MARCH - 2009

19E(A)

GENERAL SCIENCE PAPER – I

(English version)

Parts A and B

Time: 2 1/2 Hours] **[Maximum Marks : 50**

Instructions:

1. Answer the questions under **Part –A** on a separate answer book.
2. Write the answers to the questions under **Part – B** on the Question Paper itself and attach it to the answer book of **Part – A**

Part – A

Time : 2 Hours **Marks : 35**

SECTION – I

5 x 2 = 10

NOTE:

1. Answer **ANY FIVE** questions, choosing at least **TWO** from each of the following Groups.
2. Each question carries **2** marks.

GROUP – A

1. What is a centrifuge? How does it work?
2. Write the applications of LASER in the field of medicine?
3. State and explain inverse square law of magnetism?
4. Draw the block diagram of computer?

GROUP – B

5. Draw the shapes of i) H_2O ii) NH_3
6. Write the electronic configuration of i) Chromium, ii) Sodium
7. What are the advantages of hydrogenation of oils?
8. How is Tollen's reagent prepared? How is Glucose tested with it?

SECTION – II

4 x 1 = 4

NOTE:

1. Answer any **FOUR** questions in one or two sentences.
2. Each question carries **ONE** mark

9. A ball is thrown up and attains a height of 80m. Find its initial speed?
10. Define the term "mass defect"?
11. What are Ferro magnetic substances?
12. Draw the structure of Benzene?
13. What is the use of adding 'Cullet' to the raw material of glass?
14. What is Heat of neutralization?

SECTION – III

4 x 4 = 16

NOTE:

1. Answer any **FOUR** questions choosing at least **TWO** from each group
2. Each question carries **FOUR** marks.

GROUP – A

15. How do you determine the diameter of a wire using screw gauge?
16. What are the differences between Progressive and Stationary waves?
17. What is the principle of Nuclear Reactor? How is a chain reaction controlled in a nuclear reactor?
18. What are the properties and uses of Junction Transistor?

GROUP – B

19. How does the following change in a Period and Group? Explain?
    i) Atomic radius ii) Electro negativity iii) Electro positive character iv) Oxidising and Reducing property.
20. Explain the formation of Triple bond in Nitrogen?
21. How is Alcohol manufactured industrially?
22. Define Molarity? 2.12 gm of Na_2CO_3 is present in 250ml of its solution. Calculate Molarity of solution. (Molecular weight of Na_2CO_3 is 106)

SECTION – IV

1 x 5 = 5

NOTE:

1. Answer any **ONE** of the following questions.
2. It carries **FIVE** marks.

22. Draw the magnetic lines of force when North pole of a bar magnet facing Geographic South and locate the null points?
23. Draw a neat diagram of fractionating Petroleum and label its parts.

□□□□□□□

GENERAL SCIENCE, PAPER – I

(English Version)

Parts A and B

Time: 21/2Hours] **[Maximum Marks: 50**

Part – B

Time: 30 Minutes **Marks: 15**

Instructions:

1. Choose the correct answer from the given options and write the corresponding answers (A,B,C,D) in the brackets provided with Capital Letters.
2. Each question carries ½mark.
3. Answers with overwriting are not valued.
4. Answer all the questions.

I. Choose the correct answer and mention the corresponding letter in the bracket provided **10 x ½=5**

1. Numerical value of G is experimentally found to be ( )
   A) $6.67 \times 10^{-11}\ Nm^2\ Kg^2$ B) $6.67 \times 10^{-11}\ Nm^2\ Kg^{-2}$
   C) $6.67 \times 10^{-11}\ Nm^{-2}\ Kg^{-2}$ D) $6.67 \times 10^{-11}\ Nm^{-2}\ Kg^2$
2. A car moves on a curved but level road. The necessary centripetal force on the car is provided by ( )
   A) Inertia B) gravity C) friction between tyres and the road
   D) Normal reaction of the car
3. A transformer works on the principle of ( )
   A) Flemming's right hand rule B) Lenz's law C) Mutual induction
   D) Self - induction
4. In a p-type semiconductor majority carriers are ( )
   A) Electrons B) Holes C) Ions D) Electrons and Holes
5. Velocity of sound in air is ( )
   A) $v = \sqrt{\rho} / \gamma P$ B) $v = \sqrt{\rho P} / \gamma$ C) $v = \sqrt{\gamma P} / \rho$ D) $v = \sqrt{P} / \rho$
6. Among 3p, 4s, 3d and 4p which orbital has least energy ( )
   A) 4s B) 3p C) 3d D) 4p
7. CaO is ---------- ( )
   A) Acidic B) Basic C) Neutral D) Amphoteric
8. Which of the following is the sweetest sugar ( )
   A) Sucrose B) Glucose C) Fructose D) Maltose
9. 10gm of Na_2CO_3 is dissolved in 190 gms of water. The weight percentage of solution is ( )
   A) 20 B) 10 C) 2.5 D) 5
10. Shape of CO_2 molecule is ( )
    A) Pyramidal B) Angular C) Tetra hedral D) Linear

II. Fill in the blanks. Each question carries ½marks **10 x ½= 5**

11. The electromagnetic radiation that are used to take photographs of objects in darkness ----------

12. In simple harmonic motion, the acceleration of the particle is directly proportional to ------
13. The process of achieving population inversion is called ----------
14. The value of mechanical equivalent of heat is ----------
15. Assembler is a ---------- language
16. The number of sub shells present in L- shell is ----------
17. Formula of Dolamite is ----------
18. Ionic product of water at 25^0C is ----------
19. The process of cooling glass is called ----------
20. Bond length of C – C in Graphite is ----------

. Match the following **10 x ½= 5**

	GROUP: A			**GROUP: B**
21.	Angular displacement	. .	A)	Centrifugal force
22.	Angular velocity	. .	B)	Radian
23.	Fictious force	. .	C)	Radian / sec
24.	Banking angle	. .	D)	Centripetal force
25.	Centre seeking force	. .	E)	Banking of roads

	GROUP: A			**GROUP: B**
26.	Lauric acid	( )	A)	$C_{17}H_{33}COOH$
27.	Stearic acid	( )	B)	CH_3COOH
28.	Oleic acid	( )	C)	$C_{17}H_{29}COOH$
29.	Linoleinic acid	( )	D)	$C_{11}H_{23}COOH$
30.	Acetic acid	( )	E)	$C_{17}H_{35}COOH$

ANSWERS FOR PART – B

1) B 2) C 3) C 4) B 5) C 6) B 7) B 8) C 9) D 10) D

11) Infra red rays 12) displacement 13) Pumping 14) 4.185 J/Cal 15) Machine
16) 2 17) $CaCO_3MgCO_3$ 18) 1.0×10^{-14}Mole ion^2/lit^2 19) Annealing
20) $1.42A^0$

21) B 22) C 23) A 24) E 25) D
26) D 27) E 28) A 29) C 30) B

ANSWERS

PART: A

1. What is a centrifuge? How does it work?

Ans: **Centrifuge:**

A centrifuge is a machine used to separate particles of higher mass from those of lower mass in a given mixture.

Working:

1) It works on the principle of Centrifugal force.
2) A centrifuge consists of cylindrical vessel rotated about its own axes at high speed.
3) When milk is poured into the cylindrical vessel, particles of higher mass (Cream and butter) are thrown away from the centre due to greater centrifugal force.
4) Lower mass cream particles are collected at the centre.

2. Write the applications of LASER in the field of medicine?

Ans: Applications of LASER in the field of Medicine:

1) Lasers are used in bloodless surgery
2) The liver and lung diseases could be treated by lasers.
3) Lasers are used in fibre-optic endoscope to detect ulcers in the intestines.
4) Lasers are used extensively in the treatment of eye-diseases, particularly to reattach a detached retina.

3. State and explain inverse square law of magnetism?

Ans: Inverse square law of magnetism

The inverse square law of magnetism state that the force of attraction or repulsion between two magnetic poles (F) is directly proportional to the product of their pole strengths (m_1 and m_2) and inversely proportional to the square of the distance (r^2) between them and acts along the line of joining the poles.

$F \propto m_1.m_2 \rightarrow 1$

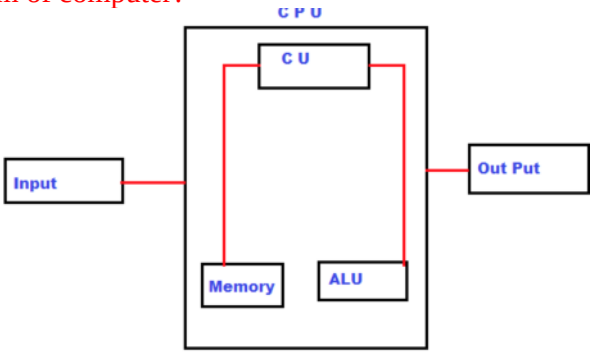
$F \propto 1/r^2 \rightarrow 2$

$F \propto m_1\, m_2 /r^2$

$F = \mu_0 /4\pi \;\; m_1\, m_2 /r^2$

μ_0 is the permeability of air.

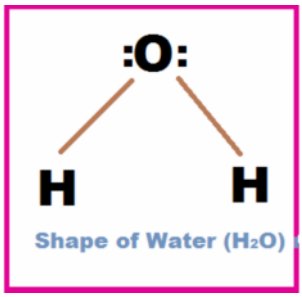
4. Draw the block diagram of computer?

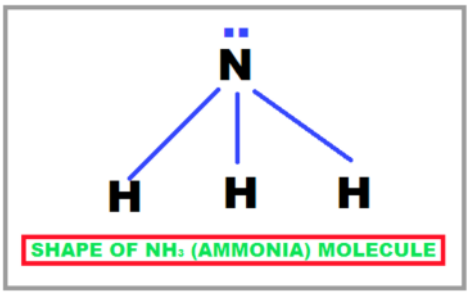


Computer Block Diagram

5. Draw the shapes of i) H_2O ii) NH_3

Ans: Shape of H_2O Shape of NH_3





6. Write the electronic configuration of i) Chromium, ii) Sodium

Ans: i) Chromium Cr (Z = 24)

Electronic Configuration: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$ (or) $[Ar]\ 4s^1\ 3d^5$

ii) Sodium Na (Z = 11)

Electronic Configuration $1s^2\ 2s^2\ 2p^6\ 3s^1$ (or) $[Ne]\ 3s^1$

7. What are the advantages of hydrogenation of oils?

Ans: Advantages of hydrogenation of oils:

1) Hydrogenation of oils is more suitable for edible purpose.
2) Hydrogenation improves preservation, taste and odour of many oils.

8. How is Tollen's reagent prepared? How is Glucose tested with it?

Ans: Preparation of Tollen's reagent

1) Take a test tube and take 5ml of dil. $AgNO_3$ solution in it and add one or two drops of 5% NaOH.
2) It produces a gray precipitate of AgOH.
3) Add dil. NH_4OH dropwise carefully just to dissolve the precipitate.
4) The solution so formed is known as Ammonical Silver Nitrate solution or Tollen's reagent.

Preparation of Glucose Solution

1) Take a clean test tube and rinse with dil. HNO_3.
2) Take about one gm of Glucose it to the test tube and add 5ml of distilled water.

Testing

1) Add Tollen's reagent to the glucose solution and heat it on the water bath.

Result

A silver mirror is formed on the walls of the test tube.

Reason

Glucose reduces Ag^+ ions into Ag metal.

9. A ball is thrown up and attains a height of 80m. Find its initial speed?

Ans: **Data:**

Max height 'h' = 80m

g = 10 m/sec^2

To be found

Initial Speed of he ball 'u' = ?

Formula

Max. Height 'h' = $u^2/2g$ → $U = \sqrt{2gh}$

Solving

$U = \sqrt{2 \times 10 \times 80} = \sqrt{1600} = 40m/sec.$

10. Define the term "mass defect"?

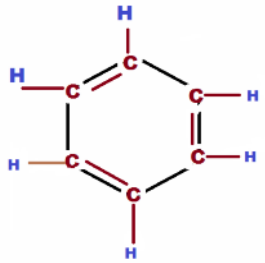
Ans: Mass defect is the difference between the sum of the individual masses of constituents of nucleus and the mass of the nucleus itself.

11. What are Ferro magnetic substances?

Ans: Ferro magnetic substances are those in which the resultant magnetic moments of individual Atoms align themselves in parallel because of a special effect present in them giving rise to Spontaneous magnetization.

Ex: Iron, Nickel, Cobalt, Gadolinium, Dysprosium etc.

12. Draw the structure of Benzene?



BENZENE

13. What is the use of adding 'Cullet' to the raw material of glass?

Ans: Addition of 'Cullet' to the raw material of glass helps in lowering the melting temperature of raw materials.

14. What is Heat of neutralization?

Ans: The amount of heat liberated when one mole of acid reacts with one mole of base is called Heat of neutralization.

For a reaction between a strong acid and a strong base, this value is constant and is equal to 13.7 K.Cal/mole.

15. How do you determine the diameter of a wire using screw gauge?

Ans:

1. To determine the diameter of a wire by using a screw gauge, first we should find the least count of the screw gauge.

   L.C = Pitch of the Screw / No. of Head Scale Divisions.
2. The zero error of the screw gauge if any is noted.
3. The wire is placed between the shafts S_1 and S_2 and the head scale is rotated anti-clockwise so that the shafts hold the wire tightly.
3. The value of the pitch scale division which just precedes edge of the head scale is noted as pitch scale reading (P.S.R.)
4. The value of the head scale division which just coincides with the index line is the observed Head Scale Reading (H.S.R)
5. Diameter of the wire = P.S.R. + (H.S.R x L.C)
6. The wire is placed at different positions in between lthe studs and the observations are recorded.

S.NO.	P.S.R	Observed H.S.R	Corrected H.S.R	Corrected HSR x LC	Diameter = PSR +(HSR x LC)

16. What are the differences between Progressive and Stationary waves?

Ans:

PROGRESSIVE WAVES		*STATIONARY WAVES*	
1	These waves are produced by vibrating source and continuously travel forward in the medium	1	These waves are formed when two waves of equal frequency and equal amplitude travel in opposite directions along the same path.
2	These waves travel in the form of crests and troughs (or compressions and rarefactions) through the medium in all directions	2	These waves are confined to a fixed region of the medium where they from nodes and antinodes.
3	All the particles have same amplitude and frequency every where in the medium. Every particle undergoes the maximum displacement at one time or the other.	3	Amplitudes of different particles in the medium are different at different points. It varies from a minimum at nodes and maximum at antinodes.
4	The phase of vibration changes for different points along the wave. At any particular instant different particles have different phases.	4	The vibration of all the points within a loop (between nodes) is in phase and is out of phase with respect to the points in the adjacent loop.
5	Distance between successive crests (compressions) or troughs (rarefactions) is λ.	5	Distance between successive nodes or antinodes is $\lambda/2$

6	Energy is carried continuously by forward moving waves throughout the medium	6	Energy is trapped in a fixed region of medium.
7	Every particle undergoes maximum displacement at one time or other.	7	The particles at nodes undergo only minimum displacement, while at antinodes, they undergo only maximum displacement.

17. What is the principle of Nuclear Reactor? How is a chain reaction controlled in a nuclear reactor?

Ans: The controlled chain reaction is the basic principle on which nuclear reactor functions. The essential features of a nuclear reactor are

1) The fuel, 2) Moderator 3) Control rods, 4) Radioactive Shielding 5) The coolant.

1) FUEL:

The fissionable material used in the reactor is called fuel. Isotopes of Uranium, Plutonium, and Thorium are commonly used fuels. The rods of these fuels are tightly sealed in aluminium cylinders.

2) MODERATOR:

The purpose of using moderator is to slowdown the fast moving neutrons during the fission process. Heavy water or graphite or berilium, or Hydro carbon plastics are some of the suitable material used as moderator.

3) CONTROL RODS:

These absorb the neutrons and control the chain reaction. Cadmium or Boron rods are generally used for this purpose.

4) RADIATION SHIELDING:

Lead blocks, Concrete walls of thickness 10m are used to prevent spreading of radioactive effect to the space around the nuclear reactor. This is called radiation shielding.

5) COOLANT:

The substance used to absorb heat generated in the reactor is called the coolant. Generally Water with pumps is used as coolant.

WORKING

The reactor core (consisting Moderator and Fuel rods) and pump are in contact with a heat exchanger which is generally water. This water changes into steam which is utilized to turn the turbine.

18. What are the properties and uses of Junction Transistor?

Ans: Properties of a Junction transistor:

1) In a circuit, one junction of the transistor is forward biased and the other is reverse biased. The forward biased junction offers less resistance to the current flow. A reverse biased junction offers a high resistance to the current flow.

Uses:

1) Transistor acts as an amplifier.
   An electronic device which can raise the magnitude of current or of voltage input signals is called as amplifier.
2) Transistors are used in electronic circuits called ‘ oscllators’ .
3) Transistorsare also used in stabilized power supplies.
4) Transistors form important components of micro electronic systems called ICs (Integrated Circuits) or ‘C hips’ .

19. How does the following change in a Period and Group? Explain?

i) Atomic radius ii) Electro negativity iii) Electro positive character iv) Oxidising and Reducing property.

Ans: i) Atomic radius

In a **group** from top to bottom, the Atomic radius **increases**, due to the addition of a new shell.

In a **period** from left to right, the Atomic radius **decreases.**

ii) Electro negativity

In a **group,** form top to bottom, the Electro negativity **decreases** due to increase in the size of the atom.

In a **period**, from left to right the Electro negativity **increases** due to decrease in the size of the atom.

iii) Electro Positive character

In a **group** Electro positive character **increases** from top to bottom

In a **period** Electro positive character **decreases** from left to right

iv) Oxidising property

In a **group** the oxidizing property **decreases** from top to bottom

In a **period** the oxidizing property **increases** from left to right.

v) Reducing property

In a **group** the reducing property **increases** form top to bottom.

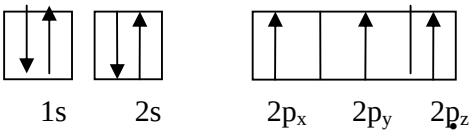
In a **period** the reducing property **decreases** from left to right.

20. Explain the formation of Triple bond in Nitrogen?

Ans: The bond formed by the share of 3 pair of electrons between two atoms is called Triple covalent bond or Triple bond.

Formation of Triple bond in Nitrogen

The electronic configuration of Nitrogen is $1s^2 2s^2 2p^3$



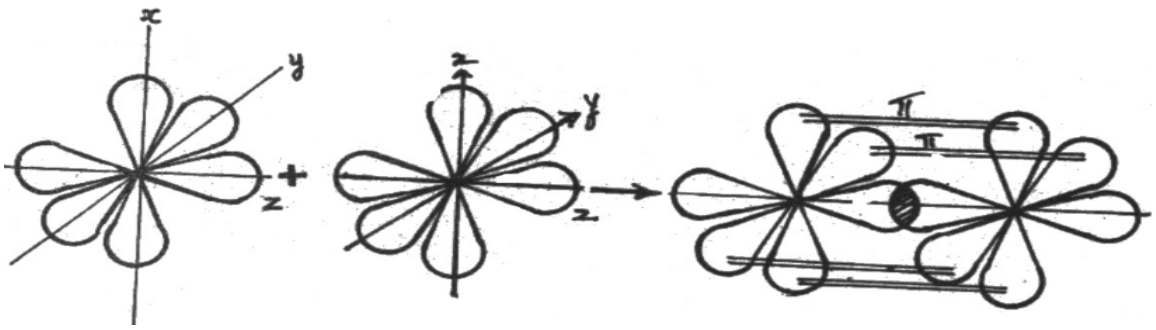
There are three unpaired electrons one each in $2p_x$, $2p_y$ and $2p_z$ orbitals.

The two $2p_z$ orbitals overlap end-on-end to give rise to a sigma (σ) bond.

The remaining two orbitals $2p_x$ and $2p_y$ are perpendicular to each other and also perpendicular to $2p_z$. They cannot overlap end-on-end.

Hence they overlap sideway to give two pie (π) bonds.

Thus in nitrogen, triple bond (one sigma bond and two pie bonds) is formed.



21. How is Alcohol manufactured industrially?

Ans: 1. Industrially alcohol is manufactured by fermentation followed by distillation

2. Fermentation is the process of breaking down of large molecules into small molecules by the action of enzymes.

3. Ethyl alcohol is produced by fermentation of molasses by yeast.

4. Molasses is diluted to 10% sugar by adding required water.

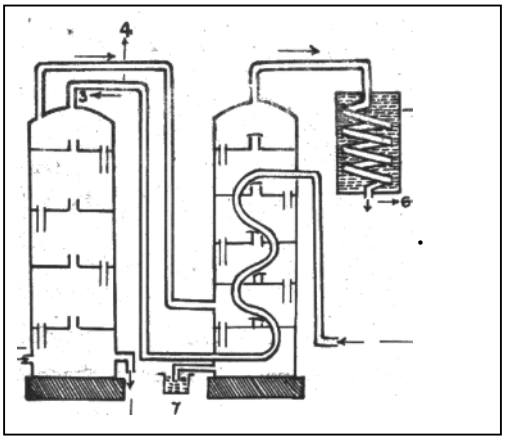
5. Salts like ammonium sulphate and ammonium phosphate are added to sugar solution. These act as food to the growth of yeast.
6. The solution of molasses ad the salt is transferred to a fermentation tank.
7. The yeast is added to the above solution.
8. The temperature is maintained at $30^{o}C$ and kept for 2, 3 days for the fermentation to complete. Yeast produces two enzymes namely invertase and zymase.
9. The enzyme invertase breaks down sucrose into glucose and fructose.

$$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{Invertase}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

10. The enzyme Zymase converts Glucose into Ethyl Alcohol and Carbon dioxide.

$$\underset{\text{Glucose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} \underset{\text{Ethyl Alcohol}}{2C_2H_5OH} + 2CO_2\uparrow$$

11. When the concentration ofalcohol reaches 15 – 20% in the solution the yeast cells are killed and the fermentation comes to stop.
12. The alcohol produced in fermentation tank is called ‘wa sh’, which is subjected to factional distillation to get 96% alcohol.



22. Define Molarity?
2.12 gm of Na_2CO_3 is present in 250ml of its solution. Calculate Molarity of solution. (Molecular weight of Na_2CO_3 is 106).

Ans: Molarity : The number of moles of solute present in one litre of solution is called Molarity. It is measured in moles/litre. It is denoted by the symbol M.

Problem:

Data: Weight of solute = 2.12 gm.
Volume of solution = 250ml = 0.25 l.
Molecualr weight of solute = 106

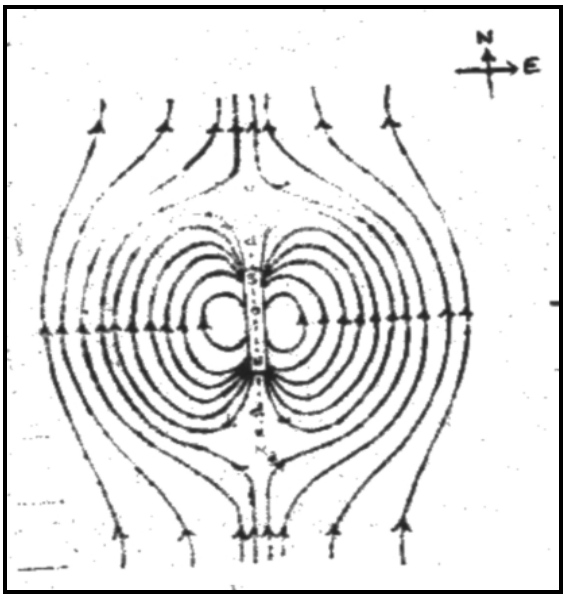
To be found: Molarity of solution = M

Formula: $\text{Molarity M} = \dfrac{\text{Weight of solute}}{\text{Mol. Weight of solute}} \times \dfrac{1}{\text{Volume of solution}}$

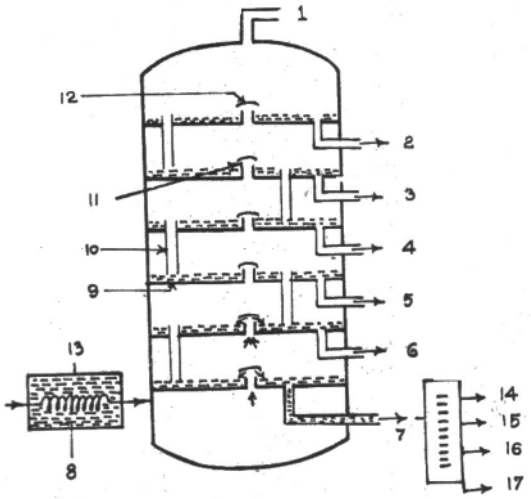
Solution:

$$\frac{2.12}{106} \times \frac{1}{0.25} = 0.08M$$

23. Draw a diagram of magnetic lines of force, when N-pole of a bar magnet is facing South pole of earth and locate the null points.



Draw a neat diagram of fractionation of Petroleum and label its parts?



Parts:

1. Uncondensed gases 2. Petroleum ether 3) Petrol 4) Naphtha 5) Kerosene 6) Diesel 7) Heavy oil 8) Crude Oil 9) Tray 10) Pipe 11) Chimney 12) Loose cap 13) Heater 14) Lubricating Oil 15) Petroleum jelly 16) Grease 17) Paraffin wax.