

v. $3H^+$ makes 1 H_3PO_4

3 moles of H^+ makes 1 mole of H_3PO_4

2 moles of H^+ makes (1/3x2) moles= (2/3x6.022x10^{23}) molecules

vi. $Mg(OH)_2$ is more basic, as Mg is more electropositive in nature.

vii. 100ml water contains 5.6g Quicklime; Therefore 10ml water contains 0.56g Quicklime.

Working Chemical Equation:

$CaO + 2HCl = CaCl_2 + 2H_2O$

1 mole of CaO reacts to form 2 moles of HCl

0.56/100 CaO reacts to form (2x0.56/100) moles of HCl

20ml of CaO reacts to form (2x0.56x1000/100x20) moles of HCl

Therefore, 1000ml of CaO recats to form (2x056x1000/100x20)x36.5g HCl=20.44g HCl

viii. Wrong; as there is no visible link between the oppositely charged ions.

ix. Working Chemical equation:

$2H_2 + O_2 = 2H_2O$;

Moles of H_2 reacts with 16/32 moles of O_2

1 mole of O_2 reacts with 2 moles of H_2 to form 2 moles of H_2O

Therefore, 16/32 moles of O_2 reacts to form (2x16/32) mole of H_2O

= (2x16x18/32)g of H_2O=18g H_2O

Group – D

4.

(i)

➢ If, $V = volume\ of\ certain\ amount\ of\ real\ gas.$

$T = absolute\ temperature\ of\ the\ gas.$

And, $P = pressure\ on\ the\ gas.$

Then, from Charle's law–

$we\ get,\quad V \propto T$ (in Kelvin scale) .....(1)

And from, Boyle's law,

$we\ get, V \propto \frac{1}{P}$ ..... (2)

Combining equation- (1) and equation – (2) , we get

$$V \propto \frac{T}{P}$$

Or, $PV \propto T$

Or, $PV = RT$. Where R is a proportionality constant called universal gas constant.

➢ According to the question, $P_1 = pressure\ exerted\ by\ 760mm\ of\ Hg\ column.$

$V_1 = 10lit$

$T_1 = 0^0C = 273K$

$P_2 = pressure\ exerted\ by\ 750mm\ of\ Hg\ column.$

$T_2 = 27^0C = 300K$

Let the final volume be V_2

So, from the equation $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$,

We $V_2 = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2} = \frac{760\times10\times300}{273\times750} = 11.13\ lit$

So, the volume of the gas will be 11.13 lit

(ii) According to Charle's law, if V_0 be the volume of certain amount of ideal gas at temperature 0^0C, and temperature is lowered by t^0C, then the volume of gas becomes $V_t, where -$

$$V_t = V_0\left(1 - \frac{t}{273}\right).$$

If, the temperature is lowered to -273^0C, i.e. $t = 273^0C$

Then $V_t = V_0\left(1 - \frac{273}{273}\right) = V_0(1-1) = 0$

So, the volume of any ideal gas becomes zero at -273^0C.

This temperature is called absolute zero temperature.

Real expansion coefficient – The coefficient of real expansion of a liquid is the fraction of its volume by which it actually expands per degree rise in temperature.

Apparent expansion coefficient – It is the fraction of its volume by which it appears to expand per degree rise in temperature.

iii) Coefficient of surface expansion – it is the increase in surface area per unit area per degree rise of temperature.

$$\beta = \frac{s_2 - s_1}{s_1(t_2 - t_1)}$$

Given, $l_2 - l_1 = 6cm$

$t_2 - t_1 = 1000^0C$

And, $\alpha = 12 \times 10^{-6}\ /^0C$

So, $l_1 = \frac{l_2 - l_1}{\alpha(t_2 - t_1)} = \frac{6}{12\times10^{-6}\times1000} cm = 500cm$

iv. a) When elements are arranged in vertical columns, the atomic weight of the middle element is the average of the atomic weights of the first and the third element.

b) Alkali Metals occupy the peak of the Lother Meyer Curve.

c) The tendency of an atom to draw the shared pair of electron towards itself remaining in a covalently bonded state, is regarded as electronegativity of atom.

v. 1st Part:

Working Chemical Equation:

$CaCO_3 + 2NH_3 = Ca(NO_3)_2 + H_2O + CO_2$

2 moles of HNO_3 reacts with 1 mole of $CaCO_3$

0.4 moles of HNO_3 reacts with 0.2moles of $CaCO_3$

0.2 moles of $CaCO_3$= (0.2x100)g=20g

% Purity= (20x100/25)%=80%

2nd Part:

Working Chemical Equation:

$N_2 + 3H_2 = 2NH_3$

3 moles of H_2 reacts with 1 moles of N_2 to form 2 moles of NH_3

30parts H_2 combines with 10 parts N_2 to form 20 parts of NH_3

Therfore,Reaction yields 50%,each number is halved.

15parts H_2 combines with 5 parts N_2 to form 10 parts of NH_3

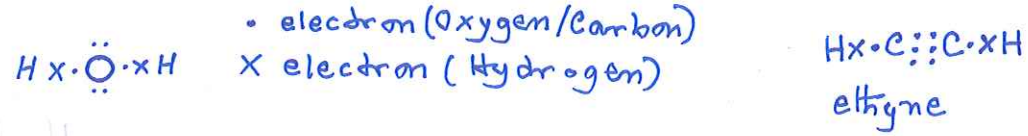
Therefore,

H_2=(30-15) mole=15mole

N_2=(30-5)mole=25mole

NH_3=10 mole

vi. Lewis Dot Structure:



Ionic compounds possess relatively higher melting point than covalent compound due to Lattice energy .