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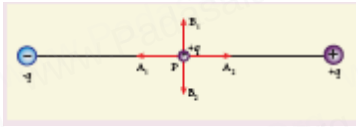
1 ELECTROSTATICS

1. Two identical point charges of magnitude –q are fixed as shown in the figure below. A third charge +q is placed midway between the two charges at the point P. Suppose this charge +q is displaced a small distance from the point P in the directions indicated by the arrows, in which direction(s) will +q be stable with respect to the displacement?



(a) A1 and A2 (b) B1 and B2

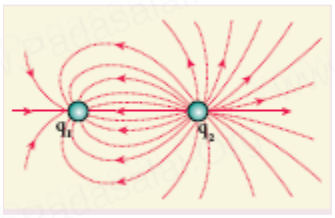
(c) both directions (d) No stable

2. Which charge configuration produces a uniform electric field?

(a) point Charge (b) infinite uniform line charge

(c) uniformly charged infinite plane (d) uniformly charged spherical shell

3. What is the ratio of the charges $\left|\frac{q_1}{q_2}\right|$ for the following electric fi eld line pattern?



(a) $\frac{1}{5}$ (b) $\frac{25}{11}$

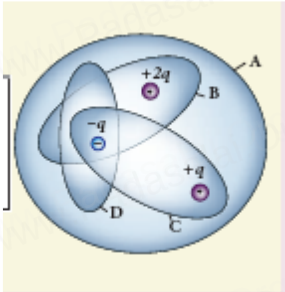
(c) 5 (d) $\frac{11}{15}$

4. An electric dipole is placed at an alignment angle of 30^0 with an electric field of 2×10^5 N C^{-1}. It experiences a torque equal to 8 N m. The charge on the dipole if the dipole length is 1 cm is

(a) 4 mC (b) 8 mC

(c) 5 mC (d) 7 mC

5. Four Gaussian surfaces are given below with charges inside each Gaussian surface. Rank the electric fl ux through each Gaussian surface in increasing order.



(a) D < C < B < A
(b) A < B = C < D
(c) C < A = B < D
(d) D > C > B > A

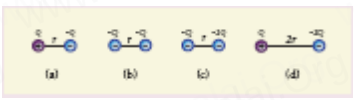
6. The total electric flux for the following closed surface which is kept inside water

(a) $\frac{80q}{\varepsilon_0}$
(b) $\frac{q}{40\varepsilon_0}$
(c) $\frac{q}{80\varepsilon_0}$
(d) $\frac{q}{160\varepsilon_0}$

7. Two identical conducting balls having positive charges q_1 and q_2 are separated by a centre to center distance r. If they are made to touch each other and then separated to the same distance. The fore between them will be

(a) less than before
(b) same as before
(c) more than before
d) zero

8. Rank the electrostatic potential energies for the given system of charges in increasing order.



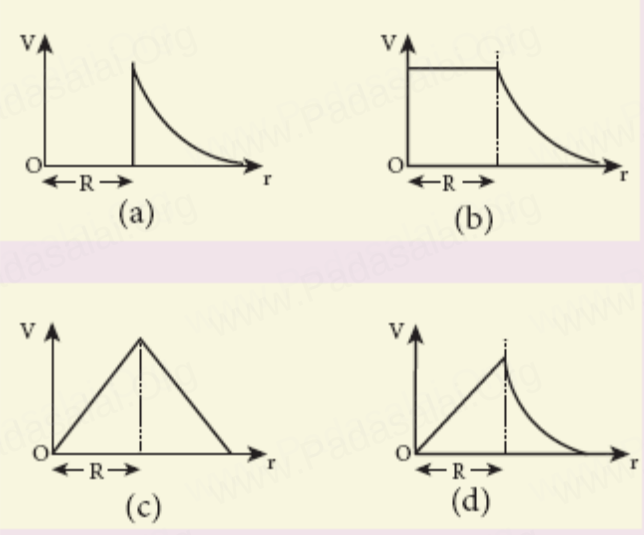
(a) 1 = 4 < 2 < 3
(b) 2 = 4 < 3 < 1

(c) 2 = 3 < 1 < 4 (d) 3 < 1 < 2 < 4

9. An electric field $\vec{E}$ =10 x$\hat{\imath}$ exists in a certain region of space. Then the potential difference V=V_0-V_A , where V_0 is the potential at the origin and V_A is the potential at x=2 m is

(a) 10 J (b) – 20 J
(c) +20 J (d) -10J

10. A thin conducting spherical shell of radius R has a charge Q which is uniformly distributed on its surface. The correct plot for electrostatic potential due to this spherical shell is



11. Two points A and B are maintained at a potential of 7 V and -4 V respectively. The work done in moving 50 electrons from A to B is

(a) 8.80×10^{-17}J (b) -8.80×10^{-17}J
(c) 4.40×10^{-17}J (d) 5.80×10^{-17}J

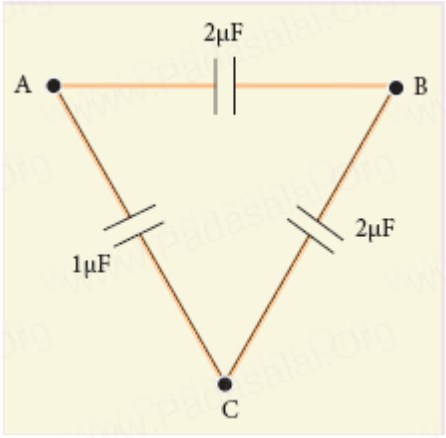
12. If voltage applied on a capacitor is increased from V to 2V, choose the correct conclusion.

(a) Q remains the same, C is doubled (b) Q is doubled, C doubled
(c) C remains same, Q doubled (d) Both Q and C remain same

13. A parallel plate capacitor stores a charge Q at a voltage V. Suppose the area of the parallel plate capacitor and the distance between the plates are each doubled then which is the quantity that will change?

(a) Capacitance (b) Charge
(c) Voltage (d) Energy density

14. Three capacitors are connected in triangle as shown in the figure. The equivalent capacitance between the points A and C is



15. Two metallic spheres of radii 1 cm and 3 cm are given charges of -1×10^{-2} C and 5×10^{-2} C respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is (AIIPMT -2012)

(a) 3×10^{-2} C (b) 4×10^{-2} C
(c) 1×10^{-2} C (d) 2×10^{-2} C

II SHORT ANSWER UESTIONS

1. What is meant by quantization of charge?(BII-1)-4
2. Write down Coulomb's law in Vector form and mention what each term represent. (BII-2)-5
3. What are the differences between Coulomb force and gravitational force?(BII-3)-5
4. Write a short note on superposition principle.(BII-4)-9
5. Define 'Electric field'.(BII-5)-12

6. What is mean by ‘Electric field lines’.(BII-6)-18
7. The electric field lines never intersect.Justify.(BII-7)-20
8. Define ‘Electric dipole’.(BII-8)-20
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15. Define ‘Electric flux’.-(BII-15)-38
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III LONG ANSWER QUESTIONS

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19. Obtain the expression for energy stored in the parallel plate capacitor.(BIII-19)-58
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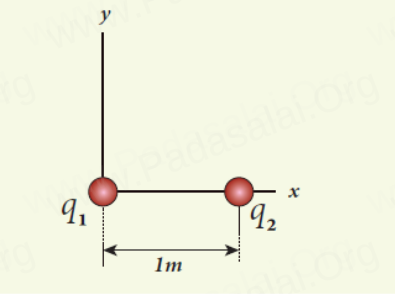
23. Explain in detail the construction and working of a Van de graaff generator.(BIII-23)68

NUMERICAL PROBLEMS

1.1 Calculate the number of electrons in one coulomb of negative charge.

1.2 Consider two point charges q1 and q2 at rest as shown in the figure.



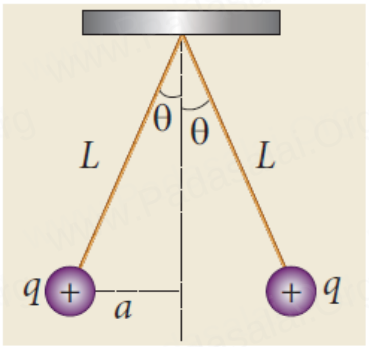
They are separated by a distance of 1m. Calculate the force experienced by the two charges for the following cases:

(a) $q_1 = +2\mu C$ and $q_2 = +3\mu C$

(b) $q_1 = +2\mu C$ and $q_2 = -3\mu C$

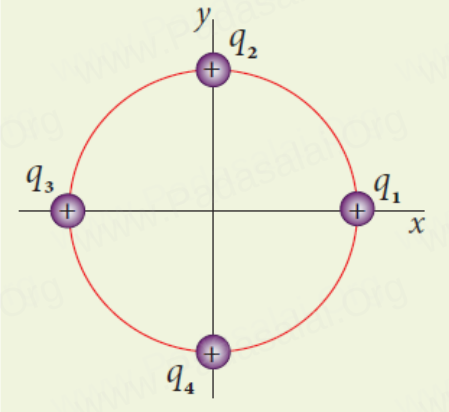
(c) q1= +2μC and q2 = -3μC kept in water ($\varepsilon r = 80$)

1.3 Two small – sized identical equally charged spheres, each having mass 1 g are hanging in equilibrium as shown in the figure. The length of each string is 10 cm and the angle Θ is 7^0 with the vertical. Calculate the magnitude of the charge in each sphere. (Take g = 10 ms^{-2})



1.4 Calculate the electrostatic force and gravitational force between the proton and the electron in a hydrogen atom. They are separated by a distance of 5.3×10^{-11} m. The magnitude of charges on the electron and proton are 1.6×10^{-19} C. Mass of the electron is $m_e = 9.1 \times 10^{-31}$ kg and mass of proton is $m_p = 1.6 \times 10^{-27}$ kg.

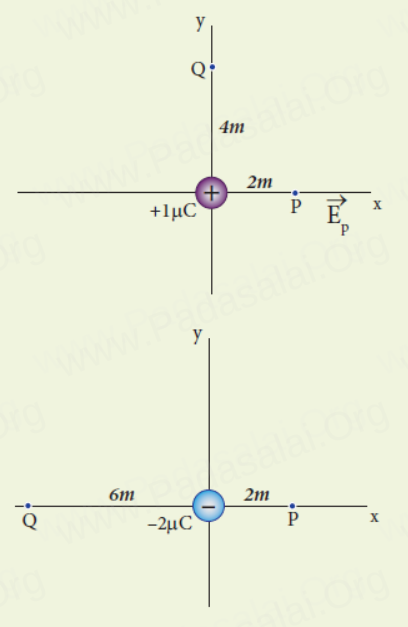
1.5 Consider four equal charges q_1 , q_2 , q_3 and $q_4 = q = + \hat{\imath}\ \mu$ C located at four different points on a circle of radius 1 m , as shown in the figure. Calculate the total force acting on the charge q_1 due to all the other charges.



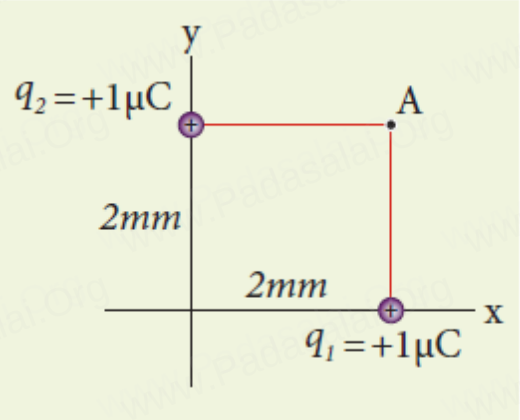
1.6 Calculate the electric field at points P, Q for the following two cases, as shown in the figure.

(a) A positive point charge +1 μC is placed at the origin

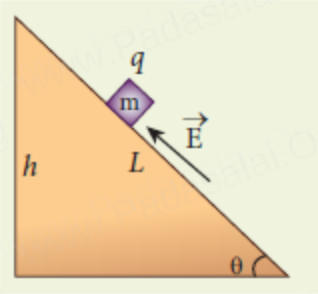
(b) A negative point charge -2 μC is placed at the origin



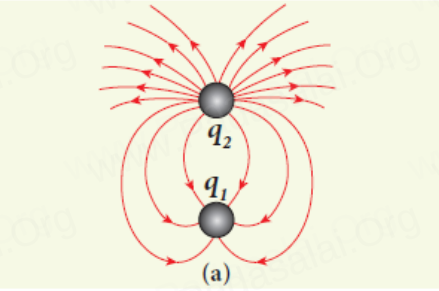
1.7 Consider the charge configuration as shown in the figure. Calculate the electric field at point A. If an electron is placed at points A, what is the acceleration experienced by this electron? (mass of the electron = 9.1×10^{-31} kg and charge of electron = -1.6×10^{-19} C)

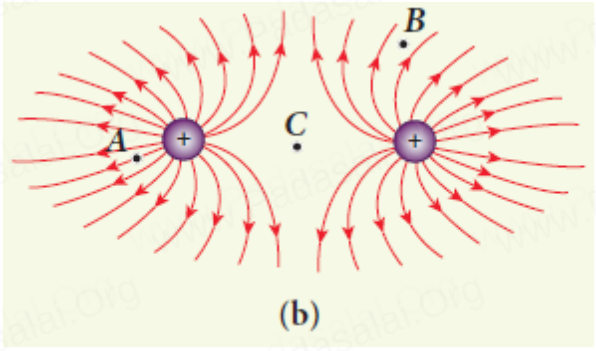


1.8 A block of mass m and positive charge q is placed on an insulated frictionless inclined plane as shown in the figure. A uniform electric field E is applied parallel to the inclined surface such that the block is at rest. Calculate the magnitude of the electric field E.

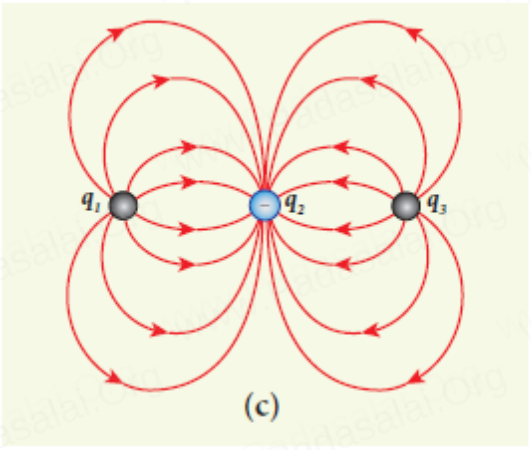


1.9 The following pictures depict electric field lines for various charge configurations.





(b)



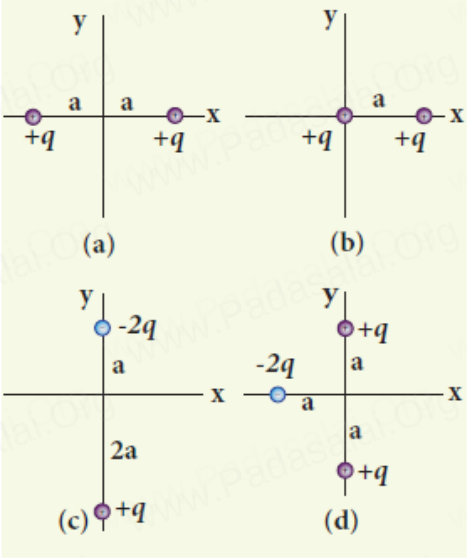
(c)

(i) In figure (a) identify the signs of two charges and find the ratio $\left|\frac{q_1}{q_2}\right|$

(ii) In figure (b), calculate the ratio of two positive charges and identify the strength of the electric field at three points A, B, and C

(iii) Figure (c) represents the electric field lines for three charges. If q_2 = -20 nC, then calculate the values of q_1 and q_3

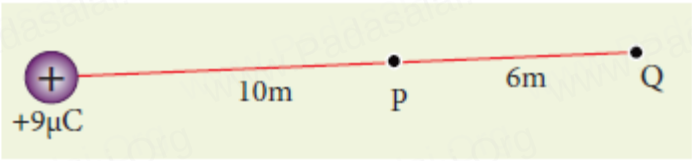
1.10 Calculate the electric dipole moment for the following charge configurations.



1.11 A sample of HCl gas is placed in a uniform electric field of magnitude 3×10^4 N C^{-1}. The dipole moment of each HCl molecule is 3.4×10^{-30} Cm. Calculate the maximum torque experienced by each HCl molecule.

1.12 (a) Calculate the electric potential at points P and Q as shown in the figure below.

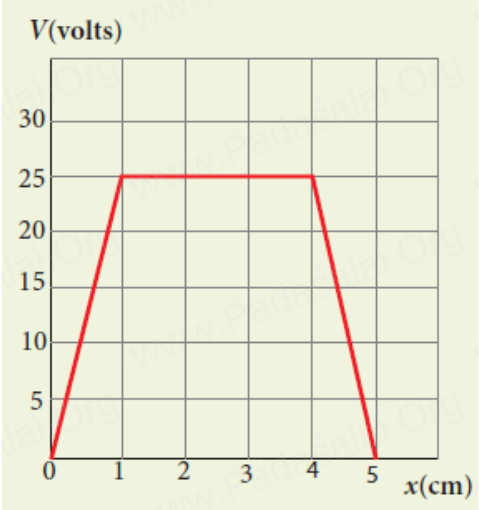
(b) Suppose the charge +9μC is replaced by -9μC find the electrostatic potentials at points P and Q



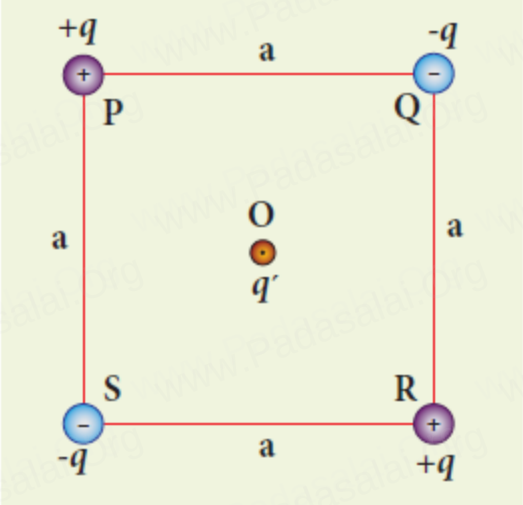
(c) Calculate the work done to bring a test charge +2μC from infinity to the point P. Assume the charge +9μC is held fixed at origin and +2μC is brought from infinity to P.

1.13 Consider a point charge +q placed at the origin and another point charge -2q placed at a distance of 9 m from the charge +q. Determine the point between the two charges at which electric potential is zero.

1.14 The following figure represents the electric potential as a function of x – coordinate. Plot the corresponding electric field as a function of x.

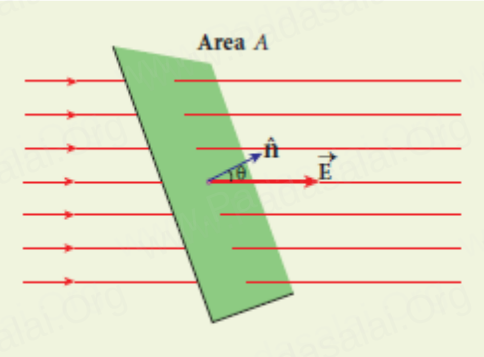


1.15 Four charges are arranged at the corners of the square *PQRS* of side *a* as shown in the figure.(a) Find the work required to assemble these charges in the given configuration. (b) Suppose a charge q′ is brought to the center of the square, by keeping the four charges fixed at the corners, how much extra work is required for this?

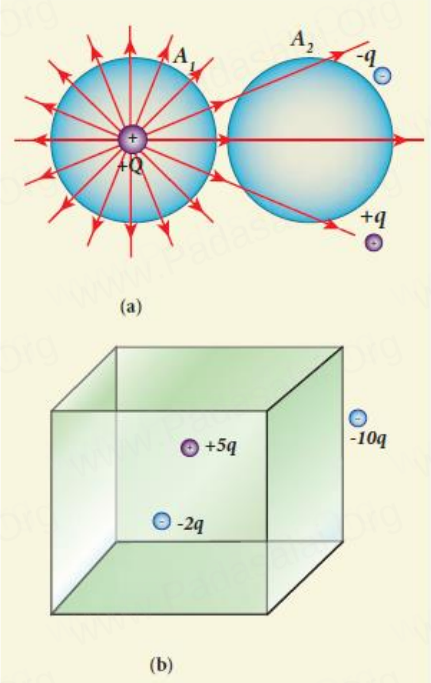


1.16 A water molecule has an electric dipole moment of 6.3×10^{-30} Cm. A sample contains 10^{22} water molecules, with all the dipole moments aligned parallel to the external electric field of magnitude 3×10^{5} N C^{-1}. How much work is required to rotate all the water molecules from $\theta = 0^{o}$ to 90^{o}?

1.17 Calculate the electric flux through the rectangle of sides 5 cm and 10 cm kept in the region of a uniform electric field 100 NC^{-1}. The angle θ is 60^{o}. Suppose θ becomes zero, what is the electric flux?



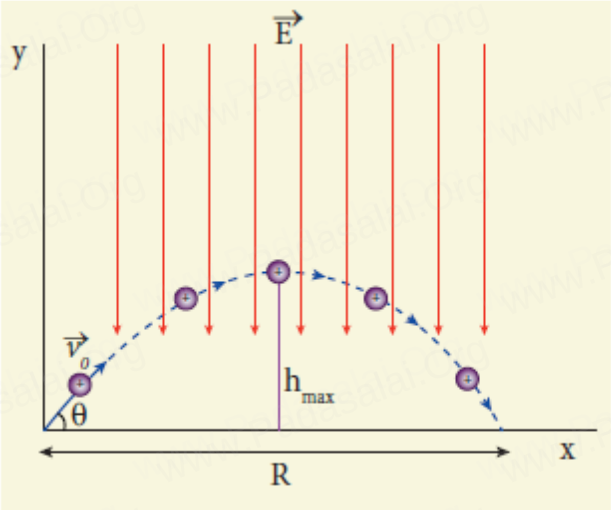
1.18



(i) In figure (a), calculate the electric flux through the closed areas A_1 and A_2.

(ii) In figure (b), calculate the electric flux through the cube

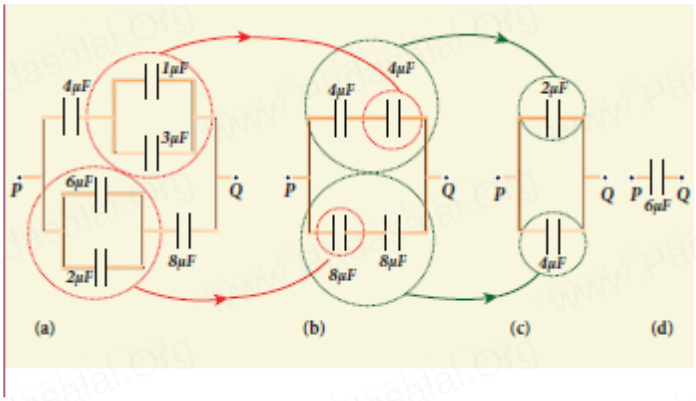
1.19 A small ball of conducting material having a charge +q and mass m is thrown upward at an angle θ to horizontal surface with an initial speed v_o as shown in the figure. There exists an uniform electric field E downward along with the gravitational field g. Calculate the range, maximum height and time of flight in the motion of this charged ball. Neglect the effect of air and treat the ball as a point mass.



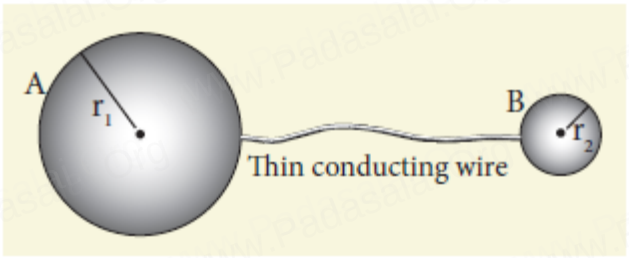
1.20 A parallel plate capacitor has square plates of side 5 cm and separated by a distance of 1 mm. (a) Calculate the capacitance of this capacitor. (b) If a 10 V battery is connected to the capacitor, what is the charge stored in any one of the plates? (The value of $\varepsilon_o = 8.85 \times 10^{-12}$ $Nm^2 C^{-2}$)

1.21 A parallel plate capacitor filled with mica having $\varepsilon_r = 5$ is connected to a 10 V battery. The area of the parallel plate is 6 m^2 and separation distance is 6 mm. (a) Find the capacitance and stored charge. (b) After the capacitor is fully charged, the battery is disconnected and the dielectric is removed carefully. Calculate the new values of capacitance, stored energy and charge.

1.22 Find the equivalent capacitance between P and Q for the configuration shown below in the figure (a).



1.23 Two conducting spheres of radius r_1 = 8 cm and r_2 = 2 cm are separated by a distance much larger than 8 cm and are connected by a thin conducting wire as shown in the figure. A total charge of Q = +100 nC is placed on one of the spheres. After a fraction of a second, the charge Q is redistributed and both the spheres attain electrostatic equilibrium.



(a) Calculate the charge and surface charge density on each sphere.

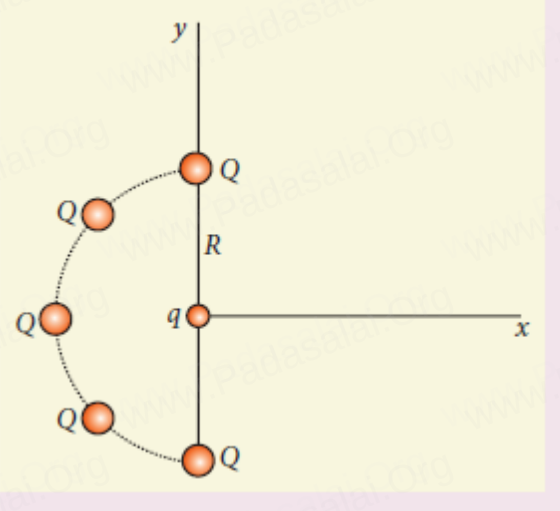
(b) Calculate the potential at the surface of each sphere.

1.24 Dielectric strength of air is 3×10^6 V m^{-1}. Suppose the radius of a hollow sphere in the Van de Graff generator is R = 0.5 m, calculate the maximum potential difference created by this Van de Graaff generator.

1. When two objects are rubbed with each other, approximately a charge of 50 nC can be produced in each object. Calculate the number of electrons that must be transferred to produce this charge.

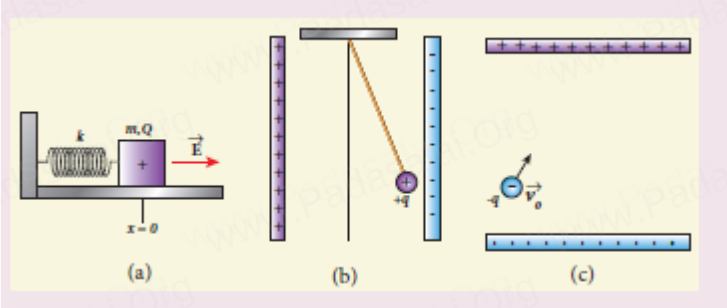
2. The total number of electrons in the human body is typically in the order of 1028. Suppose, due to some reason, you and your friend lost 1% of this number of electrons. Calculate the electrostatic force between you and your friend separated at a distance of 1m. Compare this with your weight. Assume mass of each person is 60 kg and use point charge approximation.

3. Five identical charges Q are placed equidistant on a semicircle as shown in the figure. Another point charge q is kept at the center of the circle of radius R. Calculate the electrostatic force experienced by the charge q.

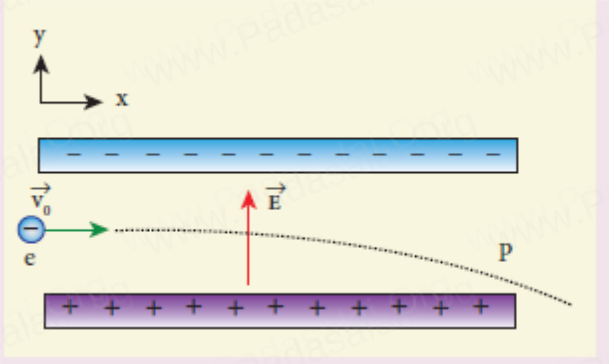


4. Suppose a charge +q on Earth's surface and another +q charge is placed on the surface of the Moon. (a) Calculate the value of q required to balance the gravitational attraction between Earth and Moon (b) Suppose the distance between the Moon and Earth is halved, would the charge q change?

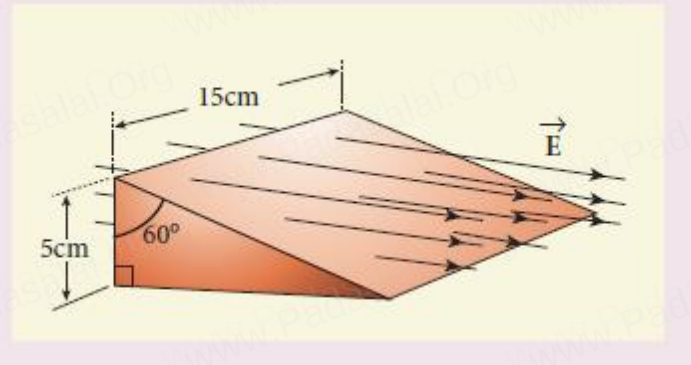
5. Draw the free body diagram for the following charges as shown in the figure (a), (b) and (c).



6. Consider an electron travelling with a speed v_o and entering into a uniform electric field $\vec{E}$ which is perpendicular to $\overrightarrow{v_0}$ as shown in the Figure. Ignoring gravity, obtain the electron's acceleration, velocity and position as functions of time.

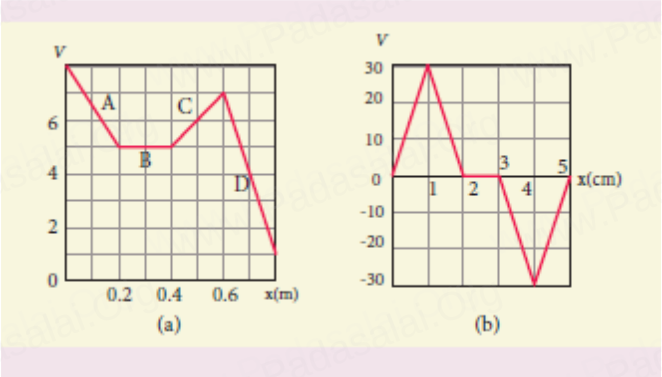


7. A closed triangular box is kept in an electric field of magnitude $E = 2 \times 10^3$ N C^{-1} as shown in the figure.



Calculate the electric flux through the (a) vertical rectangular surface (b) slanted surface and (c) entire surface.

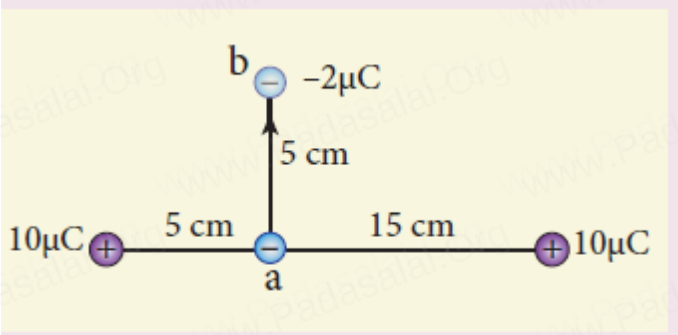
8. The electrostatic potential is given as a function of x in figure (a) and (b). Calculate the corresponding electric fields in regions A, B, C and D. Plot the electric field as a function of x for the figure (b).



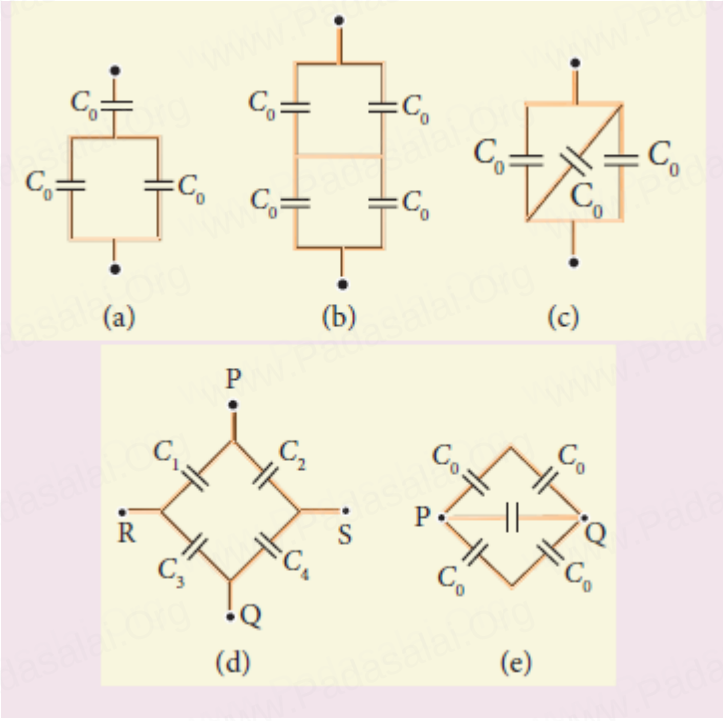
9. A spark plug in a bike or a car is used to ignite the air-fuel mixture in the engine. It consists of two electrodes separated by a gap of around 0.6 mm gap as shown in the figure.

To create the spark, an electric field of magnitude 3×10^6 Vm^{-1} is required. (a) What potential difference must be applied to produce the spark? (b) If the gap is increased, does the potential difference increase, decrease or remains the same? (c) find the potential difference if the gap is 1 mm.

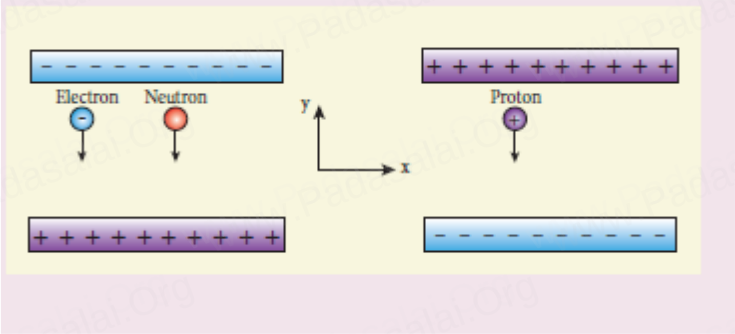
10. A point charge of +10 μC is placed at a distance of 20 cm from another identical point charge of +10 μC. A point charge of -2 μC is moved from point a to b as shown in the figure. Calculate the change in potential energy of the system? Interpret your result.



11. Calculate the resultant capacitances for each of the following combinations of capacitors.

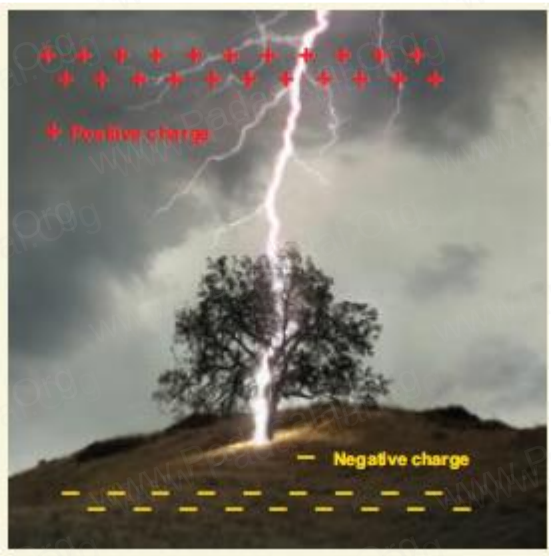


12. An electron and a proton are allowed to fall through the separation between the plates of a parallel plate capacitor of voltage 5 V and separation distance h = 1 mm as shown in the figure.



(a) Calculate the time of flight for both electron and proton (b) Suppose if a neutron is allowed to fall, what is the time of flight? (c) Among the three, which one will reach the bottom first? (Take $m_p = 1.6 \times 10^{-27}$ kg, $m_e = 9.1 \times 10^{-31}$ kg and $g = 10$ m s^{-2})

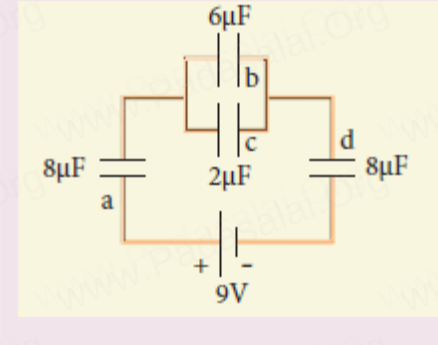
13. During a thunder storm, the movement of water molecules within the clouds creates friction, partially causing the bottom part of the clouds to become negatively charged. This implies that the bottom of the cloud and the ground act as a parallel plate capacitor. If the electric field between the cloud and ground exceeds the dielectric breakdown of the air (3×10^6 Vm^{-1}), lightning will occur.



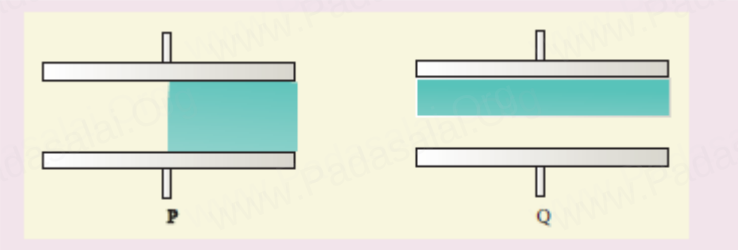
(a) If the bottom part of the cloud is 1000 m above the ground, determine the electric potential difference that exists between the cloud and ground.

(b) In a typical lightning phenomenon, around 25C of electrons are transferred from cloud to ground. How much electrostatic potential energy is transferred to the ground?

14. For the given capacitor configuration (a) Find the charges on each capacitor (b) potential difference across them (c) energy stored in each capacitor



15. Capacitors P and Q have identical cross sectional areas A and separation d. The space between the capacitors is filled with a dielectric of dielectric constant εr as shown in the figure. Calculate the capacitance of capacitors P and Q.



By

M.GANESAN

PG ASSISTANT IN PHYSICS

EINSSTEIN MATRIC HR. SEC SCHOOL

KOMARAPALAYAM

I. Choose the best answer.

1. Which of the following has the smallest mass?

   a. 6.023 × 1023 atoms of He b.1 atom of He

   c. 2 g of He d.1 mole atoms of He

2. Which of the following is a triatomic molecule?

   a. Glucose b.Helium

   c. Carbon dioxide d. Hydrogen

3. Th e volume occupied by 4.4 g of CO2 at S.T.P

   a. 22.4 litre b.2.24 litre

   c. 0.24 litre d.0.1 litre

4. Mass of 1 mole of Nitrogen atom is

   a. 28 amu b.14 amu

   c. 28 g d.14 g

5. Which of the following represents 1 amu?

   a. Mass of a C – 12 atom b.Mass of a hydrogen atom

   c. $1/12^{th}$ of the mass of a C – 12 atom d.Mass of O – 16 atom

6. Which of the following statement is incorrect?

   a. One gram of C – 12 contains Avogadro's number of atoms.

   b. One mole of oxygen gas contains Avogadro's number of molecules.

   c. One mole of hydrogen gas contains Avogadro's number of atoms.

   d. One mole of electrons stands for 6.023×10^{23} electrons.

7. The volume occupied by 1 mole of a diatomic gas at S.T.P is

   a. 11.2 litre b. 5.6 litre

   c. 22.4 litre d. 44.8 litre

8. In the nucleus of 20Ca40, there are

   a. 20 protons and 40 neutrons b. 20 protons and 20 neutrons

   c. 20 protons and 40 electrons d. 40 protons and 20 electrons

9. The gram molecular mass of oxygen molecule is

   a. 16 g b. 18 g

   c. 32 g d. 17 g

10. 1 mole of any substance contains ____ molecules.

a. 6.023×10^{23} b. 6.023×10^{-23}

c. 3.0115×10^{23} d. 12.046×10^{23}

II. Fill in the blanks

1. Atoms of different elements having _____ mass number, but _____ atomic numbers are called isobars.
2. Atoms of different elements having same number of _____ are called isotones.
3. Atoms of one element can be transmuted into atoms of other element by _____
4. The sum of the numbers of protons and neutrons of an atom is called its _____
5. Relative atomic mass is otherwise known as _____
6. The average atomic mass of hydrogen is _____ amu.
7. If a molecule is made of similar kind of atoms, then it is called _____ atomic molecule.
8. The number of atoms present in a molecule is called its _____
9. One mole of any gas occupies _____ ml at S.T.P
10. Atomicity of phosphorous is _____

III. Match the following

1.	8 g of O_2	-	4 moles
2.	4 g of H_2	-	0.25 moles
3.	52 g of He	-	2 moles
4.	112 g of N_2	-	0.5 moles
5.	35.5 g of Cl_2	-	13 moles

IV. True or False: (If false give the correct statement)

1. Two elements sometimes can form more than one compound.
2. Noble gases are Diatomic
3. The gram atomic mass of an element has no unit
4. 1 mole of Gold and Silver contain same number of atoms
5. Molar mass of CO_2 is 42g.

V. Assertion and Reason:

Answer the following questions using the data given below:

i) A and R are correct, R explains the A.

ii) A is correct, R is wrong.

iii) A is wrong, R is correct.

iv) A and R are correct, R doesn't explains A.

1. **Assertion:** Atomic mass of aluminium is 27

Reason: An atom of aluminium is 27 times heavier than 1/12th of the mass of the C – 12 atom.

2. **Assertion:** The Relative Molecular Mass of Chlorine is 35.5 a.m.u.

Reason: The natural abundance of Chlorine isotopes are not equal.

VI. Short answer questions

1. Define: Relative atomic mass.
2. Write the different types of isotopes of oxygen and its percentage abundance.
3. Define: Atomicity
4. Give any two examples for heterodiatomic molecules.
5. What is Molar volume of a gas?
6. Find the percentage of nitrogen in ammonia.

VII. Long answer questions

1. Calculate the number of water molecule present in one drop of water which weighs 0.18 g.
2. $N_2 + 3\ H_2 \rightarrow 2\ NH_3$

   (The atomic mass of nitrogen is 14, and that of hydrogen is 1)

   1 mole of nitrogen (_____g) + 3 moles of hydrogen (_____ g) →

   2 moles of ammonia (_____ g)
3. Calculate the number of moles in

   i) 27g of Al ii) 1.51 × 1023 molecules of NH4Cl
4. Give the salient features of "Modern atomic theory".
5. Derive the relationship between Relative molecular mass and Vapour density

VIII. HOT question

1. Calcium carbonate is decomposed on heating in the following reaction

   $CaCO_3 \rightarrow CaO + CO_2$

   i. How many moles of Calcium carbonate are involved in this reaction?

   ii. Calculate the gram molecular mass of calcium carbonate involved in this reaction

   iii. How many moles of CO_2 are there in this equation?

IX. Solve the following problems

1. How many grams are there in the following?

   i. 2 moles of hydrogen molecule, H_2

   ii. 3 moles of chlorine molecule, Cl_2

   iii. 5 moles of sulphur molecule, S_8

   iv. 4 moles of phosphorous molecule, P_4

2. Calculate the % of each element in calcium carbonate. (Atomic mass: C-12, O-16, Ca - 40)
3. Calculate the % of oxygen in $Al_2(SO_4)_3$. (Atomic mass: Al-12, O-16, S -32)
4. Calculate the % relative abundance of B -10 and B -11, if its average atomic mass is 10.804 amu.

Example 1: Oxygen is the most abundant element in both the Earth's crust and the human body. It exists as a mixture of three stable isotopes in nature as shown in Table 7.3:

Table 7.3 Isotopes of oxygen

Isotope	Mass (amu)	% abundance
$_8O^{16}$	15.9949	99.757
$_8O^{17}$	16.9991	0.038
$_8O^{18}$	17.9992	0.205

Example 2: Boron naturally occurs as a mixture of boron-10 (5 protons + 5 neutrons) and boron-11 (5 protons + 6 neutrons) isotopes. The percentage abundance of B-10 is 20 and that of B-11 is 80. Then, the atomic mass of boron is calculated as follows:

Example 1: Relative molecular mass of sulphuric acid (H_2SO_4) is calculated as follows: Sulphuric acid conatins 2 atoms of hydrogen, 1 atom of sulphur and 4 atoms of oxygen.

Example 2: Relative molecular mass of water (H_2O) is calculated as follows: A water molecule is made of 2 atoms of hydrogen and one atom of oxygen.

Example 1: Find the mass percentage composition of methane (CH_4).

I. Calculation of molar mass

Calculate the gram molar mass of the following.

1) H_2O 2) CO_2 3) $Ca_3(PO_4)_2$

II. Calculation based on number of moles from mass and volume

1) Calculate the number of moles in 46 g of sodium?

2) 5.6 litre of oxygen at S.T.P

3) Calculate the number of moles of a sample that contains 12.046×10^{23} atoms of iron ?

III. Calculation of mass from mole

Calculate the mass of the following

1) 0.3 mole of aluminium (Atomic mass of Al = 27)

2) 2.24 litre of SO_2 gas at S.T.P

3) 1.51×10^{23} molecules of water

4) 5×10^{23} molecules of glucose ?

IV. Calculation based on number of atoms/ molecules.

1) Calculate the number of molecules in 11.2 litre of CO_2 at S.T.P

2) Calculate the number of atoms present in 1 gram of gold (Atomic mass of Au = 198)

3) Calculate the number of molecules in 54 gm of H_2O?

4) Calculate the number of atoms of oxygen and carbon in 5 moles of CO_2.

V. Calculation based on molar volume

Calculate the volume occupied by:

1) 2.5 mole of CO_2 at S.T.P

2) 3.011×10^{23} of ammonia gas molecules

3) 14 g nitrogen gas

VI. Calculation based on % composition Calculate % of S in H_2SO_4

BY

MR.NAGARAJ - CHEMISTRY

MR.GANESAN - PHYSICS

MRS.MALLISHWARI – BIOLOGY

EINSSTEIN MATRIC HR. SEC. SCHOOL

KOMARAPALAYAM.

NAMAKKAL.

I. Choose the best answer.

1. The number of periods and groups in the periodic table are_____.
   a) 6,16 b) 7,17
   c) 8,18 d) 7,18
2. The basis of modern periodic law is_____.
   a) atomic number b) atomic mass
   c) isotopic mass d) number of neutrons
3. _____ group contains the member of halogen family.
   a) 17^{th} b) 15^{th}
   c) 18^{th} d) 16^{th}
4. _____ is a relative periodic property
   a) atomic radii b) ionic radii
   c) electron affinity d) electronegativity
5. Chemical formula of rust is _____.
   a) $FeO.xH_2O$ b) $FeO_4.xH_2O$
   c) $Fe_2O_3.xH_2O$ d) FeO
6. In the alumino thermic process the role of Al is _____.
   a) oxidizing agent b) reducing agent
   c) hydrogenating agent d) sulphurising agent
7. The process of coating the surface of metal with a thin layer of zinc is called_____.
   a) painting b) thinning
   c) galvanization d) electroplating
8. Which of the following have inert gases 2 electrons in the outermost shell.
   a) He b) Ne
   c) Ar d) Kr
9. Neon shows zero electron affinity due to _____.
   a) stable arrangement of neutrons b) stable configuration of electrons
   c) reduced size d) increased density

10. _____ is an important metal to form amalgam.

a) Ag b) Hg

c) Mg d) Al

II. Fill in the blanks

1. If the electronegativity difference between two bonded atoms in a molecule is greater than 1.7, the nature of bonding is _____
2. _____ is the longest period in the periodical table.
3. _____ forms the basis of modern periodic table.
4. If the distance between two Cl atoms in Cl_2 molecule is 1.98Å, then the radius of Cl atom is _____.
5. Among the given species A^-,A^+, and A, the smallest one in size is _____.
6. The scientist who propounded the modern periodic law is _____.
7. Across the period, ionic radii _____ (increases,decreases).
8. _____ and _____ are called inner transition elements.
9. The chief ore of Aluminium is _____.
10. The chemical name of rust is _____.

III. Match the following

1.Galvanisation	:	Noble gas elements
2. Calcination	:	Coating with Zn
3.Redox reaction	:	Silver-tin amalgam
4. Dental filling	:	Alumino thermic process
5.Group18 elements	:	Heating in the absence of air

IV. True or False: (If false give the correct statement)

1. Moseley's periodic table is based on atomic mass.
2. Ionic radius increases across the period from left to right.
3. All ores are minerals; but all minerals cannot be called as ores;
4. Al wires are used as electric cables due to their silvery white colour.
5. An alloy is a heterogenous mixture of metals.

V. Assertion and Reason

Answer the following questions using the data given below:

i) A and R are correct, R explains the A.

ii) A is correct, R is wrong.

iii) A is wrong, R is correct.

iv) A and R are correct, R doesn't explains A.

1. **Assertion :** The nature of bond in HF molecule is ionic

   Reason : The electronegativity difference between H and F is 1.9

2. **Assertion :** Magnesium is used to protect steel from rusting

   Reason : Magnesium is more reactive than iron

3. **Assertion :** An uncleaned copper vessel is covered with greenish layer.

   Reason : copper is not attacked by alkali

VI. Short answer questions

1. A is a reddish brown metal, which combines with O_2 at < 1370 K gives B, a black coloured compound. At a temperature > 1370 K, A gives C which is red in colour. Find A,B and C with reaction.
2. A is a silvery white metal. A combines with O_2 to form B at 800^oC, the alloy of A is used in making the aircraft. Find A and B
3. What is rust? Give the equation for formation of rust.
4. State two conditions necessary for rusting of iron.

VII. Long answer questions

1. a) State the reason for addition of caustic alkali to bauxite ore during purification of bauxite.

   b) Along with cryolite and alumina, another substance is added to the electrolyte mixture. Name the substance and give one reason for the addition.

2. The electronic configuration of metal A is 2,8,18,1. The metal A when exposed to air and moisture forms B a green layered compound. A with con. H_2SO_4 forms C and D along with water. D is a gaseous compound. Find A,B,C and D.
3. Explain smelting process.

VIII. HOT questions

1. Metal A belongs to period 3 and group 13. A in red hot condition reacts with steam to form B. A with strong alkali forms C. Find A,B and C with reactions
2. Name the acid that renders aluminium passive. Why?
3. a) Identify the bond between H and F in HF molecule.
   b) What property forms the basis of identification?
   c) How does the property vary in periods and in groups?

BY

MR.NAGARAJ - CHEMISTRY

MR.GANESAN - PHYSICS

MRS.MALLISHWARI – BIOLOGY

EINSSTEIN MATRIC HR. SEC. SCHOOL

KOMARAPALAYAM.

NAMAKKAL.

I. Choose the correct answer.

1. A solution is a _____ mixture.
   a. homogeneous b. heterogeneous
   c. homogeneous and heterogeneous d. non homogeneous
2. The number of components in a binary solution is _____
   a. 2 b. 3
   c. 4 d. 5
3. Which of the following is the universal solvent?
   a. Acetone b. Benzene
   c. Water d. Alcohol
4. A solution in which no more solute can be dissolved in a definite amount of solvent at a given temperature is called _____
   a. Saturated solution b. Un saturated solution
   c. Super saturated solution d. Dilute solution
5. Identify the non aqueous solution.
   a. sodium chloride in water b. glucose in water
   c. copper sulphate in water d. sulphur in carbon-di-sulphide
6. When pressure is increased at constant temperature the solubility of gases in liquid _____.
   a. No change b. increases
   c. decreases d. no reaction
7. Solubility of NaCl in 100 ml water is 36 g. If 25 g of salt is dissolved in 100 ml of water how much more salt is required for saturation _____.
   a. 12g b. 11g
   c. 16g d. 20g
8. A 25% alcohol solution means
   a. 25 ml alcohol in 100 ml of water b. 25 ml alcohol in 25 ml of water
   c. 25 ml alcohol in 75 ml of water d. 75 ml alcohol in 25 ml of water
9. Deliquescence is due to _____

a. Strong affinity to water b. Less affinity to water

c. Strong hatred to water d. Inertness to water

10. Which of the following is hygroscopic in nature?

a. ferric chloride b. copper sulphate penta hydrate

c. silica gel d. none of the above

II. Fill in the blanks

1. The component present in lesser amount, in a solution is called _____
2. Example for liquid in solid type solution is _____
3. Solubility is the amount of solute dissolved in _____ g of solvent.
4. Polar compounds are soluble in _____ solvents
5. Volume persentage decreases with increases in temperature because _____

III. Match the following

1. Blue vitriol – $CaSO_4 .2H_2O$
2. Gypsum – CaO
3. Deliquescence – $CuSO_4.5H_2O$
4. Hygroscopic – NaOH

IV. True or False: (If false give the correct statement)

1. Solutions which contain three components are called binary solution.
2. In a solution the component which is present in lesser amount is called solvent.
3. Sodium chloride dissolved in water forms a non-aqueous solution.
4. The molecular formula of green vitriol is $MgSO_4.7H_2O$
5. When Silica gel is kept open, it absorbs moisture from the air, because it is hygroscopic in nature

V. Short answer

1. Define the term: Solution
2. What is mean by binary solution
3. Give an example each i) gas in liquid ii) solid in liquid iii) solid in solid iv) gas in gas
4. What is aqueous and non-aqueous solution? Give an example.
5. Define Volume percentage

6. The aquatic animals live more in cold region Why?
7. Define Hydrated salt.
8. A hot saturated solution of copper sulphate forms crystals as it cools. Why?
9. Classify the following substances into deliquescent, hygroscopic.
   Conc. Sulphuric acid, Copper sulphate penta hydrate, Silica gel, Calcium chloride, and Gypsum salt.

VI. Long answer:

1. Write notes on i) saturated solution ii) unsaturated solution
2. Write notes on various factors affecting solubility.
3. a) What happens when $MgSO_4.7H_2O$ is heated? Write the appropriate equation
   b) Define solubility
4. In what way hygroscopic substances differ from deliquescent substances.
5. A solution is prepared by dissolving 45 g of sugar in 180 g of water. Calculate the mass percentage of solute.
6. 3.5 litres of ethanol is present in 15 litres of aqueous solution of ethanol. Calculate volume percent of ethanol solution.

VII. HOT

1. Vinu dissolves 50 g of sugar in 250 ml of hot water, Sarath dissolves 50 g of same sugar in 250 ml of cold water. Who will get faster dissolution of sugar? and Why?
2. 'A' is a blue coloured crystaline salt. On heating it loses blue colour and to give 'B'. When water is added, 'B' gives back to 'A'. Identify A and B, write the equation.
3. Will the cool drinks give more fizz at top of the hills or at the foot? Explain

I. Problems based on solubility

1) 1.5 g of solute is dissolved in 15 g of water to form a saturated solution at 298K. Find out the solubility of the solute at the temperature.
2) Find the mass of potassium chloride would be needed to form a saturated solution in 60 g of water at 303 K? Given that solubility of the KCl is 37/100 g at this temperature.
3) What is the mass of sodium chloride that would be needed to form a saturated solution in 50 g of water at 30°C. Solubility of sodium chloride is 36 g at 30°C?

4) The Solubility of sodium nitrate at 50°C and 30°C is 114 g and 96 g respectively. Find the amount of salt that will be thrown out when a saturated solution of sodium nitrate containing 50 g of water is cooled from 50°C to 30°C?

II. Problem based on mass percentage

1) A solution was prepared by dissolving 25 g of sugar in 100 g of water. Calculate the mass percentage of solute.
2) 16 grams of NaOH is dissolved in 100 grams of water at 25°C to form a saturated solution. Find the mass percentage of solute and solvent.
3) Find the amount of urea which is to be dissolved in water to get 500 g of 10% w/w aqueous solution?

(iii) **Problem based on Volume – volume percentage.**

1) A solution is made from 35 ml of Methanol and 65 ml of water. Calculate the volume percentage.
2) Calculate the volume of ethanol in 200 ml solution of 20% v/v aqueous solution of ethanol.

BY

MR.NAGARAJ - CHEMISTRY

MR.GANESAN - PHYSICS

MRS.MALLISHWARI – BIOLOGY

EINSSTEIN MATRIC HR. SEC. SCHOOL

KOMARAPALAYAM.

NAMAKKAL