# Key Answers

# TOPIC;- ELECTROSTATICS

1. A (Positively)
2. a (Negatively)
3. b (Benjamin Franklin)
4. b (Since a charge is conserved after electrification)
5. d
6. c
7. b
8. a
9. b
10. a

11(a) Cube has sin faces. Each face has a area = 5cm X 5cm=25cm$^2$
=25 X 10$^{-4}$m$^2$

- **Total Area** (A) = 6 X 25 X 10$^{-2}$ = 150 x 10$^{-4}$m$^2$
- $\sigma = q/A$, by substituting the values of q and A, we get
- $\sigma$= 4x10$^2$μC/m$^2$

18. (C) In the field E a Charge q experiences force F =ma = qE

$$a = \frac{qE}{m}$$

After travelling a distance s=y it has a velocity $V = \sqrt{\frac{2qEy}{M}}$ $E_k = ½ mv^2 = qEy$

17. (a) Two masses m and 2m, gets accelerated in an uniform electric field with an acceleration $a_1$ and $a_2$, such that $a_1 = 2 a_2$. But

$$\frac{E_{k1}}{E_{k2}} = \frac{a_1^2}{a_2^2} = \frac{2}{1}$$

19. (b) The Speed gained by a charged particles of different charges is directly proportional to the charge to its charge at same potential difference .

$$\frac{V_A^2}{V_B^2} = \frac{q_A}{q_B} = \frac{q}{4q} = \frac{1}{4}$$

$$\frac{V_A}{V_B} = \frac{1}{2}$$

20. (a) Since the electrostatic force between two charges is inversely proportional to dielectric constant (K) and to the square of the distance between the two charges.

$R = r/\sqrt{K}$

21.

22. (c) Because charge reside on the surface of the spheres, which is independent of mass of the spheres.

23. (d) p.d between two points =w/q=2/20=$10^{-1}$volts

24. (c) Since the electric intensity at a point within the sphere is zero and at appoint outside sphere is inversely proportional to the square of the distance between the point and the center of the sphere.

25. (a) $q=+ne=+1.6\times10^{-19}\times10^{19}=+1.6$

26. (c) potential at the center of square=$V_o=9\times10^{9}\times10^{-6}\left[\frac{10}{1}+\frac{5}{1}-\frac{3}{1}+\frac{8}{1}\right] = 9\times10^{3}\times20 = 180\times10^{3}$
$=1.8\times10^{5}$volts

27. (a) potential of smaller drop=v α q/r
Potential bigger drop =V α Q/R , But Q=nq and R=$n^{1/3}$r, substituting these values we get
$V=n^{2/3}v$

28. (d) When a charge q is placed in the region uniform electric field experience a force f=ma=qxE
a =qxE/m, After a time of 't' seconds it has a velocity (v) given by
v=u+ at = 0+ (qxE/m) t
v = (qxE/m) xt
$E_K=(1/2)mv^2= \frac{q^2E^2t^2}{2m}$

29. (d) It means that the body has a deficit of electrons.Therefore the body is charged positively.

30. (a) $E_k$=qxv =eV
$(1/2)\ mv^2= e \times V$
$V^2 = 2e V/m$ = ………..$\times10^6$ m/s

31. (c)

32. (d) Because the charge q is moved once round the circle of radius r with a charge Q at the center is a equipotential surface.

33. (a)

34. (a) Because mica is a dielectric material.

35. (c) Because the dielectric slab placed between the plates decrease the strength of electric field, which in turn decrease the potential.

36. (b) Before the slab is introduced =U= $(1/2)\ CV^2$
After the slab is introduced =U' = $(1/2)\ C'V^2$ } $\frac{U}{U'} = \frac{C}{C'}$
( C/C')= 1/K
(U/U') =1/K

37. ( c) Because the given circuit is the balanced wheatstone's network ,
$C_{AB}= C/2 + C/2 = C$

38. ( c) Here there are combinations two capacitors in series of capacitances, $c_1=\frac{2k_1\varepsilon_0A}{d}$

and $c_2= 2k_2\varepsilon_0A / d$ , Therefore effective capacitance $C= c_1 c_2 / c_1+ c_2$
$C = \frac{\varepsilon_0A2k_1k_2}{d\ (k_1+ k_2}$

39. (b) since two capacitors 2µF & 4µF are in parallel,therefore the pd across each of them is same.If $v_1$ is the pd across this combination,then it is given by $v_1=6\times10^{-6}\times12/(6+6)\times10^{-6}$=6volts

40.(b) Because in the figure it is the combination of two capicators in parallel of capacitances, $C_1 = \frac{k_1 \varepsilon_0 A}{2d}$ and $c_2 = \frac{k_2 \varepsilon_0 A}{2d}$ , therefore its effective capacitance is $= C = c_1 + c_2 = \varepsilon_0 A \frac{(k_1+k_2)}{2d}$

41.(a) we have $C = \varepsilon_0 A/d$ , $A = cd/\varepsilon_0$ substituting the values we get $= 1.694 X 10^3 m^2$

42.(d) we have common potential $V = (C_1V_1 + C_2V_2)/ C_1+C_2$

$$V = 200 \text{volts}$$

43.(a) capacitance of bigger drop $= C = 4\pi\varepsilon_0 R$

Capatiance of smaller drop $= c = 4\pi\varepsilon_0 r$, but we have $R = n^{1/3} X\ r$, substituting this value we get $C = n^{1/3}c$ , therefore $c = C/n^{1/3} = 0.5\mu F$

44.(d) In the ckt the capacitors are connected to form a wheatstone's network .This network is balanced one. The effective capacitance between A&B is given by

$$C_{AB}=2+32/12 = (14/3)\mu F$$

45.

46.(a) Because $C = n^{1/3}c = (125)^{1/3}c = 5c$

47.(d) Because $Q \alpha C$

48.(a)

49.(d)

50.

51.(d) Because $C_m = Kc_a/2d$

52.(d)

53.(b)

54.(a)

55.(a)

56.(d) Because effective capacitance in series becomes C/n

57.(d)

58.(c) Because $C^1/C = d/d^1$ , $C^1 = 20\mu F$

59.(a) $V_2/V_1 = C_1/C_2 = 1\mu F/4\mu F = ¼$

60.(c) Because charge present in $C_1$ is equal to the charge stored in parallel combination of $C_2$ & $C_3$ .And according to law of conservation of energy we have $V = V_1 + V_2$