

CLASS 12

PHYSICS

EXTRA QUESTIONS

Class 12 Physics Chapter 2 Electrostatic Potential and Capacitance – Extra Questions with Answers

These questions on Electrostatic Potential and Capacitance cover the farad as the unit of capacitance, the potential at a dipole's equatorial point, and how a dielectric raises a capacitor's capacitance.

Contents

Very Short Answer Questions (1 mark)

Short Answer Questions (2–3 marks)

Higher-Order Thinking / Application Questions

Class 12 Physics Chapter 2 – Solutions and Notes

These questions on Electrostatic Potential and Capacitance cover the farad as the unit of capacitance, the potential at a dipole's equatorial point, and how a dielectric raises a capacitor's capacitance.

Very Short Answer Questions (1 mark)

Q1. What is the SI unit of capacitance?

Ans: Farad (F).

Q2. What is the potential at the equatorial point of a dipole?

Ans: Zero.

Q3. Write the formula for energy stored in a capacitor.

Ans: $U = \frac{1}{2}CV^2$.

Q4. What is an equipotential surface?

Ans: A surface where the potential is the same at every point.

Q5. How does capacitance change when a dielectric is inserted?

Ans: It increases by a factor K, the dielectric constant.

Short Answer Questions (2–3 marks)

Q6. Two capacitors of $2\mu\text{F}$ and $3\mu\text{F}$ are connected in series. Find the equivalent capacitance.

Ans: $1/C = 1/2 + 1/3 = 5/6$, so $C = 6/5 = 1.2\mu\text{F}$.

Q7. A parallel plate capacitor has $C = 2\mu\text{F}$. Find the new capacitance if a dielectric of $K = 5$ fully fills the gap.

Ans: $C' = KC = 5 \times 2 = 10\mu\text{F}$.

Q8. Find the potential energy of two charges $+2\mu\text{C}$ and $-3\mu\text{C}$ placed 0.5m apart.

Ans: $U = kq_1q_2/r = (9 \times 10^9)(2 \times 10^{-6})(-3 \times 10^{-6})/0.5 = -0.108 \text{ J}$.

Higher-Order Thinking / Application Questions

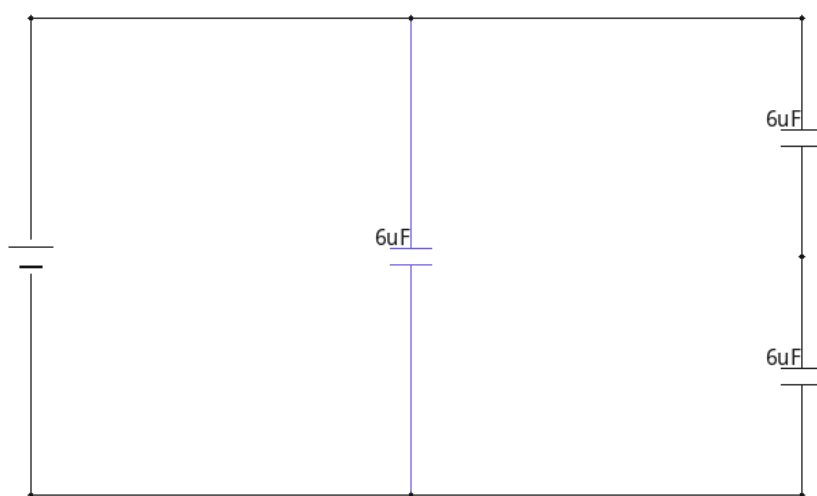
Q9. Derive the expression for capacitance of a parallel plate capacitor with a dielectric slab of thickness t ($t < d$) and dielectric constant K partially filling the gap between plates separated by distance d .

Ans: Consider a parallel plate capacitor with plate area A , plate separation d , and a dielectric slab of thickness t ($t < d$, so there is still an air gap of thickness $d-t$) inserted between the plates. The electric field in the air gap is $E_0 = \sigma/\epsilon_0 = Q/(A\epsilon_0)$, and the electric field inside the dielectric is $E = E_0/K = Q/(AK\epsilon_0)$. The total potential difference across the capacitor is the sum of the potential drops across the air gap and the dielectric: $V = E_0(d-t) + Et = [Q/(A\epsilon_0)](d-t) + [Q/(AK\epsilon_0)]t = [Q/(A\epsilon_0)][(d-t) + t/K]$. The capacitance is $C = Q/V = A\epsilon_0/[(d-t) + t/K]$. Verification: if $t=0$ (no dielectric), $C = A\epsilon_0/d$, the standard vacuum formula [?]. If $t=d$ (dielectric fills entire gap), $C = A\epsilon_0/(d/K) = KA\epsilon_0/d$, matching the fully-dielectric-filled formula [?]. This shows how a partial dielectric slab increases capacitance from the vacuum value but less than a fully-filled capacitor would.

Q10. Three capacitors of $6\mu\text{F}$ each are connected such that two are in series and this combination is in parallel with the third. Find the equivalent capacitance, and calculate the total charge stored if a 12V battery is connected across the combination.

Ans: First find the series combination of two $6\mu\text{F}$ capacitors: $1/C_{\text{series}} = 1/6 + 1/6 = 2/6 = 1/3$, so $C_{\text{series}} = 3\mu\text{F}$. This

series combination ($3\mu\text{F}$) is now in parallel with the third $6\mu\text{F}$ capacitor: $C_{\text{eq}} = C_{\text{series}} + C_{\text{third}} = 3 + 6 = 9\mu\text{F}$. With a 12V battery connected across this $9\mu\text{F}$ equivalent capacitance, the total charge stored is $Q = C_{\text{eq}}V = 9 \times 10^{-6} \times 12 = 108 \times 10^{-6} \text{ C} = 1.08 \times 10^{-4} \text{ C} = 108\mu\text{C}$. This demonstrates the standard method for reducing mixed series-parallel capacitor networks: simplify series branches first into their equivalent, then combine that with parallel branches, applying $Q = CV$ only at the final equivalent stage (since voltage is not necessarily equal across all original capacitors in a mixed network).



Two $6\mu\text{F}$ capacitors in series, that combination in parallel with a third $6\mu\text{F}$ (12V battery).

Class 12 Physics Chapter 2 – Solutions and Notes

For complete step-by-step answers and a quick summary, check the [Class 12 Physics Chapter 2 Solutions](#) and [Class 12 Physics Chapter 2 Revision Notes](#).

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