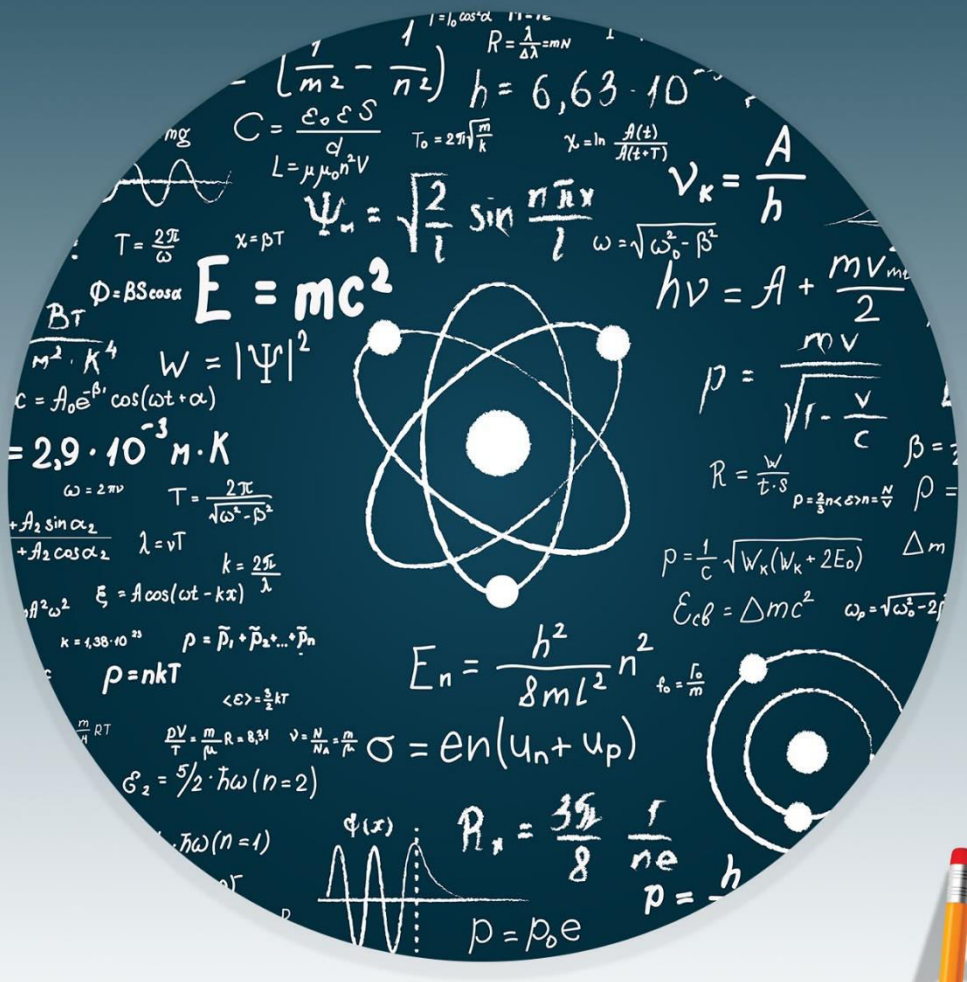
PHYSICS



WORKSHEET-2

STEP

A PROJECT BY PUNJAB GROUP

Worksheet-02

Topics:- Capacitor, Capacitance of a capacitor and its unit, Energy stored in a capacitor, Charging and discharging a capacitor, Polarization of dielectric of a capacitor

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Q.1 A capacitor is a:

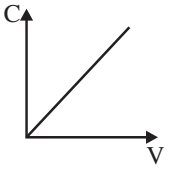
A) Two terminal passive device

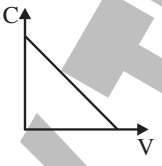
B) Electric energy storing device

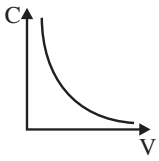
C) Electric charge storing device

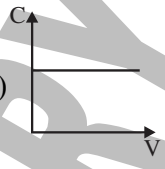
D) All of these

Q.2 In the relation $C = \frac{Q}{V}$, the graph between "C" and "V" when no dielectric is placed is:

A) 

C) 

B) 

D) 

Q.3 The capacitance of capacitor does not depend on:

A) Area of plates

B) Distance between plates

C) Geometry of plates

D) Thickness of plates

Q.4 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

Q.5 A capacitor has a capacitance of 10μF 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

Q.6 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 C) 10 V

B) 5 V D) 40 V

Q.7 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) $\frac{2}{\varepsilon_\circ}$ C) $\varepsilon_\circ$

B) $2\varepsilon_\circ$ D) $\frac{1}{\varepsilon_\circ}$

Q.8 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) $C_e=\frac{C_1C_2}{C_1+C_2}$

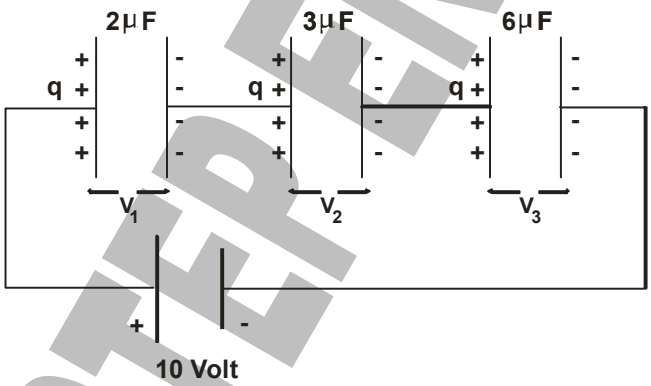
D) All of these

Q.9 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 C) 4:1

B) 1:2 D) 1:4

Q.10 The equivalent capacitance in the circuit shown is:



A) 1 μF C) $\frac{1}{2}$ μF

B) 2μF D) 3μF

Q.11 Referring to circuit shown in previous question, what is the charge stored on capacitor with capacitance $3\mu F$:

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A) $5\mu C$ C) $10\mu C$
B) $6\mu C$ D) $3\mu C$

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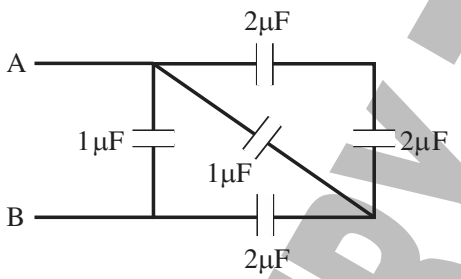
Q.12 Because of electric polarization of dielectric:

A) Surface charge density decreases
B) Electric Intensity decreases
C) Potential difference decrease
D) All of these

Q.13 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) None of these

Q.14 The total capacitance of the system of capacitors shown in the figure between the points A and B)



A) 1 μF C) 3 μF
B) 2 μF D) 4 μF

Q.15 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 C) 30 μF
B) 10 μF D) 15 μF

Q.16 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 C) 15 V
B) 10 V D) None of these

Q.17 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

Q.18 The effective capacitance between A & B in given circuit is:

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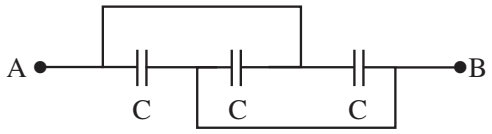


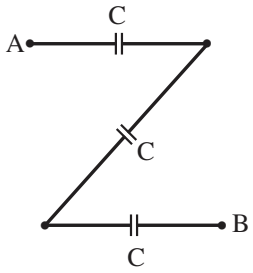
A) C

C) 3C

B) 2C

D) $\frac{C}{2}$

Q.19 The effective capacitance between A & B in given circuit is:



A) 3C

C) $\frac{2C}{3}$

B) $\frac{C}{3}$

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

Q.20 Which one is not the expression of energy stored in a capacitor?

A) $\frac{1}{2}CV^2$

C) $\frac{1}{2}\frac{Q^2}{C}$

B) $\frac{1}{2}QV$

D) $\frac{1}{2}E^2\varepsilon_\circ\varepsilon_r$

Q.21 A capacitor stores _____ energy in it _____ field.

A) Gravitational Potential, Gravitational

B) Electric Potential, Electric

C) Magnetic Potential, Magnetic

D) None of these

Q.22 If the electric field strength is doubled, the energy stored in capacitor becomes:

A) Double

C) Remains same

B) Half

D) Four times

Q.23 If a dielectric slab of dielectric constant ε_r is placed between plates of a charged capacitor, the energy stored:

A) Decreases

C) Remains same

B) Increases

D) None of these

Q.24 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

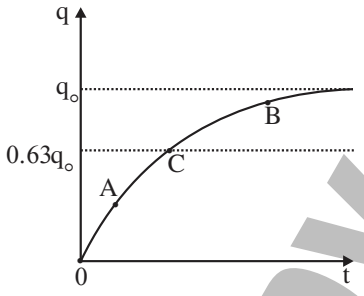
Q.25 Capacitor charges or discharges:

A) Linearly with time
B) Exponentially with time
C) Sinusoidally with time
D) None of these

Q.26 "$\frac{t}{RC}$" has the dimensions same as that of:

A) Time
B) Strain
C) Frequency
D) Capacitance

Q.27 In the following charging curve of capacitor what does the slope represent?



A) Capacitance
B) Charge stored
C) Current passing
D) Voltage

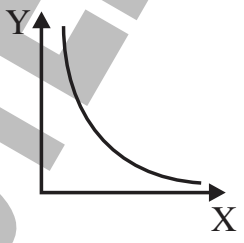
Q.28 Referring to the Question # 27, the value of current will be maximum at:

A) Point A
B) Point B
C) Point C
D) Same at all points

Q.29 Referring to Question # 27, the charging speed of capacitor is maximum at:

A) Point A
B) Point B
C) Point C
D) Same at all points

Q.30 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

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C) Capacitance vs charge to give a constant potential
D) Potential vs capacitance to give a constant charge

ANSWER KEY (Worksheet-02)					
1	D	11	C	21	B
2	D	12	D	22	D
3	D	13	C	23	A
4	C	14	B	24	A
5	B	15	D	25	B
6	A	16	B	26	B
7	C	17	C	27	C
8	D	18	C	28	A
9	D	19	B	29	A
10	A	20	D	30	D

SOLUTIONS

Unit – 6 (WS-02)

Q.1 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".

Q.2 Answer is "D"

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

Q.3 Answer is "D"

Solution:- Capacitance does not depend on:

(i) Thickness of plates

(ii) Metal of plates

Q.4 Answer is "C"

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

Q.5 Answer is "B"

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

Q.6 Answer is "A"

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

Q.7 Answer is "C"

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

Q.8 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;**

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

Q.9 Answer is "D"

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

Q.10 Answer is "A"

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

Q.11 Answer is "C"

Solution:- $Q = C_e V$

Q.12 Answer is "D"

Solution:- Because of electric polarization of dielectric;

- Charge stored on plates remains same.
- Effective area of plates increases.
- Surface charge density decreases $\left(\sigma = \frac{Q}{A_{eff}}\right)$
- Electric field strength decreases $\left(E = \frac{\sigma}{\varepsilon}\right)$
- Potential difference between plates decreases (V = Ed)

- Capacitance increases $\left(C_{med} = \varepsilon_r C_{vac}\right)$

Q.13 Answer is "C"

Solution:- Because of electric polarization of dielectric;

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

Q.14 Answer is "B"

Solution:- Start simplifying circuit form top right corner

Q.15 Answer is "D"

Solution:- $V_{net} = \frac{C_1V_1 + C_2V_2}{C_1 + C_2}$

Q.16 Answer is "B"

Solution:- For series capacitors

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

Q.17 Answer is "C"

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

Q.18 Answer is "C"

Solution:- All capacitors are in parallel

Q.19 Answer is "B"

Solution:- All capacitors are in series

Q.20 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.

Q.21 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;

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

Q.22 Answer is "D"

Solution:- Energy $\propto E^2$

Q.23 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.

Q.24 Answer is "A"

Solution:- ↑t=RC↑

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

Q.25 Answer is "B"

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

Q.26 Answer is "B"

Solution:- RC has units of time

Q.27 Answer is "C"

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

Q.28 Answer is "A"

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

Q.29 Answer is "A"

Solution:- $I \propto$ Slope $\propto$ Charging speed

Q.30 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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