CHAPTER

08 Capacitors

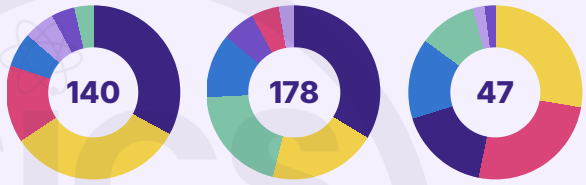
MHT CET · JEE · NEET Physics

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EXAM WEIGHTAGE



MHT CET 2019–2026 · **JEE Main** 2002–2026 · **NEET** 1992–2026

	CET	JEE	NEET
Dielectrics	46 (33%)	60 (34%)	8 (17%)
Combination of Capacitors	46 (33%)	36 (20%)	13 (28%)
Capacitors in DC Circuits & RC	5 (4%)	36 (20%)	5 (11%)
Energy Stored & Force between Plates	20 (14%)	9 (5%)	12 (26%)
Charge Sharing & Loss of Energy	9 (6%)	21 (12%)	7 (15%)
Parallel Plate Capacitor	6 (4%)	11 (6%)	1 (2%)
Capacitance of a Conductor	8 (6%)	5 (3%)	1 (2%)

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01 CONCEPT Capacitance of a Conductor

IN ONE LINE
Charge given to a conductor raises its potential in step. The ratio **C = Q ÷ V** depends only on the size and shape of the conductor.

8.1.1 What capacitance means

$$Q \propto V \Rightarrow Q = CV$$

$$C = \frac{Q}{V}$$

- C is the ability of a conductor to hold charge.
- It does not depend on the charge given or the potential raised.
- It depends on shape, size and the medium around the conductor.

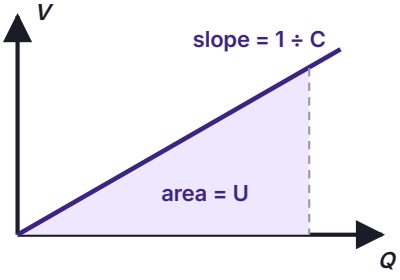
8.1.2 Units and dimensions

$$1 \text{ farad} = \frac{1 \text{ coulomb}}{1 \text{ volt}}$$

Unit	Value
1 mF	10^{-3} F
1 μF	10^{-6} F
1 nF	10^{-9} F
1 pF (μμF)	10^{-12} F
1 F	9×10^{11} stat farad

$$[C] = [M^{-1} L^{-2} T^{4} A^{2}]$$

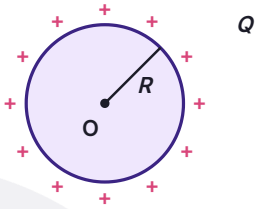
8.1.3 Reading a Q–V graph



V against Q is a straight line through the origin

- Graph of V against Q: slope = 1 ÷ C. Steeper line means smaller C.
- Graph of Q against V: slope = C.
- The area under the V–Q line is the energy stored.

8.1.4 Capacitance of an isolated sphere



Charge Q spreads over the surface of radius R

$$V = \frac{1}{4\pi\varepsilon_0}\frac{Q}{R}$$

$$C = 4\pi\varepsilon_0 R = \frac{R}{9 \times 10^{9}}$$

- $C \propto R$: a bigger sphere holds more charge at the same potential.
- Solid or hollow, the capacitance is the same: the charge sits on the surface.

8.1.5 Capacitance of the earth

- Earth as a sphere of radius 6400 km: C = 711 μF.
- In practice the earth is taken as infinite capacitance at zero potential.

From volume V: $R = \left(\frac{3V}{4\pi}\right)^{1/3}$ · from area A: $R = \sqrt{\left(\frac{A}{4\pi}\right)}$

8.1.6 Energy of a charged conductor

$$U = \tfrac{1}{2} QV = \tfrac{1}{2} CV^2 = \frac{Q^2}{2C}$$

$$\text{sphere: } U = \frac{Q^2}{8\pi\varepsilon_0 R}$$

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8.1.7 Two spheres at the same potential

- $Q = CV \propto R$, so the bigger sphere carries more charge.
- Surface density $\sigma = \frac{Q}{4\pi R^2} \propto \frac{1}{R}$: the smaller sphere has the larger σ.
- Field at the surface $E = \sigma \div \varepsilon_0$, so $E \propto 1 \div R$ too.

$$\frac{\sigma_1}{\sigma_2} = \frac{R_2}{R_1} \cdot \frac{Q_1}{Q_2} = \frac{R_1}{R_2}$$

JEE · NEET Corner

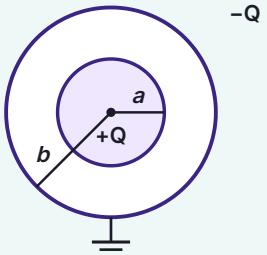
Combining n identical drops

- n drops, each of radius r, charge q, capacitance c, potential v and energy u, merge into one big drop.

Quantity	Big drop
Charge	$Q = nq$
Radius	$R = n^{1/3} r$
Capacitance	$C = n^{1/3} c$
Potential	$V = n^{2/3} v$
Energy	$U = n^{5/3} u$

- The big drop has more energy than all small drops together.

Spherical capacitor

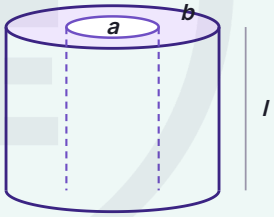


Inner sphere +Q, outer sphere earthed

$$C = 4\pi\varepsilon_0 \frac{ab}{b - a}$$

- With a dielectric K between the spheres: $C = 4\pi\varepsilon_0 K \frac{ab}{b - a}$
- If the outer sphere is charged and the inner one earthed: $C = 4\pi\varepsilon_0 \frac{b^2}{b - a}$
- An isolated sphere is a spherical capacitor with $b = \infty$.
- Large radii and a small gap: it behaves like a parallel plate capacitor.

Cylindrical capacitor



Two coaxial cylinders of length l

$$C = \frac{2\pi\varepsilon_0 l}{\ln(b \div a)}$$

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Solved Examples 01 Capacitance of a Conductor

SOLVED 1 MHT CET 2026 · 12 May · Shift 2

A capacitor of unknown capacitance is connected across a battery of V volt. The charge stored in it is Q coulomb. When the potential across the capacitor is reduced by V_1 volt, the charge stored in it becomes Q_1 coulomb. The potential V is

(a) $\frac{QV_1}{Q - Q_1}$ (b) $\frac{Q}{Q - Q_1}$

(c) $\frac{V_1}{Q_1 - Q}$ (d) $\frac{Q - Q_1}{V_1}$

STEP 1 $Q = CV$ and $Q_1 = C(V - V_1)$

STEP 2 Subtracting: $Q - Q_1 = CV_1$, so $C = \frac{Q - Q_1}{V_1}$

STEP 3 $V = \frac{Q}{C} = \frac{\mathbf{QV_1}}{\mathbf{Q - Q_1}}$

Answer: **(a)**

SOLVED 2 MHT CET 2023 · 12 May · Shift 1

The potentials on the plates of a capacitor are +20 V and −20 V. The charge on the plate is 40 C. The capacitance of the capacitor is

(a) 2 F (b) 1 F

(c) 4 F (d) 0.5 F

STEP 1 Potential difference $V = 20 - (-20) = 40$ V

STEP 2 $C = \frac{Q}{V}$

STEP 3 $C = \frac{40}{40} = \mathbf{1\ F}$

Answer: **(b)**

SOLVED 3 NEET 2024

The capacitance of a capacitor with charge q and a potential difference V depends on

(a) both q and V (b) the geometry of the capacitor

(c) q only (d) V only

STEP 1 If q is doubled, V also doubles

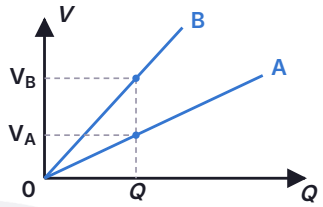
STEP 2 So $C = \frac{q}{V}$ stays the same

STEP 3 C depends on **the geometry of the capacitor**

Answer: **(b)**

SOLVED 4 MHT CET 2024 · 16 May · Shift 2

The graph shows the variation of voltage V across the plates of two capacitors A and B versus increase in charge Q stored in them. Then



(a) capacitor A has higher capacity

(b) capacitor B has higher capacity

(c) both have the same capacity

(d) capacity of A = 2 times capacity of B

STEP 1 $C = \frac{Q}{V} = \frac{1}{\text{slope of V–Q graph}}$

STEP 2 For the same Q, $V_A < V_B$ (A has the smaller slope)

STEP 3 **Capacitor A has higher capacity**

Answer: **(a)**

SOLVED 5 MHT CET 2026 · 11 Apr · Shift 2

The earth is assumed to be a charged conducting sphere having volume V and surface area A. The capacitance of the earth in free space is (ε_0 = permittivity of free space)

(a) $2\pi\varepsilon_0 \frac{V}{A}$ (b) $4\pi\varepsilon_0 \frac{V}{A}$

(c) $8\pi\varepsilon_0 \frac{V}{A}$ (d) $12\pi\varepsilon_0 \frac{V}{A}$

STEP 1 $C = 4\pi\varepsilon_0 R$

STEP 2 $\frac{V}{A} = \frac{4\pi R^3}{3 \times 4\pi R^2} = \frac{R}{3}$, so $R = \frac{3V}{A}$

STEP 3 $C = \mathbf{12\pi\varepsilon_0 \frac{V}{A}}$

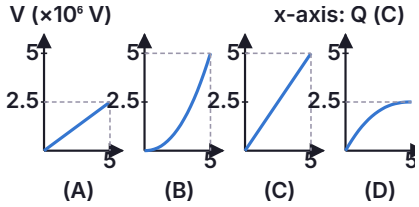
Answer: **(d)**

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Solved Examples 01 Capacitance of a Conductor (contd.)

SOLVED 6 JEE Main 2022 · 25 Jul · Shift 1

A condenser of 2 μF capacitance is charged steadily from 0 to 5 C. Which of the following graphs correctly represents the variation of potential difference V across its plates with the charge Q on the condenser?



(a) Graph (A) (b) Graph (B)
(c) Graph (C) (d) Graph (D)

STEP 1 $V = \frac{Q}{C}$, a straight line through the origin

STEP 2 At Q = 5 C: $V = \frac{5}{2 \times 10^{-6}} = 2.5 \times 10^{6}$ V

STEP 3 **Graph (A)**

Answer: **(a)**

SOLVED 7 AIEEE 2002

Capacitance (in F) of a spherical conductor with radius 1 m is

(a) 1.1×10^{-10} (b) 10^{-6}
(c) 9×10^{-9} (d) 10^{-3}

STEP 1 $C = 4\pi\varepsilon_0 R$

STEP 2 $C = \frac{1}{9 \times 10^{9}} \times 1$

STEP 3 $C = \mathbf{1.1 \times 10^{-10}\ F}$

Answer: **(a)**

SOLVED 8 MHT CET 2023 · 11 May · Shift 2

Two spherical conductors of capacities 3 μF and 2 μF are charged to the same potential, having radii 3 cm and 2 cm respectively. If σ_1 and σ_2 represent the surface densities of charge on the respective conductors, then $\frac{\sigma_1}{\sigma_2}$ is

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$
(c) $\frac{2}{3}$ (d) $\frac{3}{4}$

STEP 1 $\sigma = \frac{Q}{4\pi R^2} = \frac{4\pi\varepsilon_0 RV}{4\pi R^2} = \frac{\varepsilon_0 V}{R}$

STEP 2 Same V, so $\sigma \propto \frac{1}{R}$

STEP 3 $\frac{\sigma_1}{\sigma_2} = \frac{2}{3}$, answer $\mathbf{\frac{2}{3}}$

Answer: **(c)**

SOLVED 9 JEE Main 2023 · 1 Feb · Shift 2

Assertion A: Two metallic spheres are charged to the same potential. One of them is hollow and the other is solid, and both have the same radius. The solid sphere will have lower charge than the hollow one. Reason R: Capacitance of metallic spheres depends on the radii of the spheres.

(a) Both A and R are true but R is not the correct explanation of A
(b) Both A and R are true and R is the correct explanation of A
(c) A is false but R is true
(d) A is true but R is false

STEP 1 $C = 4\pi\varepsilon_0 R$ for solid and hollow alike: R is true

STEP 2 Same C and same V give the same Q = CV: A is false

STEP 3 **A is false but R is true**

Answer: **(c)**

SOLVED 10 JEE Main 2017 · 8 Apr · Shift 1

The energy stored in the electric field produced by a metal sphere is 4.5 J. If the sphere contains 4 μC charge, its radius will be [Take $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^{9}$ N m² C^{-2}]

(a) 20 mm (b) 32 mm
(c) 28 mm (d) 16 mm

STEP 1 $U = \frac{Q^2}{2C} = \frac{Q^2}{8\pi\varepsilon_0 R}$, so $R = \frac{1}{4\pi\varepsilon_0} \times \frac{Q^2}{2U}$

STEP 2 $R = 9 \times 10^{9} \times \frac{16 \times 10^{-12}}{9}$

STEP 3 $R = 0.016$ m = **16 mm**

Answer: **(d)**

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02 CONCEPT Parallel Plate Capacitor

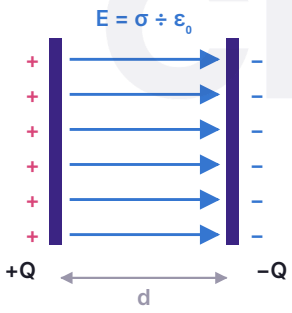
IN ONE LINE

Two plates carry +Q and −Q. The field between them is uniform, $E = \sigma \div \varepsilon_0$, and the capacitance is $C = \varepsilon_0 A \div d$.

8.2.1 What a capacitor is

- Two conductors close to each other carrying equal and opposite charge.
- The charge Q of a capacitor means the charge on its positive plate.
- Net charge on a capacitor is always zero.
- A battery charges it until the plate voltage equals the battery voltage.
- A capacitor actually stores **energy** in the field between the plates.

8.2.2 Field and voltage between the plates



Uniform field from the + plate to the − plate

$$E = \frac{\sigma}{\varepsilon_0} = \frac{Q}{A\varepsilon_0}$$

$$V = Ed = \frac{\sigma d}{\varepsilon_0}$$

- E does not depend on the separation d.
- Outside the plates the field is zero.
- The plates are kept close to avoid fringing (bending of field at the edges).

8.2.3 Capacitance of parallel plates

$$C = \frac{\varepsilon_0 A}{d}$$

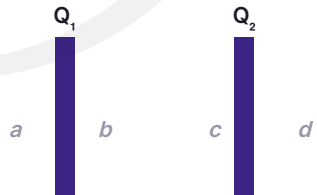
- $C \propto A$ and $C \propto 1 \div d$.
- It does not depend on the charge, the voltage, the metal or the plate thickness.
- For unequal plates use the overlapping area.
- In CGS: $C = A \div 4\pi d$.

8.2.4 Changing area and separation

Change	New C
d halved	2C
d doubled, A halved	$\frac{C}{4}$
radius × n, d same	n^2C
radius × 2, d × 2	2C

- Circular plates: $A = \pi r^2$, so $C \propto r^2$.
- Plates moved apart at speed v: $dC \div dt \propto 1 \div d^2$.

8.2.5 Plates given unequal charges



inner faces: $\pm (Q_1 - Q_2) \div 2$
outer faces: $(Q_1 + Q_2) \div 2$ each

Charges settle on the four faces

$$V = \frac{Q_1 - Q_2}{2C}$$

- Inner faces carry $\pm(Q_1 - Q_2) \div 2$; only these make the field between the plates.
- Outer faces carry $(Q_1 + Q_2) \div 2$ each.
- Plates with +2 µC and +4 µC on 1 µF: $V = 2 \div 2 = 1$ V.

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CAPACITORS

LEVEL 1 · EASY

Topic-wise Previous Year Questions

MHT CET · NEET · JEE Main

137	25	7
questions	concepts	topics

CONTENTS

01	Capacitance of a Conductor	Q 1–11	11 Qs
02	Parallel Plate Capacitor	Q 12–20	9 Qs
03	Energy Stored & Force between Plates	Q 21–46	26 Qs
04	Dielectrics	Q 47–89	43 Qs
05	Combination of Capacitors	Q 90–111	22 Qs
06	Charge Sharing & Loss of Energy	Q 112–130	19 Qs
07	Capacitors in DC Circuits & RC	Q 131–137	7 Qs
	Answer key		

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TOPIC 01

Capacitance of a Conductor

11 PYQs · Easy 11 · Medium 0 · Difficult 0 | MHT CET 7 · NEET 1 · JEE 3

Concepts covered: Capacitance & C = Q/V (7) · Isolated sphere & earth (3) · Spheres, drops & spherical capacitor (1)

LEVEL 1 · EASY 11 questions

◆ Capacitance & C = Q/V 7 Qs

1. A capacitor of unknown capacitance is connected across a battery of $'V'$ volt. The charge stored in it is $'Q'$ C. When potential across the capacitor is reduced by $'V_1'$ volt, the charge stored in it becomes $'Q_1'$ C. The potential $'V'$ is

MHT CET 2026 · 12 MAY · SHIFT 2

(a) $\frac{QV_1}{Q-Q_1}$ (b) $\frac{Q}{(Q-Q_1)}$
(c) $\frac{V_1}{(Q_1-Q)}$ (d) $\frac{(Q-Q_1)}{V_1}$

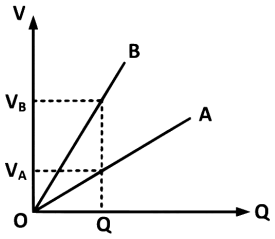
2. A capacitor of unknown capacity is connected across a battery of V volt. The charge stored in it is Q coulomb. When potential across the capacitor is reduced by V_1 volt, the charge stored in it becomes Q_1 coulomb. The potential V is

MHT CET 2025 · 26 APR · SHIFT 2

(a) $\frac{QV_1}{Q-Q_1}$ (b) $\frac{Q_1V_1}{Q+Q_1}$ (c) $\frac{Q_1}{Q}$ (d) $\frac{Q}{Q_1}$

3. The graph shows the variation of voltage (v) across the plates of two parallel plate capacitos A and B versus increase of charge Q stored in them. Then

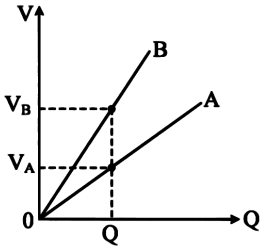
MHT CET 2025 · 22 APR · SHIFT 1



(a) capacity of both capacitors is same.
(b) capacity of A is higher than B.
(c) capacity of B is higher than A.
(d) capacity of both is zero.

4. The graph shows the variation of voltage ' V ' across the plates of two capacitors A and B versus increase in charge ' Q ' stored in them. Then

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(a) capacitance A has high capacity.
(b) capacitance B has high capacity.
(c) both have same capacity.
(d) capacity of $A = 2$ times capacity of B.

5. The potential on the plates of capacitor are $+20$ V and -20 V . The charge on the plate is 40C . The capacitance of the capacitor is

MHT CET 2023 · 12 MAY · SHIFT 1

(a) 2 F (b) 1 F (c) 4 F (d) 0.5 F

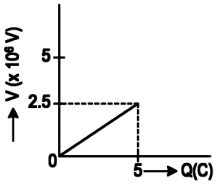
6. The capacitance of a capacitor with charge q and a potential difference V depends on

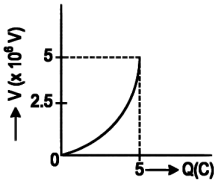
NEET 2024

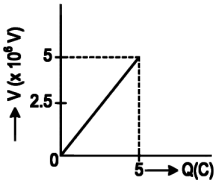
(a) both q and V
(b) the geometry of the capacitor
(c) q only
(d) V only

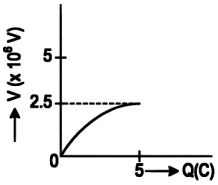
7. A condenser of $2\,\mu$F capacitance is charged steadily from 0 to 5 C. Which of the following graph represents correctly the variation of potential difference (V) across it's plates with respect to the charge (Q) on the condenser?

JEE MAIN 2022 · 25 JUL · SHIFT 1

(a)


(b)


(c)


(d)


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◆ Isolated sphere & earth 3 Qs

8. Consider the earth to be a sphere, having charge Q. Let R, V and A be its radius, volume and area respectively. The capacitance of the earth is [ε_0 = permittivity of free space]

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(a) $4\pi\varepsilon_0\dfrac{V}{A}$ (b) $4\pi\varepsilon_0\dfrac{A}{V}$ (c) $12\pi\varepsilon_0\dfrac{A}{V}$ (d) $12\pi\varepsilon_0\dfrac{V}{A}$

9. The earth is assumed to be a charged conducting sphere having volume 'V' and surface area 'A'. The capacitance of the earth in free space is (ϵ_0 = permittivity of free space)

MHT CET 2026 · 11 APR · SHIFT 2

(a) $2\pi\epsilon_0 V/A$ (b) $4\pi\epsilon_0 V/A$
(c) $8\pi\epsilon_0 V/A$ (d) $12\pi\epsilon_0 V/A$

10. Capacitance (in F) of a spherical conductor with radius $1\ m$ is

AIEEE 2002

(a) 1.1×10^{-10} (b) 10^{-6}
(c) 9×10^{-9} (d) 10^{-3}

◆ Spheres, drops & spherical capacitor 1 Q

11. Given below are two statements: One is labeled as Assertion A and the other is labeled as Reason R.

Assertion A: Two metallic spheres are charged to the same potential. One of them is hollow and another is solid, and both have the same radii. Solid sphere will have lower charge than the hollow one.

Reason R: Capacitance of metallic spheres depends on the radii of spheres

In light of the above statements, choose the correct answer from the options given below.

JEE MAIN 2023 · 1 FEB · SHIFT 2

(a) Both **A** and **R** are true but **R** is not the correct explanation of **A**
(b) Both **A** and **R** are true and **R** is the correct explanation of **A**
(c) **A** is false but **R** is true
(d) **A** is true but **R** is false

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TOPIC 02

Parallel Plate Capacitor

9 PYQs · Easy 9 · Medium 0 · Difficult 0 | MHT CET 4 · NEET 1 · JEE 4

Concepts covered: Capacitance of parallel plates (7) · Plates with unequal charges (1) · Charges between the plates (1)

LEVEL 1 · EASY 9 questions

◆ Capacitance of parallel plates 7 Qs

12. Two circular plates each of radius 'r' are kept parallel to each other distance 'd' apart. The capacitance of the capacitor formed is 'C_1'. If the radius of each of the plates is increased to $\sqrt{3}$ times the earlier radius and their distance of separation decreased to half the initial value, the capacitance now becomes 'C_2'. The ratio $C_1 : C_2$ is

MHT CET 2026 · 18 APR · SHIFT 1

(a) 1 : 2 (b) 1 : 4 (c) 1 : 6 (d) 6 : 1

13. Two circular metal plates each of radius ' r ' are kept parallel to each other distance ' d ' apart. The capacitance of the capacitor formed is ' C_1 '. If the radius of each of the plates is increased to $\sqrt{2}$ times the earlier radius and their distance of separation decreased to half the initial value, the capacitance now becomes ' C_2 '. The ratio of the capacitances $C_1 : C_2$ is

MHT CET 2024 · 3 MAY · SHIFT 1

(a) 1 : 1 (b) 1 : 2 (c) 1 : 4 (d) 4 : 1

14. Charge on a parallel plate capacitor of capacity C is Q, the electric field intensity between its two plates separated by a distance of t is

MHT CET 2024 · 2 MAY · SHIFT 2

(a) $\frac{Qt}{C}$ (b) $\frac{Q}{Ct}$ (c) $\frac{C}{Qt}$ (d) $\frac{Ct}{Q}$

15. The plates of a parallel plate capacitor of capacity 'C_1' are moved closer together until they ant half their original separation. The new capacitance 'C_2' is

MHT CET 2021 · 24 SEP · SHIFT 1

(a) $C_2 = \frac{C_1}{2}$ (b) $C_2 = C_1$
(c) $C_2 = 2C_1$ (d) $C_2 = 3C_1$

16. The distance between the two plates of a parallel plate capacitor is doubled and the area of each plate is halved. If C is its initial capacitance, its final capacitance is equal to

NEET 2022 · PHASE 2

(a) $\frac{C}{4}$ (b) 2C (c) $\frac{C}{2}$ (d) 4C

17. A parallel plate capacitor was made with two rectangular plates, each with a length of $l = 3$ cm and breadth of $b = 1$ cm. The distance between the plates is 3μ m. Out of the following, which are the ways to increase the capacitance by a factor of 10?

A. $l = 30$ cm, $b = 1$ cm, $d = 1\mu$ m
B. $l = 3$ cm, $b = 1$ cm, $d = 30\mu$ m
C. $l = 6$ cm, $b = 5$ cm, $d = 3\mu$ m
D. $l = 1$ cm, $b = 1$ cm, $d = 10\mu$ m
E. $l = 5$ cm, $b = 2$ cm, $d = 1\mu$ m

Choose the correct answer from the options given below:

JEE MAIN 2025 · 24 JAN · SHIFT 1

(a) C only (b) A only
(c) B and D only (d) C and E only

18. A parallel plate capacitor with plates of area 1 m^2 each, are at a separation of 0.1 m. If the electric field between the plates is 100 N/C, the magnitude of charge on each plate is:

(Take $\varepsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{N-m^2}$)

JEE MAIN 2019 · 12 JAN · SHIFT 2

(a) 9.85×10^{-10} C (b) 8.85×10^{-10} C
(c) 6.85×10^{-10} C (d) 7.85×10^{-10} C

◆ Plates with unequal charges 1 Q

19. A parallel plate capacitor has 1μF capacitance. One of its two plates is given +2μC charge and the other plate, +4μC charge. The potential difference developed across the capacitor is:-

JEE MAIN 2019 · 8 APR · SHIFT 2

(a) 1V (b) 5V (c) 2V (d) 3V

◆ Charges between the plates 1 Q

20. A capacitor of capacitance C is charged to a potential V. The flux of the electric field through a closed surface enclosing the positive plate of the capacitor is:

JEE MAIN 2023 · 11 APR · SHIFT 2

(a) Zero (b) $\frac{CV}{\varepsilon_0}$ (c) $\frac{CV}{2\varepsilon_0}$ (d) $\frac{2CV}{\varepsilon_0}$

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TOPIC 03

Energy Stored & Force between Plates

26 PYQs · Easy 26 · Medium 0 · Difficult 0 | MHT CET 12 · NEET 11 · JEE 3

Concepts covered: Energy stored (11) · Energy density (2) · Force between plates (6) · Work done & heat (7)

LEVEL 1 · EASY 26 questions

◆ Energy stored 11 Qs

21. A parallel plate air capacitor having area of each plate 'A' and the distance between the plates 'd' has uniform electric field E in the space between the plates. The energy stored in the capacitor is (ϵ_0 = permittivity of free space.)

MHT CET 2026 · 20 APR · SHIFT 1

(a) $\frac{1}{2}\epsilon_0 E^2$ (b) $\frac{1}{2}A\epsilon_0 E$

(c) $\frac{1}{2}A\epsilon_0 E^2 d$ (d) $\frac{1}{2}A\epsilon_0^2 E \cdot d$

22. A capacitor of capacitance C has charge Q and energy stored in it is W. If the charge is increased to 3Q, the energy stored in the capacitor W' will be

MHT CET 2026 · 18 APR · SHIFT 1

(a) $9W$ (b) $3W$ (c) $\frac{W}{3}$ (d) $\frac{W}{6}$

23. A parallel plate capacitor is charged and then isolated. If the separation between the plates is increased, which one of the following statement is NOT correct?

MHT CET 2024 · 3 MAY · SHIFT 2

(a) Charge remains constant after it is isolated.

(b) Potential difference across the plates decreases.

(c) Potential difference across the plates increases.

(d) Capacitance of capacitor decreases.

24. A parallel plate air capacitor has a uniform electric field 'E' in the space between the plates. Area of each plate is A and the distance between the plates is 'd'. The energy stored in the capacitor is [ε_0 = permittivity of free space)

MHT CET 2022 · 11 AUG · SHIFT 2

(a) $2\varepsilon_0 EAd$ (b) $\frac{1}{2}\varepsilon_0 E^2 Ad$

(c) $\frac{\varepsilon_0 E^2}{2Ad}$ (d) $\frac{E^2 Ad}{2\varepsilon_0}$

25. If the potential difference across a capacitor is increased from 5 V to 15 V, then the ratio of final energy to initial energy stored in the capacitor is

MHT CET 2021 · 23 SEP · SHIFT 2

(a) 1 : 3 (b) 27 : 1 (c) 3 : 1 (d) 9 : 1

26. A parallel plate capacitor has a uniform electric field $\vec{E}$ in the space between the plates. If the distance between the plates is 'd' and the area of each plate is 'A', the energy stored in the capacitor is: ($\varepsilon 0$ = permittivity of free space)

NEET 2021

(a) $\frac{E^2 Ad}{\varepsilon_0}$ (b) $\frac{1}{2}\varepsilon_0 E^2$

(c) $\varepsilon_0 EAd$ (d) $\frac{1}{2}\varepsilon_0 E^2 Ad$

27. A parallel plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is

AIPMT 2012 · MAINS

(a) $\frac{1}{2}\varepsilon_0 E^2$ (b) $\frac{E^2 Ad}{\varepsilon_0}$

(c) $\frac{1}{2}\varepsilon_0 E^2 Ad$ (d) $\varepsilon_0 EAd$

28. A parallel plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is

AIPMT 2011 · PRELIMS

(a) $\frac{1}{2}\varepsilon_0 E^2$ (b) $\frac{E^2 Ad}{\varepsilon_0}$

(c) $\frac{1}{2}\varepsilon_0 E^2 Ad$ (d) $\varepsilon_0 EAd$

29. The energy required to charge a parallel plate condenser of plate separation d and plate area of cross-section A such that the uniform electric field between the plates is E, is

AIPMT 2008

(a) $\varepsilon_0 E^2 Ad$ (b) $\frac{1}{2}\varepsilon_0 E^2 Ad$

(c) $\frac{1}{2}\varepsilon_0 E^2/Ad$ (d) $\varepsilon_0 E^2/Ad$

30. The energy stored in a capacitor of capacity C and potential V is given by

AIPMT 1996

(a) $\frac{CV}{2}$ (b) $\frac{C^2V^2}{2}$ (c) $\frac{C^2V}{2}$ (d) $\frac{CV^2}{2}$

31. Consider a parallel plate capacitor of area A (of each plate) and separation 'd' between the plates. If E is the electric field and ε_0 is the permittivity of free space between the plates, then potential energy stored in the capacitor is

JEE MAIN 2025 · 24 JAN · SHIFT 1

(a) $\varepsilon_0 E^2 Ad$ (b) $\frac{3}{4}\varepsilon_0 E^2 Ad$

(c) $\frac{1}{4}\varepsilon_0 E^2 Ad$ (d) $\frac{1}{2}\varepsilon_0 E^2 Ad$

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◆ Energy density 2 Qs

32. The mean electrical energy density between plates of a charged air capacitor is (where q = charge on capacitor, A = Area of capacitor plate)

MHT CET 2023 · 10 MAY · SHIFT 1

(a) $\frac{q^2}{2\varepsilon_0 A^2}$ (b) $\frac{q}{2\varepsilon_0 A^2}$ (c) $\frac{q^2}{2\varepsilon_0 A}$ (d) $\frac{\varepsilon_0 A}{q^2}$

33. Energy per unit volume for a capacitor having area A and separation d kept at potential difference V is given by

AIPMT 2001

(a) $\frac{1}{2}\varepsilon_0 \frac{V^2}{d^2}$ (b) $\frac{1}{2\varepsilon_0}\frac{V^2}{d^2}$ (c) $\frac{1}{2}CV^2$ (d) $\frac{Q^2}{2C}$.

◆ Force between plates 6 Qs

34. The electrostatic force (F) between the metal plates of an isolated parallel plate capacitor (C) having a charge Q and area A is (d = distance between the plates)

MHT CET 2026 · 15 MAY · SHIFT 1

(a) $F \propto \sqrt{d}$ (b) $F \propto d$

(c) independent of d (d) $F \propto \frac{1}{d}$

35. The electric field between the plates of a parallel plate capacitor is 'E'. If the charge on the plates is Q then the force on each plate is

MHT CET 2026 · 16 APR · SHIFT 1

(a) QE^2 (b) QE (c) $\frac{QE}{2}$ (d) $\frac{QE^2}{2}$

36. The force between the plates of a parallel plate capacitor of capacitance 'C' and distance of separation of the plates 'd' with a potential difference 'V' between the plates is

MHT CET 2022 · 11 AUG · SHIFT 2

(a) $\frac{V^2 d}{C}$ (b) $\frac{C^2 V^2}{d^2}$ (c) $\frac{CV^2}{2d}$ (d) $\frac{C^2 V^2}{2d^2}$

37. In parallel plate capacitor, electric field between the plates is 'E'. If the charge on the plates is 'Q' then the force on each plate is

MHT CET 2021 · 22 SEP · SHIFT 2

(a) QE (b) $\frac{QE^2}{2}$ (c) QE^2 (d) $\frac{QE}{2}$

38. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A, is

NEET 2018

(a) Independent of the distance between the plates
(b) Linearly proportional to the distance between the plates
(c) Proportional to the square root of the distance between the plates
(d) Inversely proportional to the distance between the plates

39. A parallel plate air capacitor has capacity C, distance of separation between plates is d and potential difference V is applied between the plates. Force of attraction between the plates of the parallel plate air capacitor is

AIPMT 2015

(a) $\frac{CV^2}{d}$ (b) $\frac{C^2V^2}{2d^2}$ (c) $\frac{C^2V^2}{2d}$ (d) $\frac{CV^2}{2d}$

◆ Work done & heat 7 Qs

40. A parallel plate capacitor is charged and then disconnected from the charging battery. If the plates are now moved further apart by pulling them by means of insulating handles, then

MHT CET 2022 · 11 AUG · SHIFT 2

(a) the capacitance of the capacitor increases
(b) the charge on the capacitor decreases
(c) the voltage across the capacitor increases
(d) the energy stored in the capacitor decreases

41. A battery is used to charge a parallel plate capacitor till the potential difference between the plates becomes equal to the e.m.f. of the battery. The ratio of the energy stored int he capacitor to the work done by the battery will be

MHT CET 2021 · 24 SEP · SHIFT 2

(a) 2 (b) $\frac{1}{2}$ (c) 1 (d) $\frac{1}{4}$

42. A 12 pF capacitor is connected to a 50 V battery, the electrostatic energy stored in the capacitor in nJ is

NEET 2024

(a) 15 (b) 7.5 (c) 0.3 (d) 150

43. A parallel plate air capacitor is charged to a potential difference of V volts. After disconnecting the charging battery the distance between the plates of the capacitor is increased using an insulting handle. As a result the potential difference between the plates

AIPMT 2006

(a) increases (b) decreases
(c) does not charge (d) becomes zero

44. A 4 μF capacitor is charged to 400 V. If its plates are joined through a resistance of 2 kΩ, then heat produced in the resistance is

AIPMT 1995

(a) 0.64 J (b) 1.28 J (c) 0.16 J (d) 0.32 J

45. A battery is used to charge a parallel plate capacitor till the potential difference between the plates becomes equal to the electromotive force of the battery. The ratio of the energy stored in the capacitor and the work done by the battery will be

AIEEE 2007

(a) 1/2 (b) 1 (c) 2 (d) 1/4

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46. The work done in placing a charge of 8×10^{-18} coulomb on a condenser of capacity 100 micro-farad is

AIEEE 2003

(a) 16×10^{-32} *joule* (b) 3.1×10^{-26} *joule*

(c) 4×10^{-10} *joule* (d) 32×10^{-32} *joule*

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TOPIC 04

Dielectrics

43 PYQs · Easy 43 · Medium 0 · Difficult 0 | MHT CET 26 · NEET 4 · JEE 13

Concepts covered: Dielectric basics & full filling (14) · Battery connected vs removed (4) · Partial slab & metal sheet (18) · Compound dielectrics (4) · Dielectric strength & induced charge (2) · Dielectric in a combination (1)

LEVEL 1 · EASY 43 questions

◆ Dielectric basics & full filling 14 Qs

47. A parallel plate air capacitor has capacity 'C' farad, potential 'V' volt and energy 'E' joule. When the gap between the plates is completely filled with dielectric
MHT CET 2026 · 19 APR · SHIFT 2
(a) V increases, E decreases.
(b) V decreases, E increases.
(c) both V and E increase.
(d) both V and E decrease.

48. The function of a dielectric in a capacitor is to
MHT CET 2026 · 15 APR · SHIFT 1
(a) reduce the plate area of the capacitor.
(b) to decrease the capacitance.
(c) reduce the effective potential on plates.
(d) increase the effective potential on plates.

49. A parallel plate capacitor with air between the plate has a capacitance of 15 pF. The separation between the plates becomes twice and the space between them is filled with a medium of dielectric constant 3.5. Then the capacitance becomes $x/4$ pF.
The value of x is
MHT CET 2026 · 13 APR · SHIFT 2
(a) 105 (b) 109 (c) 111 (d) 115

50. The function of a dielectric in a capacitor is
MHT CET 2025 · 26 APR · SHIFT 2
(a) to reduce the effective potential on plates,
(b) to increase the effective potential on plates.
(c) to decrease the capacity of capacitance.
(d) to reduce the plate area of the capacitor.

51. The function of dielectric in a capacitor is
MHT CET 2024 · 9 MAY · SHIFT 1
(a) to reduce the effective potential on plates.
(b) to increase the effective potential on plates.
(c) to decrease the capacitance.
(d) to reduce the plate area of capacitor.

52. In a parallel plate capacitor with air between the plates, the distance d between the plates is changed and the space is filled with dielectric constant 8. The capacity of the capacitor is increased 16 times, the distance between the plates is
MHT CET 2023 · 13 MAY · SHIFT 2
(a) 2d (b) 4d (c) d/2 (d) d/4

53. An air filled parallel plate capacitor has a capacity 2 pF. The sepeartion of the plates is doubled and the interspace between the plates is filled with dielectric material, then the capacity is increased to 6 pF. The dielectric constant of the material is
MHT CET 2021 · 21 SEP · SHIFT 1
(a) 3 (b) 6 (c) 2 (d) 4

54. A parallel plate capacitor filled with oil of a dielectric constant 3 between the plates has capacitance 'C'. If the oil is removed, then the capacitance of the capacitor will be
MHT CET 2021 · 20 SEP · SHIFT 1
(a) $\frac{C}{\sqrt{3}}$ (b) 3C (c) $\sqrt{3}$C (d) $\frac{C}{3}$

55. The capacitance of a parallel plate capacitor with air as medium is 3μF. With the introduction of a dielectric medium between the plates, the capacitance becomes 15μF. The permittivity of the medium in SI unit is $[\varepsilon_0 = 8.85 \times 10^{-12}$SI unit$]$
MHT CET 2020 · 16 OCT · SHIFT 1
(a) 8.845×10^{-11} (b) 0.4425×10^{-10}
(c) 15 (d) 5

56. In a parallel plate air capacitor the distance between plates is reduced to one fourth and the space between them is filled with a dielectric medium of constant 2. If the initial capacity of the capacitor is 4μ F. then its new capacity is
MHT CET 2019 · 2 MAY · SHIFT 2
(a) 32μ F (b) 18μ F (c) 8μ F (d) 44μ F

57. The capacitance of a parallel plate capacitor with air as medium is 6μF. With the introduction of a dielectric medium, the capacitance becomes 30 μ F. The permittivity of the medium is: $(\varepsilon_0 = 8.85 \times 10^{-12} C^2 N^{-1} m^{-2})$
NEET 2020 · PHASE 1
(a) $1.77 \times 10^{-12} C^2 N^{-1} m^{-2}$
(b) $0.44 \times 10^{-10} C^2 N^{-1} m^{-2}$
(c) $5.00 C^2 N^{-1} m^{-2}$
(d) $0.44 \times 10^{-13} C^2 N^{-1} m^{-2}$

58. Two parallel metal plates having charges +Q and –Q face each other at a certain distance between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will
AIPMT 2010 · MAINS
(a) become zero (b) increase
(c) decrease (d) remain same

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59. A parallel plate condenser with oil (dielectric constant 2) between the plates has capacitance C. If oil is removed, the capacitance of capacitor becomes

AIPMT 1999

(a) $\sqrt{2}\,C$ (b) $2C$ (c) $\frac{C}{\sqrt{2}}$ (d) $\frac{C}{2}$

60. A parallel plate capacitor with air between the plates has a capacitance of 15pF. The separation between the plates becomes twice and the space between them is filled with a medium of dielectric constant 3.5. Then the capacitance becomes $\frac{x}{4}$ pF. The value of x is _____.

JEE MAIN 2023 · 24 JAN · SHIFT 2 *(Numerical)*

◆ Battery connected vs removed 4 Qs

61. A parallel plate capacitor is charged by a battery and battery remains connected. The dielectric slab of constant 'K' is inserted between the plates and then taken out. Then electric field between the plates

MHT CET 2023 · 11 MAY · SHIFT 2

(a) remains the same (b) increases
(c) decreases (d) becomes zero

62. The potential energy of charged parallel plate capacitor is v_0. If a slab of dielectric constant K is inserted between the plates, then the new potential energy will be

MHT CET 2023 · 9 MAY · SHIFT 1

(a) $\frac{v_0}{\mathrm{K}}$ (b) $v_0\,\mathrm{K}^2$ (c) $\frac{v_0}{\mathrm{K}^2}$ (d) v_0^2

63. When the battery across the plates of a charged condenser is disconnected and a dielectric slab is introduced between its plates then the energy stored

MHT CET 2021 · 22 SEP · SHIFT 1

(a) becomes infinity (b) does not change
(c) increases (d) decreases

64. A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it. A dielectric slab of dieletric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect?

AIPMT 2015 · CANCELLED PAPER

(a) The change in energy stored is $\frac{1}{2}CV^2\left(\frac{1}{K}-1\right)$
(b) The charge on the capacitor is not conserved.
(c) The potential difference between the plates decreases K times.
(d) The energy stored in the capaciotor decreases K times.

◆ Partial slab & metal sheet 18 Qs

65. A parallel plate capacitor of plate separation 2 mm and plate area 40 cm^2 is filled with dielectric whose area is same as plates of capacitor. Thickness is 1 mm and dielectric constant is 5. New capacitance is (ϵ_0 = permittivity of free space)

MHT CET 2026 · 15 MAY · SHIFT 2

(a) $\frac{3\epsilon_0}{10}\,F$ (b) $\frac{10\epsilon_0}{3}\,F$ (c) $\frac{20\epsilon_0}{3}\,F$ (d) $\frac{3\epsilon_0}{20}\,F$

66. A slab of material of dielectric constant k has the same area as the plates of the parallel plate capacitor but has thickness $\frac{3d}{4}$, where d is the separation of the plates. How is the capacitance changed, when the slab is inserted between the plates? (C = original capacitance)

MHT CET 2026 · 13 MAY · SHIFT 2

(a) $\frac{4kC}{(k+3)}$ (b) $\frac{(k+3)C}{4k}$
(c) $\frac{(k-3)C}{4k}$ (d) $\frac{4kC}{(k-3)}$

67. A parallel plate air capacitor consists of two metal plates of area A and separation d. A slab of thickness t and dielectric constant $2k$ is inserted between the plates with its faces parallel to the plates. The effective capacitance of the system is (ϵ_0 = permittivity of free space)

MHT CET 2026 · 12 MAY · SHIFT 1

(a) $\frac{\epsilon_0 A}{(d-t)+\frac{t}{2k}}$ (b) $\frac{\epsilon_0 A}{(d-t)-\frac{t}{k}}$
(c) $\frac{\epsilon_0 A}{(2d-t)-\frac{t}{2k}}$ (d) $\frac{\epsilon_0 A}{(d-2t)-\frac{t}{k}}$

68. A slab of material of dielectric constant K has the same area as the plates of a parallel plate capacitor but has a thickness $(4/5)d$, where d is the separation of the plates. The capacitance in the presence and absence of dielectric are C and C_0 respectively. The ratio (C/C_0) is

MHT CET 2026 · 19 APR · SHIFT 1

(a) $\frac{K+4}{5K}$ (b) $\frac{4K}{K+5}$ (c) $\frac{5K}{K+4}$ (d) $\frac{K+5}{4K}$

69. A capacitor has capacity C when it's parallel plates are separated by air medium of thickness 'd'. A slab of material of dielectric constant K having area equal to that of plates but thickness $\frac{d}{2}$ is inserted between the plates. Capacitance of the capacitor in the presence of slab will be

MHT CET 2026 · 16 APR · SHIFT 2

(a) KC (b) 2KC (c) $\frac{\mathrm{KC}}{\mathrm{K}+1}$ (d) $\frac{2\mathrm{KC}}{\mathrm{K}+1}$

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70. A parallel plate capacitor has plate area 40 cm^2 and plates separation 2 mm. The space between the plates is filled with a dielectric medium of a thickness 1 mm and dielectric constant 5. The capacitance of the system is

MHT CET 2026 · 11 APR · SHIFT 1

(a) $24\epsilon_0$ F (b) $\frac{3}{10}\epsilon_0$ F (c) $\frac{10}{3}\epsilon_0$ F (d) $10\epsilon_0$ F

71. A parallel plate air capacitor has capacity 'C' and distance of separation between plates is 'd'. If a conducting sheet of thickness $\frac{2d}{3}$ is inserted in between the plates, the capacitance becomes C_1. The ratio of $\frac{C_1}{C}$ is

MHT CET 2025 · 23 APR · SHIFT 1

(a) 2 : 1 (b) 4 : 1 (c) 3 : 1 (d) 5 : 1

72. A parallel plate capacitor has plate area 50 cm^2 and plate separation 3 mm. The space between the plates is filled with a dielectric medium of thickness 1 mm and dielectric constant 4. The capacitance becomes (ε_0 = permittivity of free space)

MHT CET 2025 · 21 APR · SHIFT 2

(a) $\frac{18\varepsilon_0}{7}$ (b) $\frac{20\varepsilon_0}{9}$ (c) $\frac{16\varepsilon_0}{7}$ (d) $\frac{14\varepsilon_0}{5}$

73. A parallel plate capacitor has plate area 40 cm^2 and plate separation 2 mm. The space between the plates is filled with a dielectric medium of thickness 1 mm and dielectric constant 5. The capacitance of the system is (ε_0 = permittivity of vacuum)

MHT CET 2024 · 4 MAY · SHIFT 1

(a) $24\varepsilon_0$ F (b) $\frac{3}{10}\varepsilon_0$ F (c) $\frac{10}{3}\varepsilon_0$ F (d) $10\varepsilon_0$ F

74. A parallel plate capacitor has capacitance C, when there is vacuum within the parallel plates. A sheet having thickness $\left(\frac{1}{3}\right)^{rd}$ of the separation between the plates and relative permittivity K is introduced between the plates. The new capacitance of the system is:

JEE MAIN 2026 · 21 JAN · SHIFT 1

(a) $\frac{3CK^2}{(2K+1)^2}$ (b) $\frac{4KC}{3K-1}$ (c) $\frac{CK}{2+K}$ (d) $\frac{3KC}{2K+1}$

75. The distance between two plates of a capacitor is d and its capacitance is C_1, when air is the medium between the plates. If a metal sheet of thickness $\frac{2d}{3}$ and of the same area as plate is introduced between the plates, the capacitance of the capacitor becomes C_2. The ratio $\frac{C_2}{C_1}$ is

JEE MAIN 2023 · 10 APR · SHIFT 2

(a) 1: 1 (b) 3: 1 (c) 2: 1 (d) 4: 1

76. A parallel plate capacitor has plate area 40 cm^2 and plates separation 2 mm. The space between the plates is filled with a dielectric medium of a thickness 1 mm and dielectric constant 5. The capacitance of the system is:

JEE MAIN 2023 · 25 JAN · SHIFT 1

(a) $10\varepsilon_0$ F (b) $24\varepsilon_0$ F (c) $\frac{3}{10}\varepsilon_0$ F (d) $\frac{10}{3}\varepsilon_0$ F

77. A slab of dielectric constant K has the same cross-sectional area as the plates of a parallel plate capacitor and thickness $\frac{3}{4}$ d, where d is the separation of the plates. The capacitance of the capacitor when the slab is inserted between the plates will be:
(Given C_0 = capacitance of capacitor with air as medium between plates.)

JEE MAIN 2022 · 28 JUL · SHIFT 2

(a) $\frac{4KC_0}{3+K}$ (b) $\frac{3KC_0}{3+K}$ (c) $\frac{3+K}{4KC_0}$ (d) $\frac{K}{4+K}$

78. Two metallic plates form a parallel plate capacitor. The distance between the plates is 'd'. A metal sheet of thickness $\frac{d}{2}$ and of area equal to area of each plate is introduced between the plates. What will be the ratio of the new capacitance to the original capacitance of the capacitor?

JEE MAIN 2022 · 25 JUN · SHIFT 2

(a) 2: 1 (b) 1: 2 (c) 1: 4 (d) 4: 1

79. A sheet of aluminium foil of negligible thickness is introduced between the plates of a capacitor. The capacitance of the capacitor

AIEEE 2003

(a) decreases (b) remains unchanged
(c) becomes infinite (d) increases

80. A capacitor has capacitance 5μF when its parallel plates are separated by air medium of thickness d. A slab of material of dielectric constant 1.5 having area equal to that of plates but thickness $\frac{d}{2}$ is inserted between the plates. Capacitance of the capacitor in the presence of slab will be _____ μF.

JEE MAIN 2023 · 25 JAN · SHIFT 2 *(Numerical)*

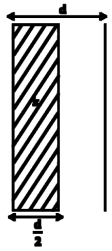
81. A parallel plate capacitor has plate area 100 m^2 and plate separation of 10 m. The space between the plates is filled up to a thickness 5 m with a material of dielectric constant of 10. The resultant capacitance of the system is 'x' pF.
The value of $\varepsilon_0 = 8.85 \times 10^{-12}$ F.m^{-1}.
The value of 'x' to the nearest integer is _____.

JEE MAIN 2021 · 18 MAR · SHIFT 1 *(Numerical)*

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82. In a parallel plate capacitor set up, the plate area of capacitor is 2 m^2 and the plates are separated by 1 m. If the space between the plates are filled with a dielectric material of thickness 0.5 m and area 2 m^2 (see fig.) the capacitance of the set-up will be _____ε_o. (Dielectric constant of the material = 3.2) (Round off to the Nearest Integer)

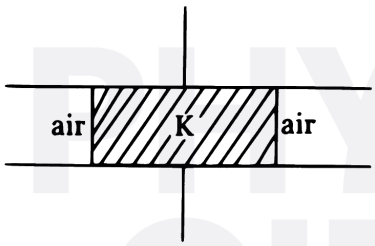
JEE MAIN 2021 · 16 MAR · SHIFT 2 *(Numerical)*



◆ Compound dielectrics 4 Qs

83. The capacity of air filled parallel plate capacitor is C_0. One-half of the space between the plates is filled with a dielectric constant ' K ' as shown in figure. The new capacity becomes C_n. The ratio C_n to C_0 is

MHT CET 2025 · 26 APR · SHIFT 1



(a) $\left(\frac{K+1}{2}\right)$ (b) $\left(\frac{K+1}{3}\right)$
(c) $\left(\frac{K+1}{4}\right)$ (d) $4(K+1)$

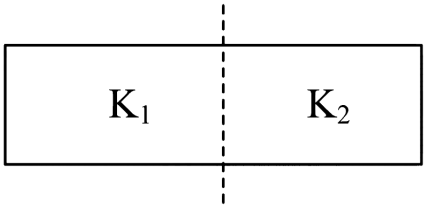
84. A parallel plate air capacitor has capacitance C_P. It is equally filled with parallel layers of materials of dielectric constants K_1 and K_2. Now its capacity becomes C_K. The ratio C_P to C_K is

MHT CET 2025 · 20 APR · SHIFT 2

(a) $K_1 + K_2$ (b) $\frac{K_1+K_2}{K_1K_2}$ (c) $\frac{K_1+K_2}{2K_1K_2}$ (d) $\frac{2K_1K_2}{K_1+K_2}$

85. A parallel plate capacitor with air medium between the plates has a capacitance of $10\mu F$. The area of capacitor is divided into two equal halves and filled with two media (as shown in figure) having dielectric constant $K_1 = 2$ and $K_2 = 4$. The capacitance of the system will be

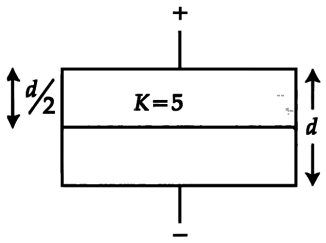
MHT CET 2023 · 14 MAY · SHIFT 2



(a) 10 μF (b) 20 μF (c) 30 μF (d) 40 μF

86. A parallel plate air capacitor has a capacitance C. When it is half filled as shown in figure with a dielectric constant $K = 5$, the percentage increase in the capacitance is _____.

JEE MAIN 2026 · 2 APR · SHIFT 1



(a) 33.34 (b) 66.67 (c) 200 (d) 400

◆ Dielectric strength & induced charge 2 Qs

87. If q_f is the free charge on the capacitor plates and q_b is the bound charge on the dielectric slab of dielectric constant k placed between the capacitor plates, then bound charge q_b an be expressed as:

JEE MAIN 2021 · 25 JUL · SHIFT 2

(a) $q_b = q_f\left(1 - \frac{1}{\sqrt{k}}\right)$ (b) $q_b = q_f\left(1 - \frac{1}{k}\right)$
(c) $q_b = q_f\left(1 + \frac{1}{\sqrt{k}}\right)$ (d) $q_b = q_f\left(1 + \frac{1}{k}\right)$

88. A parallel plate capacitor has charge 5×10^{-6}C. A dielectric slab is inserted between the plates and almost fills the space between the plates. If the induced charge on one face of the slab is 4×10^{-6}C then the dielectric constant of the slab is _____.

JEE MAIN 2025 · 7 APR · SHIFT 2 *(Numerical)*

◆ Dielectric in a combination 1 Q

89. Two parallel plate air capacitors of same capacity ' C ' are connected in parallel to a battery of e.m.f. ' E '. Then one of the capacitors is completely filled with dielectric material of constant ' K '. The change in the effective capacity of the parallel combination is

MHT CET 2025 · 19 APR · SHIFT 2

(a) $\frac{C}{(K-1)}$ (b) $\frac{KC}{K-1}$
(c) $KC + 1$ (d) $C(K - 1)$

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TOPIC 05

Combination of Capacitors

22 PYQs · Easy 22 · Medium 0 · Difficult 0 | MHT CET 12 · NEET 3 · JEE 7

Concepts covered: Series combination (8) · Parallel combination (4) · Mixed & n identical capacitors (5) · Energy in combinations (2) · Networks & multi-plate arrangements (3)

LEVEL 1 · EASY 22 questions

◆ Series combination 8 Qs

90. Capacitors of capacities C_1 and C_2 are connected in series. If the combination is connected to a supply of V volt then the potential difference across capacitor C_2 is

MHT CET 2026 · 15 APR · SHIFT 2

(a) $\frac{C_1+C_2}{C_1V}$ (b) $\frac{C_1V}{C_1+C_2}$
(c) $\frac{C_1+C_2}{C_2V}$ (d) $\frac{C_2V}{C_1+C_2}$

91. Three capacitors each of capacitance ' C ' and breakdown voltage ' V ' are connected in series. The capacitance and breakdown voltage of the series combination will be respectively

MHT CET 2025 · 22 APR · SHIFT 1

(a) 3C, 3 V (b) $\frac{C}{3}, \frac{V}{3}$ (c) 3C, $\frac{V}{3}$ (d) $\frac{C}{3}$, 3 V

92. Three condensers of capacities ' C_1 ', ' C_2 ', ' C_3 ' are connected in series with a source of e.m.f. ' V '. The potentials across the three condensers are in the ratio

MHT CET 2024 · 15 MAY · SHIFT 1

(a) 1 : 1 : 1 (b) $C_1 : C_2 : C_3$
(c) $C_1^2 : C_2^2 : C_3^2$ (d) $\frac{1}{C_1} : \frac{1}{C_2} : \frac{1}{C_3}$

93. Two capacitors $C_1 = 3\mu F$ and $C_2 = 2\mu F$ are connected in series across d.c. source of 100 V. The ratio of the potential across C_2 to C_1 is

MHT CET 2023 · 10 MAY · SHIFT 1

(a) 2 : 3 (b) 3 : 2 (c) 6 : 5 (d) 5 : 6

94. Capacitors of capacities C_1, C_2 and C_3 are connected in series. If the combination is connected to a supply of 'V' volt, then potential difference across capacitor ' C_1' is

MHT CET 2021 · 24 SEP · SHIFT 2

(a) $\frac{C_2C_3+C_1C_3+C_1C_2}{C_1C_2V}$ (b) $\frac{C_2C_3+C_1C_3+C_1C_2}{C_1C_2C_3V}$
(c) $\frac{C_2C_3V}{C_2C_3+C_1C_3+C_1C_2}$ (d) $\frac{C_1C_2C_3V}{C_2C_3+C_1C_3+C_1C_2}$

95. The effective capacitances of two capacitors are 3 μF and 16 μF, when they are connected in series and parallel respectively. The capacitance of two capacitors are:

NEET 2022 · PHASE 2

(a) 1.2 μF, 1.8 μF (b) 10 μF, 6 μF
(c) 8 μF, 8 μF (d) 12 μF, 4 μF

96. Three capacitors each of capacitance C and of breakdown voltage V are joined in series. The capacitance and breakdown voltages of the combination will be

AIPMT 2009

(a) $3C, \frac{V}{3}$ (b) $\frac{C}{3}, 3V$ (c) $3C, 3V$ (d) $\frac{C}{3}, \frac{V}{3}$

97. Two equal capacitors are first connected in series and then in parallel. The ratio of the equivalent capacities in the two cases will be:

JEE MAIN 2021 · 24 FEB · SHIFT 1

(a) 4: 1 (b) 1: 2 (c) 2: 1 (d) 1: 4

◆ Parallel combination 4 Qs

98. Four parallel plate capacitors are connected in parallel. Each capacitor has a plate area $\frac{A}{4}$ and the separation between the plates is d, $2d$, $3d$ and $4d$ respectively. The equivalent capacity of the combination is [ε_0 = permittivity of free space]

MHT CET 2026 · 19 MAY · SHIFT 2

(a) $\frac{5A\varepsilon_0}{12d}$ (b) $\frac{7A\varepsilon_0}{24d}$ (c) $\frac{9A\varepsilon_0}{36d}$ (d) $\frac{25A\varepsilon_0}{48d}$

99. Two parallel plate air capacitors are connected in parallel. Each capacitor has plate area $A/2$ and separation between the plates is d and $2d$ respectively. The equivalent capacity of the combination is
(ϵ_0 = absolute permittivity of free space)

MHT CET 2026 · 15 APR · SHIFT 2

(a) $\frac{A\epsilon_0}{d}$ (b) $\frac{3A\epsilon_0}{4d}$ (c) $\frac{2A\epsilon_0}{3d}$ (d) $\frac{A\epsilon_0}{4d}$

100. Three parallel plate air capacitors are connected in parallel. Each capacitor has plate area A/3 and separation between the plates is d, 2d and 3d respectively. The equivalent capacity of the combination is (ϵ_0-permittivity of free space)

MHT CET 2026 · 11 APR · SHIFT 2

(a) $\frac{9\epsilon_0 A}{17d}$ (b) $\frac{11\epsilon_0 A}{17d}$ (c) $\frac{11\epsilon_0 A}{18d}$ (d) $\frac{9\epsilon_0 A}{14d}$

101. The total charge on the system of capacitors $C_1 = 1\mu F, C_2 = 2\mu F, C_3 = 4\mu F$ and $C_4 = 3\mu F$ connected in parallel is:
(Assume a battery of 20 V is connected to the combination)

JEE MAIN 2022 · 26 JUL · SHIFT 1

(a) 200 μC (b) 200 C (c) 10 μC (d) 10 C

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◆ Mixed & n identical capacitors 5 Qs

102. When three capacitors of equal capacities are connected in parallel and one of the same capacity, capacitor is connected in series with the combination. The resultant capacity is 4.5μ F. The capacity of each capacitor is

MHT CET 2024 · 11 MAY · SHIFT 1

(a) 5μ F (b) 7μ F (c) 6μ F (d) 8μ F

103. Three identical capacitors of capacitance 'C' each are connected in series and this connection is connected in parallel with one more such identical capacitor. Then the capacitance of whole combination is

MHT CET 2023 · 11 MAY · SHIFT 2

(a) 3C (b) 2C (c) $\frac{4}{3}$C (d) $\frac{3}{4}$C

104. Three capacitors each of capacity 4 μF are to be connected in such a way that the effective capacitance is $6\mu F$. This can be done by

AIPMT 2003

(a) connecting all of them in series
(b) connecting them in parallel
(c) connecting two in series and one in parallel
(d) connecting two in parallel and one in series

105. Three capacitors each of 4 μF are to be connected in such a way that the effective capacitance is 6 μF. This can be done by connecting them:

JEE MAIN 2016 · 9 APR · SHIFT 1

(a) all in series
(b) two in series and one in parallel
(c) all in parallel
(d) two in parallel and one in series

106. Three capacitances, each of 3 μF, are provided. These cannot be combined to provide the resultant capacitance of:

JEE MAIN 2014 · 9 APR · SHIFT 1

(a) 1 μF (b) 2 μF (c) 4.5 μF (d) 6 μF

◆ Energy in combinations 2 Qs

107. Three identical capacitors connected in series have net capacitance 'x'. Then they are connected in parallel. The ratio of energy stored in series configuration to that in parallel configuration is (if both configurations are connected to the same source)

MHT CET 2026 · 18 APR · SHIFT 2

(a) 1 : 3 (b) 3 : 1 (c) 1 : 9 (d) 9 : 1

108. If there are n capacitors in parallel connected to V volt source, then the energy stored is equal to

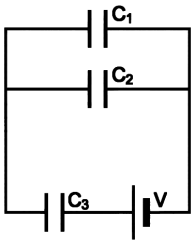
AIEEE 2002

(a) CV (b) $\frac{1}{2}nCV^2$ (c) CV^2 (d) $\frac{1}{2n}CV^2$

◆ Networks & multi-plate arrangements 3 Qs

109. Three capacitors C_1, C_2 and C_3 are connected to voltage source V as shown in figure. The voltage across C_3 will be

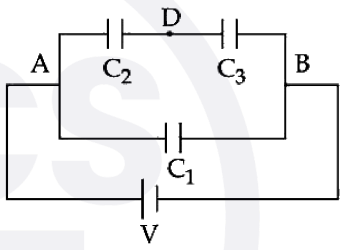
MHT CET 2026 · 17 APR · SHIFT 1



(a) $\frac{C_3V}{(C_1+C_2+C_3)}$ (b) $\frac{(C_1+C_2)V}{C_3}$
(c) $\frac{(C_2+C_3)V}{C_1+C_2}$ (d) $\frac{(C_1+C_2)V}{(C_1+C_2+C_3)}$

110. Three capacitors $C_1 = 2\mu$F, $C_2 = 6\mu$F and $C_3 = 12\mu$F are connected as shown in figure. Find the ratio of the charges on capacitors C_1, C_2 and C_3 respectively:

JEE MAIN 2021 · 27 AUG · SHIFT 2



(a) 2: 1: 1 (b) 2: 3: 3 (c) 1: 2: 2 (d) 3: 4: 4

111. A parallel plate capacitor is made by stacking n equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is $'C'$ then the resultant capacitance is

AIEEE 2005

(a) $(n+1)C$ (b) $(n-1)C$
(c) nC (d) C

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TOPIC 06

Charge Sharing & Loss of Energy

19 PYQs · Easy 19 · Medium 0 · Difficult 0 | MHT CET 4 · NEET 5 · JEE 10

Concepts covered: Common potential (10) · Energy loss on sharing (9)

LEVEL 1 · EASY 19 questions

◆ Common potential 10 Qs

112. A capacitor of $20\,\mu$F is charged up to 500 V is connected in parallel with another capacitor of $10\,\mu$F which is charged up to 200 V. Then, the common potential will be

MHT CET 2026 · 14 MAY · SHIFT 2

(a) 400 V (b) 200 V (c) 100 V (d) 50 V

113. A condenser of capacity C_1 is charged to potential V_1 and then disconnected. Uncharged capacitor of capacity C_2 is connected in parallel with C_1. The resultant potential V_2 is

MHT CET 2026 · 13 APR · SHIFT 1

(a) $\frac{C_1V_1}{C_2}$ (b) $\frac{C_1V_1}{C_1+C_2}$
(c) $\frac{C_2V_1}{C_1}$ (d) $\frac{C_2V_1}{C_1+C_2}$

114. Two capacitors of 100μ F and 50μ F are connected in parallel. If the potential difference across 100μ F is 20 V and across 50μ F is 40 V, then the common potential of the parallel combination will be (same polarities of the capacitor connected together)

MHT CET 2025 · 23 APR · SHIFT 2

(a) 20 V (b) 60 V (c) $\frac{3}{80}$ (d) $\frac{80}{3}$ V

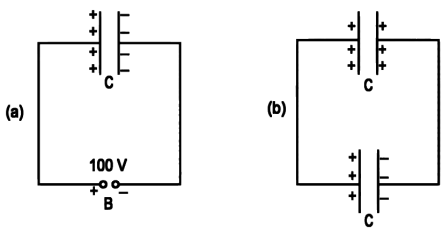
115. A condenser of capacity 'C_1' is charged to potential 'V_1' and then disconnected. Uncharged capacitor of capacity 'C_2' is connected in parallel with 'C_1'. The resultant potential 'V_2' is

MHT CET 2021 · 21 SEP · SHIFT 2

(a) $\frac{V_1C_2}{C_1}$ (b) $\frac{C_2}{C_1+C_2}$ (c) $\frac{C_1V_1}{C_2}$ (d) $\frac{C_1V_1}{C_1+C_2}$

116. A capacitor of capacitance C = 900 pF is charged fully by 100 V battery B as shown in figure (a). Then it is disconnected from the battery and connected to another uncharged capacitor of capacitance C = 900 pF as shown in figure (b). The electrostatic energy stored by the system (b) is

NEET 2022 · PHASE 1



(a) $4.5 \times 10^{-}6$ J (b) $3.25 \times 10^{-}6$ J
(c) $2.25 \times 10^{-}6$ J (d) $1.5 \times 10^{-}6$ J

117. A capacitor of capacity C_1 charged upto V volt and then connected to an uncharged capacitor of capacity C_2. The final potential difference across each will be

AIPMT 2002

(a) $\frac{C_1V}{C_1+C_2}$ (b) $\frac{C_2V}{C_1+C_2}$
(c) $\left(1-\frac{C_2}{C_1}\right)V$ (d) $\left(1+\frac{C_2}{C_1}\right)$

118. Using a battery, a 100 pF capacitor is charged to 60 V and then the battery is removed. After that, a second uncharged capacitor is connected to the first capacitor in parallel. If the final voltage across the second capacitor is 20 V, its capacitance is: (in pF)

JEE MAIN 2025 · 3 APR · SHIFT 2

(a) 600 (b) 100 (c) 400 (d) 200

119. A 10 μF capacitor is fully charged to a potential difference of 50 V. After removing the source voltage it is connected to an uncharged capacitor in parallel. Now the potential difference across them becomes 20 V. The capacitance of the second capacitor is:

JEE MAIN 2020 · 2 SEP · SHIFT 2

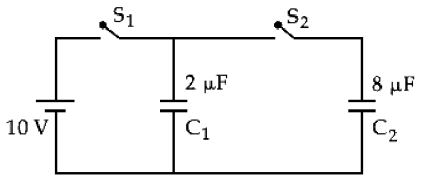
(a) 20 μF (b) 15 μF (c) 10 μF (d) 30 μF

120. A capacitor P with capacitance 10×10^{-6} F is fully charged with a potential difference of 6.0 V and disconnected from the battery. The charged capacitor P is connected across another capacitor Q with capacitance 20×10^{-6} F. The charge on capacitor Q when equilibrium is established will be $\alpha \times 10^{-5}C$ (assume capacitor Q does not have any charge initially), the value of α is ____.

JEE MAIN 2026 · 22 JAN · SHIFT 2 *(Numerical)*

121. A $2\,\mu$F capacitor C_1 is first charged to a potential difference of 10V using a battery. Then the battery is removed and the capacitor is connected to an uncharged capacitor C_2 of 8 μF. The charge in C_2 on equilibrium condition is _____ μC. (Round off to the Nearest Integer)

JEE MAIN 2021 · 17 MAR · SHIFT 2 *(Numerical)*



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◆ Energy loss on sharing 9 Qs

122. Consider two uncharged capacitors of equal capacitance 200 pF. One of them is charged by a 100 V supply and disconnected. Now this capacitor is connected to the uncharged capacitor. The amount of electrostatic energy lost in the process is:

NEET 2026

(a) 0.5×10^{-6} J (b) 1.0 J
(c) 1.0×10^{-6} J (d) 0.5 J

123. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system

NEET 2017

(a) decreases by a factor of 2
(b) remains the same
(c) increases by a factor of 2
(d) increases by a factor of 4

124. A capacitor is charged with a battery and energy stored is U. After disconnecting battery another capacitor of same capacity is connected in parallel to the first capacitor. Then energy stored in each capacitor is

AIPMT 2000

(a) $U/2$ (b) U/4 (c) 4U (d) 2U

125. A sphere of capacitance 100 pF is charged to a potential of 100 V. Another identical uncharged metal sphere is brought in contact with the charged sphere, then the change in the total energy stored on these spheres, when they touch is $\alpha \times 10^{-7}$ J. The value of α is ____. (combined capacitance of spheres is 200 pF)

JEE MAIN 2026 · 6 APR · SHIFT 2

(a) 5 (b) $\frac{5}{2}$ (c) $\frac{7}{2}$ (d) $\frac{9}{2}$

126. A parallel plate capacitor of capacitance 2 F is charged to a potential V, The energy stored in the capacitor is E_1. The capacitor is now connected to another uncharged identical capacitor in parallel combination. The energy stored in the combination is E_2. The ratio E_2/E_1 is:

JEE MAIN 2023 · 11 APR · SHIFT 1

(a) 1: 2 (b) 2: 3 (c) 2: 1 (d) 1: 4

127. A capacitor C is fully charged with voltage V_0. After disconnecting the voltage source, it is connected in parallel with another uncharged capacitor of capacitance $\frac{C}{2}$. The energy loss in the process after the charge is distributed between the two capacitors is:

JEE MAIN 2020 · 4 SEP · SHIFT 2

(a) $\frac{1}{2}CV_0^2$ (b) $\frac{1}{4}CV_0^2$ (c) $\frac{1}{3}CV_0^2$ (d) $\frac{1}{6}CV_0^2$

128. A 600 pF capacitor is charged by 200 V supply. It is then disconnected from the supply and is connected to another uncharged 600 pF capacitor. Electrostatic energy lost in the process is _____ μJ

JEE MAIN 2023 · 8 APR · SHIFT 2 *(Numerical)*

129. A capacitor of capacitance 50 pF is charged by 100 V source. It is then connected to another uncharged identical capacitor. Electrostatic energy loss in the process is _____ nJ.

JEE MAIN 2022 · 27 JUN · SHIFT 1 *(Numerical)*

130. A 60 pF capacitor is fully charged by a 20 V supply. It is then disconnected from the supply and is conneced to another uncharged 60 pF capacitor in parallel. The electrostatic energy that is lost in this process by the time the charge is redistributed between them is (in nJ)

_____

JEE MAIN 2020 · 7 JAN · SHIFT 2 *(Numerical)*

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TOPIC 07

Capacitors in DC Circuits & RC

7 PYQs · Easy 7 · Medium 0 · Difficult 0 | MHT CET 2 · NEET 3 · JEE 2

Concepts covered: Charging & discharging (RC) (2) · Displacement current & LC (5)

LEVEL 1 · EASY 7 questions

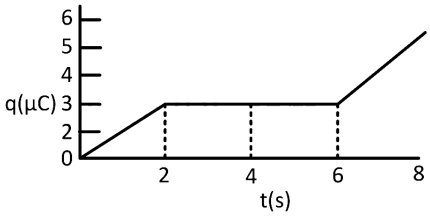
◆ Charging & discharging (RC) 2 Qs

131. The time constant of C-R circuit is

AIPMT 1992

(a) $1/CR$ (b) C/R (c) CR (d) R/C

132. The charge on a capacitor plate in a circuit, as a function of time, is shown in the figure:



What is the value of current at t = 4 s?

JEE MAIN 2019 · 12 JAN · SHIFT 2

(a) zero (b) 1.5 μA (c) 2 μA (d) 3 μA

◆ Displacement current & LC 5 Qs

133. The voltage between the plates of a parallel plate capacitor of capacity 1μ F is changing at the rate of 4 V/s. the displacement current in the capacitor is

MHT CET 2025 · 21 APR · SHIFT 1

(a) 4μ A (b) 3μ A (c) 1μ A (d) 6μ A

134. A parallel plate capacitor with plate area A and plate separation d is charged by constant current I. A plane surface of area $\frac{A}{2}$, parallel to the plates is drawn simultaneously between the plates. The displacement current through this area is

MHT CET 2025 · 20 APR · SHIFT 2

(a) I (b) $\frac{I}{2}$ (c) $\frac{I}{4}$ (d) $\frac{1}{8}$

135. To produce an instantaneous displacement current of 2 mA in the space between the parallel plates of a capacitor of capacitance 4 μF, the rate of change of applied variable potential difference $\left(\frac{dV}{dt}\right)$ must be :-

NEET 2023

(a) 800 V/s (b) 500 V/s (c) 200 V/s (d) 400 V/s

136. A parallel plate capacitor of capacitance 20 μF is being charged by a voltage source whose potential is changing at the rate of 3V/s. The conduction current through the connecting wires, and the displacement current through the plates of the capacitor, would be, respectively:

NEET 2019

(a) zero, zero (b) zero, 60 μA
(c) 60 μA, 60 μA (d) 60 μA, zero

137. To establish an instantaneous current of 2 A through a 1 μF capacitor; the potential difference across the capacitor plates should be changed at the rate of:

JEE MAIN 2013 · 22 APR · SHIFT 1

(a) 2×10^4 V/s (b) 4×10^6 V/s
(c) 2×10^6 V/s (d) 4×10^4 V/s

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ANSWER KEY

Shaded by level: **Easy**

01 Capacitance of a Conductor

1. (a)	2. (a)	3. (b)	4. (a)	5. (b)	6. (b)	7. (a)	8. (d)	9. (d)	10. (a)
11. (c)									

02 Parallel Plate Capacitor

12. (c)	13. (c)	14. (b)	15. (c)	16. (a)	17. (d)	18. (b)	19. (a)	20. (b)	

03 Energy Stored & Force between Plates

21. (c)	22. (a)	23. (b)	24. (b)	25. (d)	26. (d)	27. (c)	28. (c)	29. (b)	30. (d)
31. (d)	32. (a)	33. (a)	34. (c)	35. (c)	36. (c)	37. (d)	38. (a)	39. (d)	40. (c)
41. (b)	42. (a)	43. (a)	44. (d)	45. (a)	46. (d)				

04 Dielectrics

47. (d)	48. (c)	49. (a)	50. (a)	51. (a)	52. (c)	53. (b)	54. (d)	55. (b)	56. (a)
57. (b)	58. (c)	59. (d)	60. 105	61. (a)	62. (a)	63. (d)	64. (b)	65. (b)	66. (a)
67. (a)	68. (c)	69. (d)	70. (c)	71. (c)	72. (b)	73. (c)	74. (d)	75. (b)	76. (d)
77. (a)	78. (a)	79. (b)	80. 6	81. 161	82. 3	83. (a)	84. (c)	85. (c)	86. (b)
87. (b)	88. 5	89. (d)							

05 Combination of Capacitors

90. (b)	91. (d)	92. (d)	93. (b)	94. (c)	95. (d)	96. (b)	97. (d)	98. (d)	99. (b)
100. (c)	101. (a)	102. (c)	103. (c)	104. (c)	105. (b)	106. (d)	107. (c)	108. (b)	109. (d)
110. (c)	111. (b)								

06 Charge Sharing & Loss of Energy

112. (a)	113. (b)	114. (d)	115. (d)	116. (c)	117. (a)	118. (d)	119. (b)	120. 4	121. 16
122. (a)	123. (a)	124. (b)	125. (b)	126. (a)	127. (d)	128. 6	129. 125	130. 6	

07 Capacitors in DC Circuits & RC

131. (c)	132. (a)	133. (a)	134. (b)	135. (b)	136. (c)	137. (c)			

Note: *"Bonus" = no option is correct as the question is printed (dropped in the official key). Numerical questions show the numerical answer.*

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