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FOR GOD AND COUNTRY

ST. LAWRENCE HIGH SCHOOL

Selection Test – 2019

(Model Answer)

Sub: Physical Science **Class: X** **F. M. : 90**

Duration: 3 hrs 15 mins

Group – A

1. Choose the Correct answers **1 x 15 = 15**

1.1. The unit of electrical charge is

a. Coulomb b. Ampere

c. Volt d. Ohm

1.2. Which of the following is not a renewable source of energy?

a. Tidal energy b. Bio mass energy

c. Petrol d. Solar energy

1.3. Which colour takes minimum time when white light passes through a prism?

a. Red b. Yellow

c. Green d. Violet

1.4. Which of the following molecule has a triple bond?

a. Hydrogen b. Fluorine

c. Chlorine **d. Nitrogen**

1.5. What is the percentage of NH_3 present in liquor ammonia?

a. 25% b. 30%

c. 45% **d. 35%**

1.6. If the coefficient of linear expansion of a metal is α what is the coefficient of volume expansion?

a. α/2 b. α/3

c. 3 α d. 2 α

1.7. During electrolysis which of the following procedures take place at the cathode?

a. Oxidation **b. Reduction**

c. Both d. None of these

1.8. Which of the following is a strong electrolyte?

a. NaOH b. NH_4OH

c. CH_3COOH d. Glucose

1.9. In the formation of which of the following compounds octet rule is not obeyed?

a. NaCl **b. LiH**

c. KCl d. CaO

1.10. The number of atoms present in 2.8 g of Nitrogen is

a. 4.45×10^{24} **b. 6.022×10^{22}**

c. 1.204×10^{23} d. 3.023×10^{23}

1.11. The equivalent of 20 resistances of 20 ohm each connected in parallel is

a. 10 Ω b. 100Ω

c. 1 Ω d. 20 Ω

1.12. Mendeleev's periodic table is based on

a. Atomic radius b. Atomic volume

c. Atomic number **d. Atomic weight**

1.13. Which one of the following has the highest penetrating power

a. Sunlight b. Beta particles

c. Alpha particles **d. Gamma rays**

1.14. Which of the following is an ore of iron?

a. Bauxite **b. Hematite**

c. Malachite d. Copper Pyrites

1.15. Which of the following is an unsaturated hydrocarbon?

a. C_2H_6 b. C_3H_8

c. C_2H_2 d. CH_4

Group – B

2. **Answer the following questions in one word or in one sentence. (Alternatives are to be noted)** $1 \times 21 = 21$

2.1 **What is the full form of LPG?**

Ans: Liquefied Petroleum Gas.

2.2 **According to** ____Charle's_____ **law, the volume of certain amount of gas could be zero.**

2.3 **Absolute zero temperature** $= -273°C$.

Or

How does the kinetic energy of the gas molecules vary with decrease in temperature?

Ans: The kinetic energy of the gas molecules decreases with decrease in temperature.

2.4 **Coefficient of linear expansion of iron is** $\times 10^{-6}/°C$ **, what will be its coefficient of superficial expansion?**

Ans: As Coefficient of superficial expansion $\beta = 2 \times$ Coefficient of linear expansion ,

Hence for iron, $\beta = 2 \times 12 \times 10^{-6}/°C = 24 \times 10^{-6}/°C$

2.5 **What is the SI unit of coefficient of apparent expansion of liquid?**

Ans: $/K$ *or* K^{-1}.

2.6 **If a beam of parallel ray is made incident on a convex lens such that the rays are not parallel to the principal axis, then where will they converge after refraction?**

Ans: They will converge (or meet) at a point on the focal plane of the lens except the focus.

Or

Mention one practical use of spherical mirror.

Ans: Any one use of convex or concave mirror among the following –

Concave mirror is used -

in reflecting telescope
as shaving mirror.
in the head light of car or in torches.
in optical cavity.
as dental mirror to get magnified image.

Convex mirror is used –

as looking glass or rare view mirror in different vehicles.
as highway safety mirrors or road safety mirrors at turnings.
in ATM as a sample of handy security feature.

2.7 **What will be the measure of angle of refraction if the incident ray makes** 90^0 **angle with the surface of separation?**

Ans: It will be a normal incidence, hence there will no deviation of light and the refracting angle (or the angle of refraction) will be 0^0, although there will be refraction.

2.8 **Electrical switches are always connected with neutral wire – write true or false.**

Ans: False.

Or

The terminal voltage of an electric cell is _____ **the e.m.f of the cell.**

Ans: *The terminal voltage of an electric cell is* $<$ *the e.m.f of the cell.*

2.9 **Write down one important difference between A.C Generator and Electric motor.**

Ans: Any one difference among the following –

AC generator	Electric motor
It converts mechanical energy into electrical energy	It converts electrical energy into mechanical energy
It follows Fleming's right hand rule.	It follows Fleming's left hand rule.
It works on the principle of electromagnetic induction.	It works on the principle that a current carrying conductor experiences magnetic force in the presence of magnetic field.

2.10 **The velocity of** α **particle in space is usually** $\frac{9}{10}$ **of velocity of light in vacuum – write true or false.**

Ans: False.

2.11 **What will be the change in mass number of a nucleus, if it emits one** $\beta - particle$?

Ans: Mass number will remain same.

2.12 **Which compound can conduct electrically – electrovalent or covalent?**

Ans: Electrovalent compounds (or ionic compounds) can conduct electrically.

2.13 H_2S **reacts with** $AgNO_3$ **solution to give** __Silver sulphide (black) or $Ag_2S(\ black)$__ **precipitate.**

2.14 **What is thermite mixture?**

Ans: The mixture of ferric oxide (Fe_2O_3) and Al in 3:1 ratio.

2.15 What is the monomer of PVC?

Ans: Vinyl Chloride ($CH_2 = CHCl$)

2.16 Who proposed the tetrahedral model of carbon compounds?

Ans: Vant Hoff and Le Bel

2.17 What is denatured sprit?

Ans: Methanol (CH_3OH) 10% + Perydine or Naptha + Ethanol

2.18 Name the electrolyte used for silver coating.

Ans: Potassium Argento Cyanide $K_4[Ag(CN)_5]$ or $K[Ag(CN)_2]$ or / Sodium Argento Cyanide.

2.19 Write the IUPAC name of CH_3CH_2CHO.

Ans: Propanal or / 1-propanal .

2.20 State Dobereiner's law of triads.

Ans: Atomic mass of the middle element of a triad is arithmetic mean of atomic masses of the other two elements.

Eg – Li, Na, K

2.21 What is gilding?

Ans: Applying gold coating on the surface of any material.

Group – C

3. **Answer the following questions. (Alternatives are to be noted)** $2 \times 9 = 18$

3.1 What is the origin of pressure exerted by a certain amount of gas on the walls of its container? 2

Ans: At any temperature (except 0 K) gas molecules gain the thermal energy and it is then converted as the kinetic energy of the molecules. Hence they move along all possible direction randomly and collide with themselves and also will the walls of the container continuously. While colliding with the walls, the force exerted by the molecules per unit area of the wall is the origin of the pressure.

Or

State Boyle's law. Write down its mathematical form. 1+1

Ans: At constant temperature, the volume of a given mass of gas is inversely proportional to the pressure on the gas. *If*

T denotes absolute temperature,
V denotes the volume of the gas,
P denotes presssure on the gas and
M denotes the mass of the gas

Then according to Boyle's law, $V \propto \frac{1}{P}$ at constant T and for constant M.

3.2 Define coefficient of superficial expansion of solid. 2

Ans: It is defined as the relative change in surface area of any material for one degree change in temperature.

***Alternative : It is the change in surface area of a material over the unit initial area, per degree change in temperature.

3.3 Can the absolute refractive index of a medium be less than '1'? – justify your answer. 2

Ans: No.

We know, absolute refracting index of any medium $\mu = \frac{velocity\ of\ light\ in\ vacuum}{velocity\ of\ light\ in\ that\ medium}$.

As velocity of light in vacuum is always greater than velocity of anything else, hence the numerator is always greater and the fraction can never be less than 1.

Or

What is the distance between the object and its real image when it is placed in front of a convex lens of focal length $'f'$ and the magnification is 1. 2

Ans: In case of convex lens, the magnification is 1, when the object is placed at $2f$ distance and its real inverted image of same size is produced at $2f$ distance on the other side. Hence at that condition, the distance between object and image will be $4f$.

3.4 **Mention two important reasons for connecting the household electrical appliances in parallel with a.c. main supply.** 2

Ans: Any two of the following.

- Individual operating of the different appliance can only be done when they are in parallel connection.
- The input voltage across all the appliances will be same.
- The effective resistance will be less in parallel connection.

Or

If a mobile charger of 10 watt is used to charge a mobile daily 2hrs, then calculate the monthly electric bill on it. 1 B.O.T costs Rs 5.00. 2

Ans: In one month the amount of electrical energy (i.e. amount of B.O.T) used $= \frac{10\times2\times30}{1000} = \frac{6}{10}$ units

So the monthly cost on it $= \frac{6}{10} \times 5.00 = Rs.3.00$

***Alternative : for 31 days in a month

the cost $= \frac{10\times2\times31}{1000} \times 5 = Rs.3.10$

3.5 Define binding energy of a nucleus. **2**

Ans: Binding energy of the nucleus is the strong atomic energy by which all the neutrons and protons are bound together within a small region of space. This energy is actually originated from the mass defect according to Einstein's equation $E = mc^2$.

3.6 What do you mean by transuranic elements? Give one example. **1+1**

Ans: Chemical elements after uranium (atomic no. 92) in a periodic table. Eg – Am onwards.

3.7 'Ionic compounds are generally soluble in polar solvents' – why? **2**

Ans: Polar solvents like water decreases the electrostatic forces of attraction resulting in free ions in aqueous solution. **Or**

'Covalent compounds are bad conductors of electricity' – why? **2**

Ans: As they dissociates into ions.

3.8 What do you mean by strong electrolytes? Give one example. **1+1**

Ans: Solute that are completely dissociates or ionizes into ions . eg – HCl, NaCl etc.

3.9 Mention two important uses of ammonia. **2**

Ans: 1.Used for manufacturing of nitrogen fertilizer, organic dyes. 2.Used as refrigerant gas.

Group – D

4. **Answer the following question. (Alternatives are to be noted)** $3 \times 12 = 36$

4.1 Write down the importance of using non – conventional sources of energy. Which layer is responsible for formation of '*Auroras*'. **[2+1]**

Ans: The importance of using non – conventional source of energy, are – (Any two)

- Conventional sources can be preserved for the future generation as those are limited in amount.
- Using these is environment friendly i.e. pollution can be minimized.
- These are renewable; hence we will get the energy for a long period of time.

Ionosphere(Mesosphere, thermosphere and some parts of exosphere) is responsible for formation of Aurora.

4.2 State Charle's law. A gas initially at 0°C is heated so that its pressure and volume both are doubled. What will be its final temperature? **[1+2]**

Ans: At a constant pressure, the volume of a given mass of gas increases or decreases (or changes) by $\frac{1}{273}$ times of its volume at 0^0C in every 1^0C increase or decrease (or change) in temperature.

***Alternative: At constant pressure, the volume of a given mass of a gas is directly proportional to its absolute temperature.

According to the problem,

Let, $P_1 = P = initial\ pressure$

$V_1 = V = initial\ volume$

And $T_1 = 0^0C = 273K$

Then, $P_2 = 2P$, $V_2 = 2V$ and let $T_2 = the\ final\ temperature.$

Hence from the combined law, $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Or, $\frac{PV}{273} = \frac{2P\times2V}{T_2}$

Or, $T_2 = 1092K$ (Ans)

Or $T_2 = 819^0C$ (Ans)

Or

Write down the mathematical form of Charles' law in °C scale. 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? **[1+2]**

Ans: According to Charle's law –

If $v_0 = volume\ of\ certain\ mass\ of\ a\ gas\ at\ 0^0C$

$v_t = volume\ of\ the\ gas\ when\ the\ temperature\ is\ changed\ by\ t^0C$

And the pressure on the gas remains constant.

Then $v_t = v_0\left(1 \pm \frac{t}{273}\right)$

Let the volume at 27^0C be v_2.

Given, $v_1 = 10lit$

$p_1 = 76cm\ of\ Hg\ column$

$T_1 = 0^0C = 273K$

$p_2 = 75cm\ of\ Hg\ column$

$T_2 = 27^0C = 273 + 27\ K = 300\ K.$

We know, $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Or, $\frac{76\times10}{273} = \frac{75\times v_2}{300}$

Or, $v_2 = \frac{76\times10\times300}{273\times75} = 11.135\ lit.$ [Ans]

***Alternative :

We know $pv = nRT$ so $n = \frac{pv}{RT} = \frac{76dg\times10}{273R}$ [from the first case]

So, for the 2nd case, $v = \frac{nRT}{p} = n\frac{RT}{p} = \frac{76dg\times10}{273R} \times \frac{300R}{75dg} = \frac{76\times10\times300}{273\times75} = 11.135\ lit$ [Ans]

4.3 **Why does a glass chimney crack when few drops of water fall on it? What do you mean by the statement – "coefficient of linear expansion of iron is $= 12 \times 10^{-6}/°C$ ".** [1+2]

Ans: Due to sudden fall in temperature the concerned portion tries to contract. As the thermal conductivity of glass is not so high, it cannot balance the sudden change in temperature by conducting heat from other portions and it cracks.

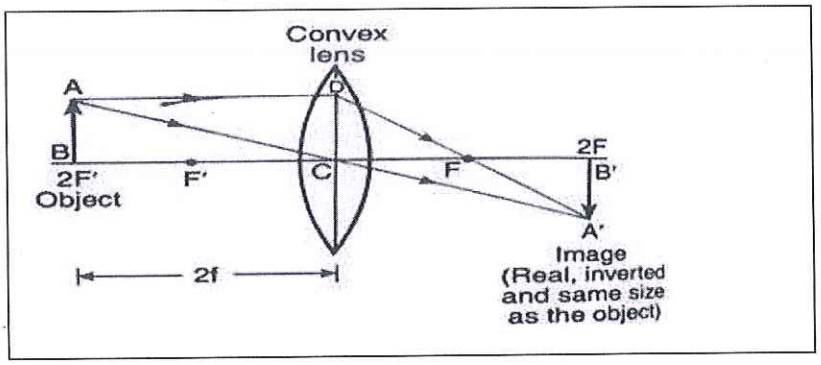
It means, if an iron rod of unit initial length is heated and the temperature is changed by 1^0C, then the length of that rod will be changed by 12×10^{-6}unit.

**** Alternative :

If the temperature of an iron rod is changed by 1^0C then the relative change of its length will be 12×10^{-6}.

4.4 **A real and inverted image of the same size is formed by a convex lens. What can you predict about the position of the object? Draw the ray diagram to justify your answer. Why is the sky blue?** [1+1+1]

Ans: The object is placed at a distance 2f from the optical centre of the lens. Where f is the focal length of lens.



When white light coming from sun passes through air,it gets scattered by different tiny particles and molecules. The light with shorter wavelength scatters more. Hence violet light scatters more, then indigo and then blue etc to red. But human eyes are more sensitive to blue and we see the sky as full of blue scattered light.

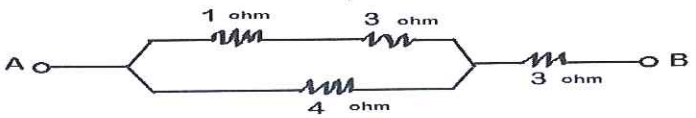
Or

On what factors does the angle of deviation (in case of a prism) depend? What do you mean by liner magnification [2+1]

Ans: Angle of deviation depends on – angle of incidence (i)
Refractive index of the material of the prism (μ)
Angle of prism (A)
Wavelength or colour of the light (λ)

Linear magnification m $= \frac{height\ of\ the\ image}{height\ of\ the\ object}$. Or the ratio of the height of the image to that of the object.

4.5 **Write down Ohm's law. Calculate the equivalent resistance between points A and B.** [1+2]



Ans: Ohm's law states that, all physical conditions and temperature of a conductor remaining same, the current flowing through a conductor is directly proportional to the potential difference across its end.

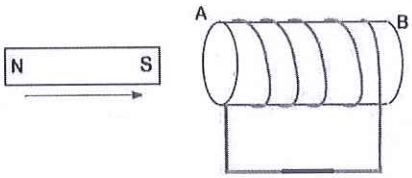
1 ohm and 3 ohm are in series. So the equivalent of those two in that path only will be 4 ohm. This 4 ohm will be in parallel to the 4 ohm right bellow it. Hence equivalent of these two will be $= \frac{4\times4}{4+4} = 2\ ohm$

This 2 ohm will be in series with 3ohm.

Hence finally the equivalent resistance in between points A and B will be (3+2) ohm = 5ohm. (Ans)

Or

Write down right hand grasp rule. If the south pole of a bar magnet approaches a solenoid as shown in the figure, then which pole will b generated at the farthest end (at point B)? Write down the law whic helped you for the prediction. [1+1+1]



Ans: If a current carrying wire is held in right hand such that the thumb stretched represents the direction of flow of current and other fingers wrap around the wire, then the wrapped fingers indicates the direction of circular magnetic field around the wire.

At the farthest point (at B) N pole will be generated due to electromagnetic induction by obeying Lenz's law.

Lenz's law: The direction of induced current because of electromagnetic induction in a closed loop will be such that it will try to oppose the cause of its generation.

4.6 What do you mean by radioactivity? If the atom X_Z^A emits one α particle and two β particles then determine the atomic number and mass number of end product? 1+(1+1)

Ans: Any suitable definition of radioactivity.

$X_Z^A - He_2^4 \rightarrow Y_{z-2}^{A-4}$ again $Y_{z-2}^{A-4} - 2e_{-1}^0 \rightarrow Z_z^{A-4}$

So, the atomic number of the end product will be $= z$

And the mass number $= A - 4$

4.7 What volume of SO_2 will be produced at STP on complete burning of 250 g of sulphur? Calculate the mass of 0.5 mole of CO_2.(C=12, O=16, S=32, O=16). 2+1

Ans: The required reaction is $S + O_2 = SO_2$

Hence 32 g of sulphur will produce 22.4 lit of SO_2 gas at STP.

So, 250 g of sulphur will produce $\frac{22.4\times250}{32}$ lit = 175 lit of SO_2 gas at STP.

$CO_2 \rightarrow 12 + 2 \times 16 = 44$

So, the mass of 1 mole of CO_2 is 44g

Hence, the mass of 0.5mole is = 44x0.5 g = 22g

Or

What do you mean by ionization energy? How does it change on moving from left to right in a period? 2+1

Ans: The minimum energy required to remove one electron from the outer most shell of an isolated gaseous atom is known as ionization energy of that atom.

*** Alternative : The amount of work done needed in moving one electron from the outer most shell of an isolated gaseous atom, to infinity, is known as the ionization energy.

In a period, on moving from left to right the number electrons in the last shell increases but the number of orbits remains same. So the atomic radii decrease and hence more energy will be required to remove electron. Hence Ionization energy increases on moving from left to right in a period.

4.8 Write down three important properties of covalent compound. Between NaCl and CH_4, which dissolves in benzene? 2+1

Ans: First two and any one from the rest -

- Bonds are formed by sharing electrons.
- They are bad conductor of electricity.
- These are generally gaseous or liquid at normal temperature.
- Low melting point and boiling point.
- Soluble in non polar solvent.

- Except hydrogen atom all achieves stable octet.

NaCl being ionic compound will not dissolve in benzene, but CH_4 will be dissolved as it is covalent compound.

4.9 Cu-. Write down the cathode and anode reaction for electrolysis of aqueous solution of copper sulphate using Electrodes. Between Cl^- ion and Cl atom which one is more stable and why? 1+2

Ans: Cathode reaction : $Cu^{+2} + 2e^- \rightarrow Cu(reduction)$

$$Cu - 2e^- \rightarrow Cu^{+2}(oxidation)$$

Electronic configuration of Cl^- :

K	L	M
2	8	8

Electronic configuration of Cl :

K	L	M
2	8	7

Hence Cl^- will be more stable having 8 electrons in the last shell.

4.10 Write down the conditions and balanced chemical equation for laboratory preparation of Ammonia. 3

Ans:Any one method -

Method –1: By heating dry ammonium chloride NH_4Cl *with dry slaked lime* $Ca(OH)_2$

$$2NH_4Cl + Ca(OH)_2 = 2NH_3 + CaCl_2 + 2H_2O$$

Method –2: By heating dry ammonium chloride NH_4Cl *with dry powder quicklime* CaO *or caustic soda.*

$$2NH_4Cl + CaO = 2NH_3 + CaCl_2 + H_2O$$

Method –3: By heating dry ammonium chloride NH_4Cl *with dry* $NaOH$

$$NH_4Cl + NaOH = NaCl + NH_3 + H_2O$$

Method –4: By heating dry ammonium sulphate $(NH_4)_2SO_4$*with dry* $NaOH$

$$NH_4Cl + 2NaOH = 2NH_3 + Na_2SO_4 + 2H_2O$$

[NB: Strong base is avoided as it affect the apparatus.]

Or

Nitrogen is not prepared in the laboratory by heating ammonium nitrite directly – give reason. What is nitrolim? 2+1

Ans: Nitrogen is not prepared in the laboratory by heating ammonium nitrite NH_4NO_2 directly because heating of NH_4NO_2 alone may result in explosion and NH_4NO_2 is not a very stable compound and it deteriorates on storage.

When calcium carbide is heated at about 1100^{0}C in nitrogen, calcium cyanamide (CaNCN) is formedalong with carbon. This blackish brown mixture of the products [i.e. CaNCN + C] is known as nitolim.

$$CaC_2 + N_2 = CaNCN + C$$

4.11 Briefly discuss the acidic property of H_2S with the help of proper chemical reaction. 3

Ans: H_2S is a weak dibasic acid. It dissociates in ions according to the equation $H_2S \rightleftharpoons 2H^+ + S^{2-}$.

Aqueous solution of H_2S turns blue litmus red. H_2S reacts with alkali to form normal salts.

For example : $NaOH + H_2S = NaHS + H_2O$; $NaOH + H_2S = Na_2S + 2H_2O$

4.12 What do you mean by unsaturated organic compounds? Name the functional group present in acetic acid. What is isomerism? 1+1+1

Ans: Organic Compounds having double or triple covalent bonds are known as unsaturated organic compounds.

Name the functional group present in acetic acid is COOH group / or oic acid group/ or organic acid group/ or carboxylic acid group.

Molecules having same molecular formula but different physical and chemical properties due to presence of different functional group, is known as isomerism.