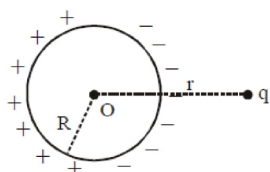


# Electrostatic Potential and Capacitance

1. **Assertion (A):** Consider a conducting sphere of radius  $R$ . Now a charge  $q$  is placed in front of sphere. Electric potential at point  $O$  is  $\frac{Kq}{r}$ .



**Reason (R):** Electric potential at the centre of sphere due to induced charges is zero.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
(3) (A) is true but (R) is false  
(4) Both (A) and (R) are false
2. **Assertion (A):** When a isolated charged body is connected to earth, all its charge flows to earth and it becomes electrically neutral.
- Reason (R):** Electric potential of earth is non zero, so the body connected to earth should also attain zero potential.
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
(3) (A) is true but (R) is false  
(4) Both (A) and (R) are false
3. **Assertion (A):** Potential difference between two points in space is zero if electric field at all points in space is zero.
- Reason (R):** Electric field  $E$  at a point  $P$  is zero if potential at that point is zero.
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
(3) (A) is true but (R) is false  
(4) Both (A) and (R) are false

4. **Assertion (A):** Electrostatic field inside a conducting shell is always zero.

**Reason (R):** The electrostatic potential is always same from center to surface of a conducting shell.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
(3) (A) is true but (R) is false  
(4) Both (A) and (R) are false
5. The electrostatic potential on the surface of a charged solid conducting sphere is 100 volts. Two statements are made in this regard :-
- Assertion (A):** At any point inside the sphere, electrostatic potential is 100 volt.
- Reason (R):** At any point inside the sphere, electric field is zero.
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
(3) (A) is true but (R) is false  
(4) Both (A) and (R) are false
6. **Assertion (A):** If electric field in  $x$ - $y$  plane is given by  $\vec{E} = y\hat{i} + x\hat{j}$  then equipotential curve is given by  $xy = \text{constant}$ .
- Reason (R):** Electric field may not be perpendicular to equipotential surface/curve/line.
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
(3) (A) is true but (R) is false  
(4) Both (A) and (R) are false
7. **Assertion (A):** Distance of closest approach for free target is more than that for fixed target.
- Reason (R):** Total energy is conserved for free target but not for fixed target.
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
(3) (A) is true but (R) is false  
(4) Both (A) and (R) are false



8. **Assertion (A):** When two positive point charges move away from each other, their electrostatic potential energy decreases.

**Reason (R):** Change in potential energy between two points is equal to the work done by electrostatic forces.

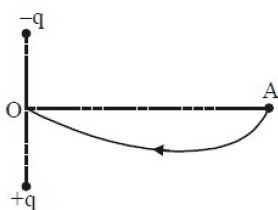
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

9. **Assertion (A):** Electric potential of earth is taken as zero.

**Reason (R):** Electric field strength on the surface of earth is zero.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

10. **Assertion (A):** A charge  $3 \mu\text{C}$  is moved from a point A that is on the equatorial line of an electric dipole to the centre of the dipole along a path as shown in figure. For this motion, work done by electric force will be zero.



**Reason (R):** Electric force is a conservative force.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

11. **Assertion (A):** If capacitor is filled with, same thickness  $t$  ( $t < d$ ) of dielectric and conducting sheet one after another, then capacitance are  $C_1$  and  $C_2$  respectively then  $C_1 < C_2$

**Reason (R):** Capacitance is more in presence of metal sheet in compare to dielectric sheet as

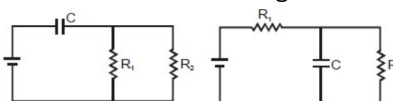
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

12. **Assertion (A):** Circuits containing high capacity capacitors, charged to high voltage should be handled with caution, even when the current in the circuit is switched off.

**Reason (R):** When an isolated capacitor is touched by hand or any other part of the human body, there is an easy path to the ground available for the discharge of the capacitor.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

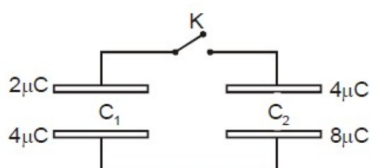
13. **Assertion (A):** Time constants of the circuits shown in the figure are same.



**Reason (R):** Instantaneous current through the capacitor branch is same at any instant for both the circuits, if batteries are inserted in the circuits at  $t = 0$

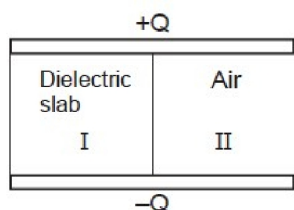
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

14. **Assertion (A):** Charges are given to plates of two plane parallel plate capacitors  $C_1$  and  $C_2$  (such that  $C_2 = 2C_1$ ) as shown in figure. Then the key K is pressed to complete the circuit. Finally the net charge on upper plate and net charge on lower plate of capacitor  $C_1$  is positive.



**Reason (R):** In a parallel plate capacitor both plates always carry equal and opposite charge.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false
15. **Assertion (A):** A charged plane parallel plate capacitor has half interplanar region (I) filled with dielectric slab. The other half region II has air. Then the magnitude of net electric field in region I is less than that in region II.



**Reason (R):** In a dielectric medium induced (or polarised) charges tend to reduce the electric field.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false

16. **Assertion (A):** A parallel plate capacitor is charged to a potential difference of 100V, and disconnected from the voltage source. A slab of dielectric is then slowly inserted between the plates. Compared to the energy before the slab was inserted, the energy stored in the capacitor with the dielectric is decreased.

**Reason (R):** When we insert a dielectric between the plates of a capacitor, the induced charges tend to draw in the dielectric into the field (just as neutral objects are attracted by charged objects due to induction). We resist this force while slowly inserting the dielectric, and thus do negative work on the system, removing electrostatic energy from the system.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false

17. **Assertion (A):** If one plate of a charged parallel plate capacitor is dipped in water and other plate is above it, then water level will rise in capacitor.

**Reason (R):** Total charge on plates increases.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false

18. **Assertion (A):** When outer grounded shell of a two charged concentric shell system is removed, the capacitance of system decreases.

**Reason (R):** Electric field will spread in vast region till infinity.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false

19. **Assertion (A):** If a capacitor (fully charged) is discharged through an ideal inductor then the charge makes SHM between the capacitor and inductor.

**Reason (R):** Current in the circuit, when a capacitor discharges through an inductor reverses its direction periodically.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

20. **Assertion (A):** In dielectric, the electric field due to polarization, is weaker than external field.

**Reason (R):** Free movement of charge is not possible in dielectric.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

21. **Assertion (A):** If separation between plates of a parallel plate isolated charged capacitor is increased, its energy stored will be increased.

**Reason (R):** Work done to separate the plates get converted in electrostatic potential energy.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

22. **Assertion (A):** When a dielectric slab is kept near an isolated parallel plate charged capacitor, it will pull the dielectric slab between the plates.

**Reason (R):** Energy of system decreases when dielectric slab enters between plates of charged parallel plate capacitor.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

23. **Assertion (A):** When two capacitors of capacitance 300 pF and 600 pF which can work upto maximum potential of 4 kV and 3 kV respectively, are connected in series, their combination can work upto maximum potential of 7 kV.

**Reason (R):** In series combination, maximum working potential will be sum of maximum working potential of individual capacitors.

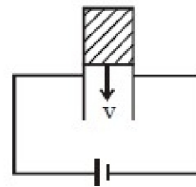
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

24. **Assertion (A):** After charging a capacitor of capacitance C from a battery, It is connected to the same battery of potential difference V with reverse polarity. Loss of energy in this process is  $2CV^2$  of

**Reason (R):** Work done by the battery is equal to loss of energy in the given case.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

25.



**Assertion (A):** If a dielectric is inserted between plates of capacitor with constant velocity a constant current is flowing in circuit.

**Reason (R):** Rate of change of capacitance is constant.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false





26. **Assertion (A):** In a system of two concentric shell of inner radius  $a$  and outer radius  $b$ . If outer is grounded and inner shell is given charge has less capacitance than inner has grounded and outer is given charge.  
**Reason (R):** Electric field is zero outside outer shell when inner shell is grounded.  
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false
27. **Assertion (A):** Two parallel plates having unequal charges have same capacitance as that of equal and opposite charges on same plates and same configuration.  
**Reason (R):** Capacitance of system/ configuration is independent of charge on plates.  
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false
28. **Assertion (A):** When a dielectric slab is gradually inserted between the plates of an isolated parallel-plate capacitor, the energy of the system decreases.  
**Reason (R):** The force between the plates decreases.  
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false
29. **Assertion (A):** A parallel plate capacitor is connected across battery through a key. A dielectric slab of dielectric constant  $K$  is introduced between the plates. The energy which is stored becomes  $K$  times  
**Reason (R):** The surface density of charge on the plate remains constant or unchanged.  
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false
30. **Assertion (A):** A dielectric slab is slightly inserted in charged parallel plate capacitor and then released slab will execute oscillation.  
**Reason (R):** Electrostatic field is conservative field.  
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false
31. **Assertion (A):** Capacitor reduces sparks in induction coil.  
**Reason (R):** Capacitor provides alternative path to current when circuit is broken.  
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false
32. **Assertion (A):** If temperature is increased, the dielectric constant of a polar dielectric decreases whereas that of a non-polar dielectric does not change significantly.  
**Reason (R):** The magnitude of dipole moment of individual polar molecule decreases significantly with increase in temperature.  
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false
33. **Assertion (A):** A capacitor of a certain capacity, whenever charged, will always store the same amount of charge.  
**Reason (R):** A definite capacity implies always a same definite value of charge.  
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)  
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)  
 (3) (A) is true but (R) is false  
 (4) Both (A) and (R) are false

**34. Assertion (A):** Two protons placed at different distances, between the plates of a parallel plate capacitor experience the same force.

**Reason (R):** The electric field between the plates of parallel plate capacitor is constant.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

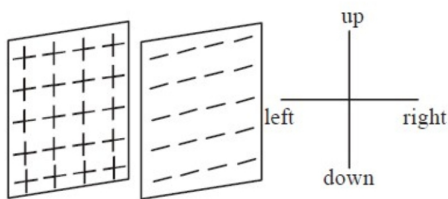
**35.** A capacitor of capacitance C is connected across a battery of potential difference V.

**Assertion (A):** The energy stored in capacitor is  $\frac{1}{2} CV^2$ .

**Reason (R):** The energy supplied by the battery is  $CV^2$ .

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

**36.** Two metal plates each of area A forms a parallel plate capacitor.



**Assertion (A):** If one plate is displaced up, then the capacitance of capacitor decreases.

**Reason (R):** Due to displacing one plate up, the overlapping area decreases.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

**37. Assertion (A):** If the distance between parallel plates of a capacitor is halved and dielectric constant is three times, then the capacitor becomes 6 times.

**Reason (R):** Capacity of a capacitor depends upon the nature of the plate material.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

**38. Assertion (A):** It is not possible to make a spherical conductor of capacitor one farad.

**Reason (R):** It is possible for earth as its radius is 6400 km.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

**39. Assertion (A):** Electrolytic capacitors have larger capacities.

**Reason (R):** Electrolytic capacitors have a positive and a negative terminal.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

**40. Assertion (A):** In parallel plate capacitor separation 'd' should be smaller than the linear dimension of the plates ( $d^2 \ll A$ ).

**Reason (R):** For  $d^2 \ll A$  fringing effect can be ignored in the region sufficiently far from the edge.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

### ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	3	4	4	1	3	3	3	3	2	1	1	3	3	1	1	3	1	1	1
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	1	1	4	1	1	3	1	3	3	2	1	3	4	1	2	1	3	3	2	1