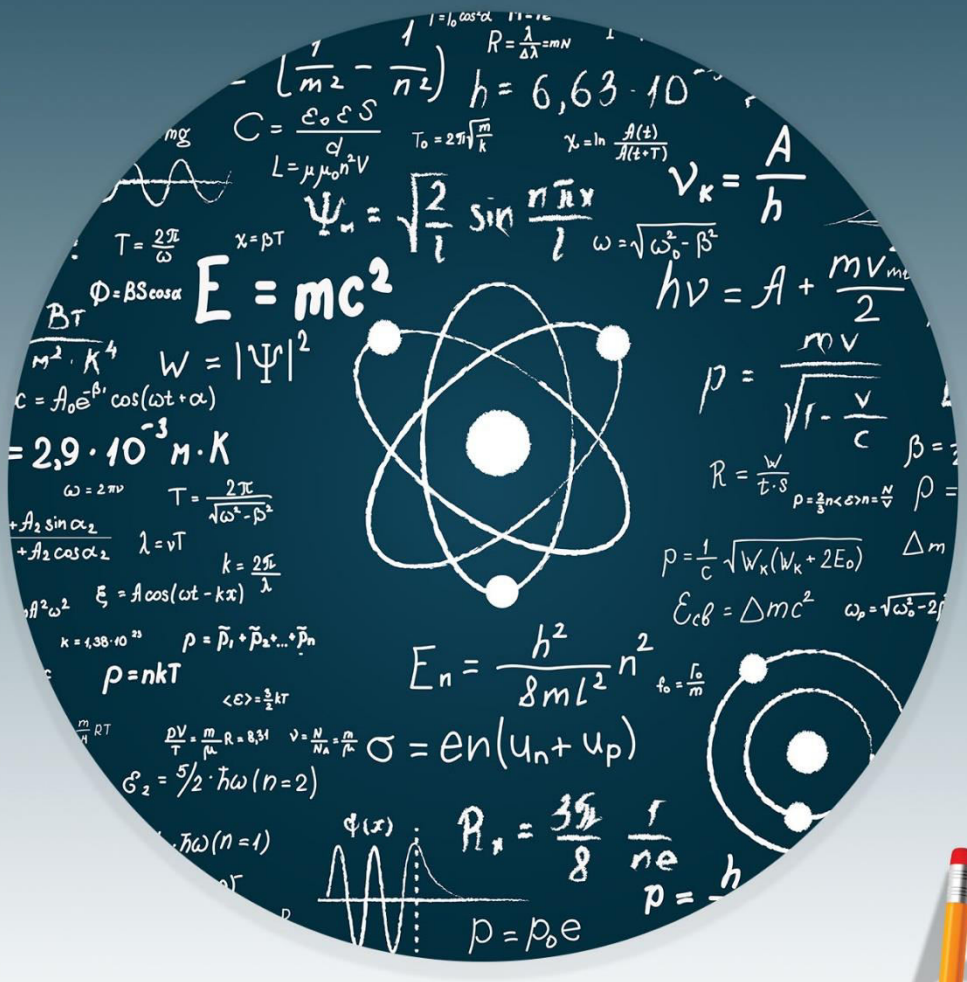
PHYSICS



WORKSHEET-2

STEP

A PROJECT BY PUNJAB GROUP

Worksheet-02

Topics:- Electric Potential to Charging & Discharging of Capacitor

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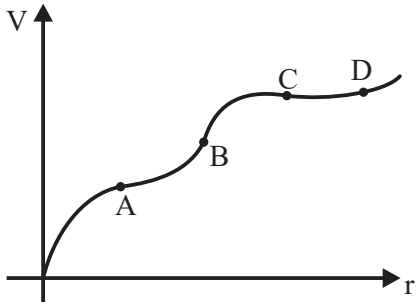
1. The variation of electric potential "V" with distance "r" is given in the figure shown. The value of electric field in the figure shown is maximum at:

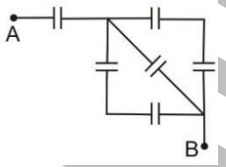


A. Point A B. Point B
C. Point C D. Point D

2. As we know that $C = \frac{Q}{V}$, now if "V" is halved, what happens with "C":

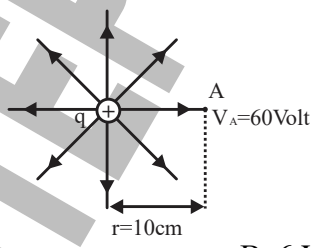
A. Halved B. Remains same
C. Doubled D. None of these

3. In the electric circuit, capacitance of each capacitor is 1 μF. The effective capacitance between the points A and B is (in μF).



A. $\frac{2}{3}$ B. $\frac{3}{2}$
C. $\frac{1}{6}$ D. 6

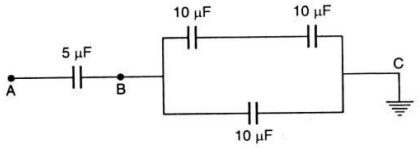
4. The electric field strength at point "A" in the diagram shown is:



A. 600 Vm^{-1} B. 6 Vm^{-1}
C. 60 Vm^{-1} D. None of these

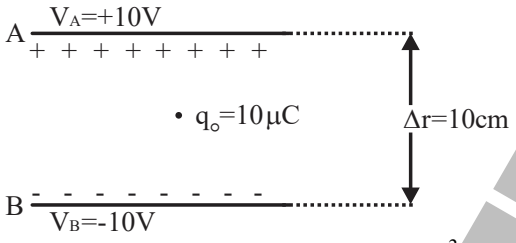
5. In the given circuit, if point C is connected to the Earth

and a potential of +2000 V is given to the point A, then the potential at B is:



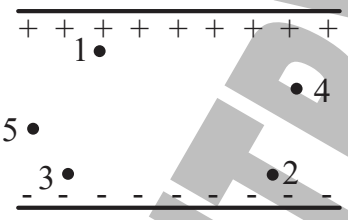
A. 1500V B. 1000V
C. 500V D. 400V

6. What will be the force acting on the charge " $q_\circ$ " shown in diagram?



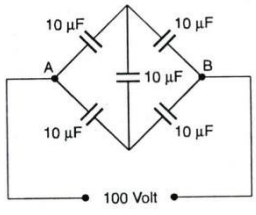
A. Zero B. 2×10^{-3} N
C. 2×10^{-4} N D. 2×10^{-5} N

7. Which points in the uniform electric field between the plates of the capacitor shown in diagram, lie on the same potential:



A. 1 and 4 B. 2 and 3
C. 3 and 5 D. 4 and 5

8. Five capacitors of 10 μF capacity each are connected to a DC potential of 100 V as shown in the following figure. The equivalent capacitance between the points A and B will be equal to:



A. $40\mu F$ B. $20\mu F$
C. $30\mu F$ D. $10\mu F$

9. The work done in carrying a unit positive charge from one

point to other in electric field keeping the charge in equilibrium is called:

A. Electric potential energy
B. Electric potential difference
C. Electric field strength
D. Electric flux density

10. An ECG records _____ between points on human skin.

A. Current B. Charge
C. Voltage D. Electric field

11. Which statement is true for two oppositely charged metal plates?

A. Electric field is constant between plates
B. The gradient of potential w.r.t space between plates is constant between plates
C. Electric potential is zero at mid-point of plates
D. All of these

12. The negative of Potential Gradient is called _____.

A. Electric Potential B. Electric intensity
C. Electric Energy D. Surface charge density

13. If potential difference between two oppositely charged plates is doubled and distance between them is halved then electric field is:

A. Doubled B. Halved
C. Increased by 3 times D. Increased by 4 times

14. If electric field between two oppositely charged plates is 10 NC^{-1} then potential gradient is:

A. $-1\ V\,m^{-1}$ B. $+10\ V\,m^{-1}$
C. $-10\ V\,m^{-1}$ D. $+1\ V\,m^{-1}$

15. If a charge of 5 C is moved against an electric field of 10 N C^{-1} through a distance of 5 m, the P.E gained by charge is:

A. 25 J B. 200 J
C. 2 J D. 250 J

16. Two point charges each of magnitude "q" and opposite sign are separated by distance "2d". Which one of following statement is true?

A. Electric Potential at midpoint of charges is zero
B. Electric field at midpoint of charges is not zero
C. Potential difference at midpoint is not zero
D. All of these

17. The graph which correctly describes the relation between electric potential "V" at a point due to point charge and

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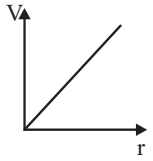
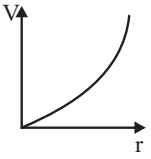
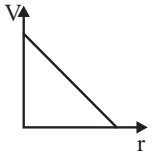
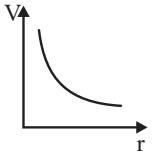
distance "r" from point charge is:

A. 

B. 

C. 

D. 

18. In the figure shown what is value of electric potential and potential difference (due to electric potentials of both charges) at point "A":

A. $\frac{kq}{d}, Zero$

B. $Zero, \frac{5}{2}\frac{kq}{d}$

C. $3\frac{kq}{d}, 3\frac{kq}{d}$

D. $\frac{3}{2}\frac{kq}{d}, \frac{5}{2}\frac{kq}{d}$

19. If the magnitude of a point charge is doubled and distance of a point from point charge is halved, then electric potential and electric field at that point becomes:

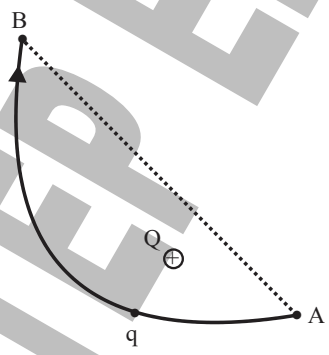
A. Two times each

B. Two times & four times

C. Four times & Eight times

D. Four times each

20. If $V_A = +200\ V$, $V_B = 100\ V$, $q = -0.05\ C$ length of AB=10 cm, length of curved path=20 cm, then how much work is done in moving the charge "q" in the field of a charge "Q" along the curved path?



A. -10 J

B. +5 J

C. +10 J

D. -5 J

21. A particle carrying a charge of 10e falls through a potential difference of 5 V, the energy gained by it is:

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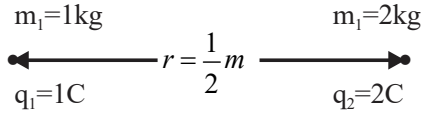
A. 50 eV B. 5 eV
C. 3.2×10^{-18} J D. Both A and C

22. Which one is true about electric and gravitational forces?

A. Both obeys inverse square law B. Both are attractive forces
C. Both are conservative force D. Both A and C

23. The comparison between electric and gravitational force in following figure is?



A. $\frac{F_e}{F_g}=\frac{2k}{G}$ B. $\frac{F_e}{F_g}=\frac{k}{2G}$

C. $\frac{F_e}{F_g}=\frac{G}{k}$ D. $\frac{F_e}{F_g}=\frac{k}{G}$

24. If "F_e" is the electric force and "F_g"is the gravitational force, then:

A. F_e = long range, F_g = short range

B. F_e = long range, F_g = long range

C. F_e = short range, F_g = short range

D. F_e = short range, F_g = long range

25. Which one is bigger unit of energy?

A. erg B. eV
C. MJ D. kWh

26. In Millikan's method charge particle is suspended when (F_D=drag force, F_e=electric force, F_g=gravitational force):

A. $F_D = F_g$ B. $F_e = F_D$

C. $F_e = F_g$ D. Both A &B

27. In Millikan's method according to the relation $q=\frac{mgd}{V}$, if the mass of droplet is doubled then charge:

A. Becomes double B. Becomes half
C. Remains same D. Becomes four times

28. Which of following cannot be a possible charge of a droplet in Millikan's experiment:

A. 8.0×10^{-19}C B. 5.6×10^{-19}C
C. 9.6×10^{-19}C D. 4.8×10^{-19}C

29. A capacitor is a:

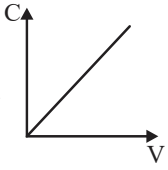
A. Two terminal passive device

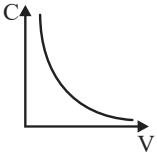
B. Electric energy storing device

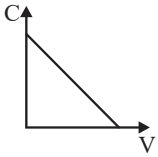
C. Electric charge storing device

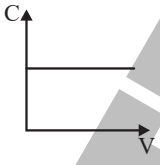
D. All of these

30. In the relation $C = \frac{Q}{V}$, the graph between "C" and "V" when no dielectric is placed is:

A. 

B. 

C. 

D. 

31. The capacitance of capacitor does not depend on:

A. Area of plates

B. Distance between plates

C. Geometry of plates

D. Thickness of plates

32. If area of plates of capacitor is doubled & distance between them is also doubled then capacitance:

A. Is doubled

B. Is halved

C. Remains unchanged

D. Is increased by four times

33. A capacitor has a capacitance of 10 µF when there is a dielectric of dielectric constant 2 between its plates. If the dielectric is removed then capacitance becomes:

A. 20 µF

B. 5 µF

C. 10 µF

D. 40 µF

34. The potential difference between capacitor plates is 10 V when these is a dielectric slab with $\varepsilon_r = 2$ between its plates. If slab is removed now potential difference is:

A. 20 V

B. 5 V

C. 10 V

D. 40 V

35. If the numerical value of area of each plate is equal to distance between parallel plates of a condenser (capacitor), then capacitance is equal to:

A. $\frac{2}{\varepsilon_\circ}$

B. $2\varepsilon_\circ$

C. $\varepsilon_\circ$ D. $\frac{1}{\varepsilon_\circ}$

36. Which one is true expression to find the series equivalent capacitance?

A. $\frac{1}{C_e}=\frac{1}{C_1}+\frac{1}{C_2}+\frac{1}{C_3}+.....$

B. $C_e=\frac{C}{n}$ (n = No. of capacitors of equal capacitances, C = Capacitance of one capacitor)

C. $C_e=\frac{C_1C_2}{C_1+C_2}$

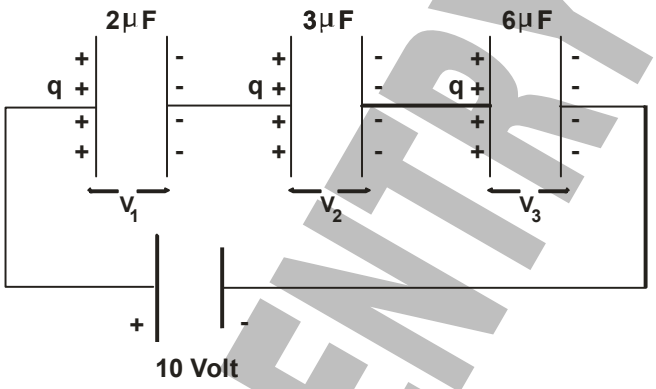
D. All of these

37. When two capacitors of equal capacitances are connected in series their effective capacitance is Cs. Now if they are connected in parallel their effective capacitance becomes C_P, then $C_S:C_P$ is:

A. 2:1 B. 1:2

C. 4:1 D. 1:4

38. The equivalent capacitance in the circuit shown is:



A. 1 μF B. 2μF

C. $\frac{1}{2}$ μF D. 3μF

39. Referring to circuit shown in previous question, what is the charge stored on capacitor with capacitance $3\ \mu F$:

A. $5\ \mu C$ B. $6\ \mu C$

C. $10\ \mu C$ D. $3\ \mu C$

40. Because of electric polarization of dielectric:

A. Surface charge density decreases

B. Electric Intensity decreases

C. Potential difference decrease

D. All of these

41. If a dielectric slab is placed between plates of an isolated charged capacitor, then:

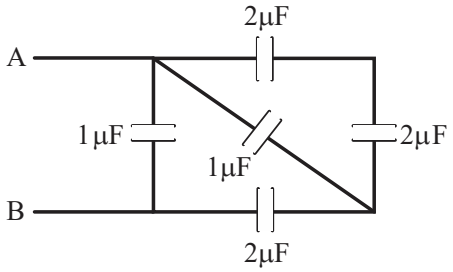
A. Charge on either plate remains same

B. Capacitance of capacitor increases

C. Both A and B

D. Potential difference increases

42. The total capacitance of the system of capacitors shown in the figure between the points A and B.



A. 1 μF B. 2 μF

C. 3 μF D. 4 μF

43. A $10\mu F$ capacitor is charged to a potential difference of 50 V and is connected to another uncharged capacitor in parallel. Now the common potential difference becomes 20 V. The capacitance of second capacitor is:

A. 20 μF B. 10 μF

C. 30 μF D. 15 μF

44. Two capacitors of capacitances 5 μF and 10 μF are connected in series. If a battery of voltage 15 V is connected across their combination, the voltage across capacitor of capacitance 5 μF is:

A. 5 V B. 10 V

C. 15 V D. None of these

45. How three capacitors of 2 μF capacitance each are connected to have an equivalent capacitance of 3 μF?

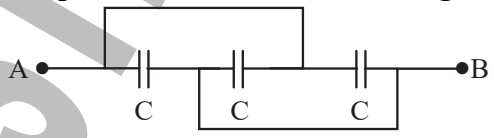
A. All in series

B. All in parallel

C. Two in series and one in parallel

D. Two in parallel and one is series

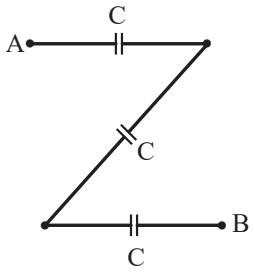
46. The effective capacitance between A & B in given circuit is:



A. C B. 2C

C. 3C D. $\frac{C}{2}$

47. The effective capacitance between A & B in given circuit is:



A. 3C B. $\frac{C}{3}$

C. $\frac{2C}{3}$ D. $\frac{3C}{2}$

48. Which one is not the expression of energy stored in a capacitor?

A. $\frac{1}{2}CV^2$ B. $\frac{1}{2}QV$

C. $\frac{1}{2}\frac{Q^2}{C}$ D. $\frac{1}{2}E^2\varepsilon_\circ\varepsilon_r$

49. A capacitor stores _____ energy in it _____ field.

A. Gravitational Potential, Gravitational
B. Electric Potential, Electric
C. Magnetic Potential, Magnetic
D. Elastic potential, Electric

50. If the electric field strength is doubled, the energy stored in capacitor becomes:

A. Double B. Half
C. Remains same D. Four times

51. If a dielectric slab of dielectric constant ε_r is placed between plates of a charged capacitor, the energy stored:

A. Decreases B. Increases
C. Remains same D. None of these

52. In the charging circuit of a capacitor if the value of capacitance is increased, then capacitor charges:

A. Slowly B. Rapidly
C. At same speed D. None of these

53. Capacitor charges or discharges:

A. Linearly with time
B. Exponentially with time
C. Sinusoidally with time

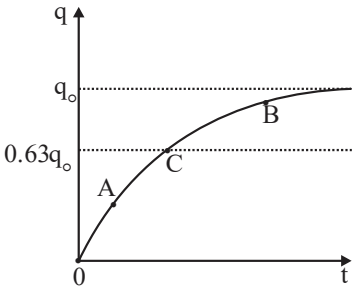
D. Square with time

54. "$\frac{t}{RC}$" has the dimensions same as that of:

A. Time B. Strain

C. Frequency D. Capacitance

55. In the following charging curve of capacitor what does the slope represent?



A. Capacitance B. Charge stored

C. Current passing D. Voltage

56. Referring to the Question # 47, the value of current will be maximum at:

A. Point A B. Point B

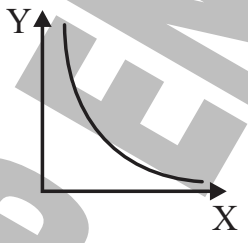
C. Point C D. Same at all points

57. Referring to Question # 47, the charging speed of capacitor is maximum at:

A. Point A B. Point B

C. Point C D. Same at all points

58. What physical quantities may X and Y represent? (Y represents the first mentioned quantity):



A. Electric Intensity vs charge
B. Kinetic energy vs velocity of particle
C. Capacitance vs charge to give a constant potential
D. Potential vs capacitance to give a constant charge

ANSWER KEY (Worksheet-02)							
1	B	16	D	31	D	46	C
2	B	17	D	32	C	47	B
3	A	18	D	33	B	48	D
4	A	19	C	34	A	49	B
5	C	20	D	35	C	50	D
6	B	21	A	36	D	51	A
7	B	22	D	37	D	52	A
8	D	23	D	38	A	53	B
9	B	24	B	39	C	54	B
10	C	25	D	40	D	55	C
11	D	26	C	41	C	56	A
12	B	27	C	42	B	57	A
13	D	28	B	43	D	58	D
14	C	29	D	44	B		
15	D	30	D	45	C		

SOLUTIONS

Chapter – 12 (WS-02)

1. Answer is "B"

Solution:- At point "B" the slope is maximum so $E = \frac{\Delta V}{\Delta r}$ is also maximum.

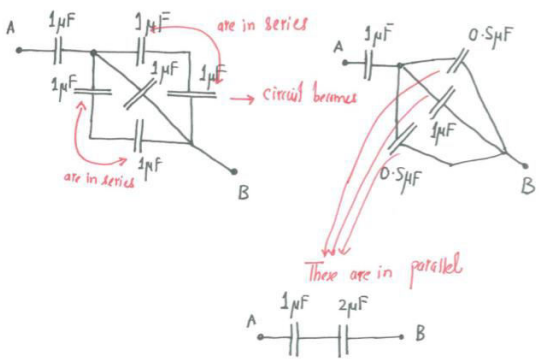
2. Answer is "B"

Solution:-

$C = \frac{Q}{V}$, here "C" is independent of "Q" & "V" which are directly proportional to each other. Which means "C" will remain same.

3. Answer is "A"

Solution:-



$C_{eq} = \frac{\text{Product}}{Sum} = \frac{1\times 2}{2+1} = \frac{2}{3}\mu F$

$= 6\times 10^{+2} = 600 Vm^{-1}$ or NC^{-1}

4. Answer is "A"

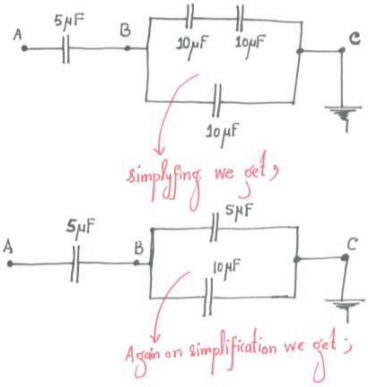
Solution:-

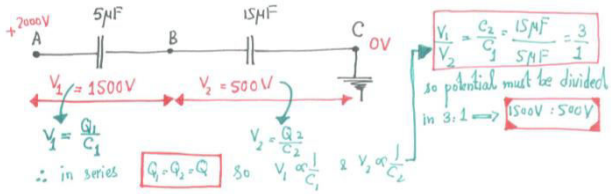
$V = E\times r \Rightarrow E = \frac{V}{r} = \frac{6\cancel{0}}{1\cancel{0}\times 10^{-2}}$

$= 6\times 10^{2} = 600 Vm^{-1}$

5. Answer is "C"

Solution:-





6. Answer is "B"

Solution:-

$\therefore E = \frac{\Delta V}{\Delta r}$

$E = \frac{F}{q_\circ}$ so above relation becomes;

$\frac{F}{q_\circ} = \frac{\Delta V}{\Delta r}$

$F = \frac{\Delta V}{\Delta r}\times q_\circ = \frac{20}{0.1}\times 10\times 10^{-6} = 2000\times 10^{-6}$

$F = 2\times 10^{-3} N$

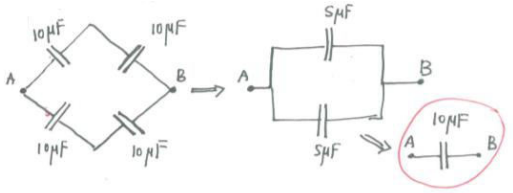
7. Answer is "B"

Solution:- "2" and "3" are at same level so have same potentia

8. Answer is "D"

Solution:-

This is a circuit identical to balanced wheat-stone bridge so the central capacitor is not considered and circuit reduces to;



9. Answer is "B"

Solution:- Potential difference is mathematically written as; $\Delta V = \frac{W_{AB}}{q_\circ}$

which exactly matches with statement of this question.

10. Answer is "C"

Solution:- ECG converts our electrical pulse of heart into waveform and measures the amount of potential created due to activity.

11. Answer is "D"

Solution:- Between two oppositely charged plates the value of "E" is a constant as $E = \frac{\sigma}{\varepsilon_\circ}$ (3^{rd} application of Gauss's law), also E can be called as gradient of potiential with respect to space $\left(E = -\frac{\Delta V}{\Delta r}\right)$, finally moving from "+ve" plate to "-ve" plate potential decreases at a constant rate and in the centre of plates it becomes "zero".

12. Answer is "B"

Solution:- According to the relation $E = \frac{-\Delta V}{\Delta r}$, it is clear that the term "$\frac{-\Delta V}{\Delta r}$" which is negative of potential gradient is equal to electric field.

13. Answer is "D"

Solution:- $E = -\frac{\Delta V}{\Delta r}$

14. Answer is "C"

Solution:- $E = \frac{-\Delta V}{\Delta r}$

15. Answer is "D"

Solution:- $\Delta V = \frac{\Delta U}{q}$ (i) also

$\Delta V = E\Delta r$ (ii)

Compare these equations and solve for P.E *i*.e ΔU.

16. Answer is "D"

Solution:- As charges are opposite so $\vec{E}$ between them cannot be zero, only potential at centre is zero not the potential difference.

17. Answer is "D"

Solution:- $V \propto \frac{1}{r}$

18. Answer is "D"

Solution:- Electric Potential $= V_+ + V_-$

Potential difference $= V_+ - V_-$

(i) $V_+ = \frac{k(2q)}{d}; V_- = \frac{k(-q)}{2d}$

(ii) Electric potential at A $= V_+ + V_-$

(iii) Potential difference at A $= V_+ - V_-$

19. Answer is "C"

Solution:- $E = \frac{kq}{r^2}, V = \frac{kq}{r}$

20. Answer is "D"

Solution:- W= qΔV

21. Answer is "A"

Solution:- K.E=QΔV

22. Answer is "D"

Solution:- Electric force can be both attractive as well as repulsive so this cannot be true, while rest of options are correct.

23. Answer is "D"

Solution:- $F_e = k\frac{q_1 q_2}{r^2}$, $F_g = G\frac{m_1 m_2}{r^2}$

24. Answer is "B"

Solution:-

Both Electric and Gravitational forces are long range forces.

25. Answer is "D"

Solution:- 1 kWh = 3.6 MJ

1 eV = 1.6×10^{-19} J

1 erg = 10^{-7} J

26. Answer is "C"

Solution:- Charge particle can only be suspended if;

$F_E = w = mg = F_g$

27. Answer is "C"

Solution:- Charge on particle is independent of its mass

28. Answer is "B"

Solution:- $Q_{droplet}$=ne, n=Integer

29. Answer is "D"

Solution:- "A capacitor is a two terminal passive device which stores electric potential energy (due to charge storage) in its electric field".

30. Answer is "D"

Solution:- In the absence of dielectric "C" remains same whenever "V" changes.

31. Answer is "D"

Solution:- Capacitance does not depend on:

(i) Thickness of plates

(ii) Metal of plates

32. Answer is "C"

Solution:- $C = \frac{A\varepsilon_\circ}{d}$

33. Answer is "B"

Solution:- $C_{med} = \varepsilon_r C_{vac}$

34. Answer is "A"

Solution:- $V_{med} = \frac{V_{vac}}{\varepsilon_r}$

35. Answer is "C"

Solution:- $C_{vac} = \frac{A\varepsilon_\circ}{d}$

36. Answer is "D"

Solution:- We must remember that the formula's for combination of capacitors are inverse of that for the resistances, so in series combination if we have number of unequal capacitors then we use;

- $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + ...$
- **For just two unequal capacitors we use;**

$$C_{eq} = \frac{\text{Product of capacitances}}{\text{Sum of capacitances}} = \frac{C_1 C_2}{C_1 + C_2}$$

37. Answer is "D"

Solution:- $C_P = nC$; $C_S = C/n$

38. Answer is "A"

Solution:- $\frac{1}{C_e} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

39. Answer is "C"

Solution:- $Q = C_e V$

40. Answer is "D"

Solution:- Because of electric polarization of dielectric;

- Charge stored on plates remains same.
- Surface charge density decreases
- Electric field strength decreases $\left(E = \frac{\sigma}{\varepsilon}\right)$
- Potential difference between plates decreases (V = Ed)
- Capacitance increases $\left(C_{med} = \varepsilon_r C_{vac}\right)$

41. Answer is "C"

Solution:- Because of electric polarization of dielectric;

- Charge stored on plates remains same.
- Surface charge density decreases
- Electric field strength decreases $\left(E = \frac{\sigma}{\varepsilon}\right)$
- Potential difference between plates decreases (V = Ed)
- Capacitance increases $\left(C_{med} = \varepsilon_r C_{vac}\right)$

42. Answer is "B"

Solution:- Start simplifying circuit form top right corner

43. Answer is "D"

Solution:- $V_{net} = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$

44. Answer is "B"

Solution:- For series capacitors

$$V_1 = \left(\frac{C_2}{C_1 + C_2}\right)V,\ V_2 = \left(\frac{C_1}{C_1 + C_2}\right)V$$

45. Answer is "C"

Solution:- $C_e = (2) + \left(\frac{2 \times 2}{2 + 2}\right)$

46. Answer is "C"

Solution:- All capacitors are in parallel

47. Answer is "B"

Solution:- All capacitors are in series

48. Answer is "D"

Solution:- "$\frac{1}{2}E^2\varepsilon_\circ\varepsilon_r$" is the relation for energy density means energy per unit volume but not just energy.

49. Answer is "B"

Solution:- Capacitor stores electric potential energy in the form of electric field (E) between the two plates of capacitor, can be seen in following relation;

$$Energy = \frac{1}{2}Ad\varepsilon_\circ\varepsilon_r E^2$$

50. Answer is "D"

Solution:- Energy $\propto E^2$

51. Answer is "A"

Solution:- By placing medium C↑, V↓ as Energy $= \frac{1}{2}CV^2$ Since power of V is greater than C, so "V" decides energy trend.

52. Answer is "A"

Solution:- ↑t=RC↑

Greater the value of time constant, slower will be the charging speed.

53. Answer is "B"

Solution:- Discharging equation⇒ $q = q_\circ e^{\frac{-t}{RC}}$

54. Answer is "B"

Solution:- RC has units of time

55. Answer is "C"

Solution:- Slope = $\frac{\Delta y}{\Delta x} = \frac{\Delta q}{\Delta t} = I$

56. Answer is "A"

Solution:- I=Slope→Maximum at starting point A

57. Answer is "A"

Solution:- I ∝ Slope ∝ Charging speed

58. Answer is "D"

Solution:- When Q=Constant and we try dielectrics of different ε_r between capacitor plates, then; $V \propto \frac{1}{C}$

STEP

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