ATUL CLASSES

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Test / Exam Name: Atul Classes **Standard: 12th Science** **Subject: Physics**

Student Name: ..... **Section:** ..... **Roll No.:** .....

Questions: 40 **Time: 01:00 hh:mm** **Negative Marks: 0** **Marks: 40**

Q1. In case of a Van de Graaff generator, the breakdown field of air is: **1 Mark**

A $2 \times 108V\ m^{-1}$ **B** $3 \times 106V\ m^{-1}$ **C** $2 \times 108V\ m^{-1}$ **D** $3 \times 104V\ m^{-1}$

Ans: B $3 \times 106V\ m^{-1}$

2. $3 \times 106V\ m^{-1}$

Q2. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A, is: **1 Mark**

A Independent of the distance between the plates.
B Linearly proportional to the distance between the plates.
C Inversely proportional to the distance between theplates.
D
Proportional to the square root of the distance betweenthe plates.

Ans: A Independent of the distance between the plates.

1. Independent of the distance between the plates.

Q3. A positively charged particle is released from rest in an uniform electric field. The electric potential energy of the charge: **1 Mark**

A Remains a constant because the electric field is uniform.
B Increases because the charge moves along the electric field.
C Decreases because the charge moves along the electric field.
D
Decreases because the charge moves opposite to the electric field .

Ans: C Decreases because the charge moves along the electric field.

3. Decreases because the charge moves along the electric field.

Q4. For two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1 Mark**

Assertion (A): A capacitor can be broken by placing large amount of charge on it.
Reason (R): After breakage potential, the capacitor is destroyed.

A Both A and R are true, and R is the correct explanation of A.
B Both A and R are true, but R is not the correct explanation of A.
C A is true, but R is false. **D** A is false, and R is also false.

Ans: B Both A and R are true, but R is not the correct explanation of A.

2. Both A and R are true, but R is not the correct explanation of A.

Explanation:
When large amount of charges are placed on capacitor a high potential difference is established between its conducting components. If this potential difference is above what is called breakage potential, an electric discharge results, destroying the capacitor. If the capacitor contains an insulator between its conducting components, the insulator will be burnt at the atomic/ molecular level. A capacitor subjected to voltage exceeding the breakage potential cannot be recovered. It should be discarded and replaced.

Q5. A capacitor is a system of two conductors separated by _____. **1 Mark**

A Conductors. **B** Dielectrics. **C** An insulators. **D** None.

Ans: C An insulators.

3. An insulators.

Q6. From a supply of identical capacitors rated 8 µF, 250 V, the minimum number of capacitors required to form a composite 16 µF, 1000 V capacitor is: **1 Mark**

A 2 **B** 4 **C** 16 **D** 32

Ans: D 32

4. 32

Explanation:

The required voltage is 1000v and the capacitors are parallel as 250v.

So number of capacitors required will be 4 i.e$250 \times 4 = 1000$ in series.

Now example of four capacitor in series will be equal 2µf (micro farade) but the equivalent capacitance required is given as 16µf so there must be 8 series of parallel arrange capacitors each of capacitor 2 micro farad hence total number of capacitor = $4 \times 8 = 32$

Q7. Which of the following statements is/ are correct for equipotential surface ? **1 Mark**

1. The potential at all the points on an equipotential surface is same.
2. Equipotential surfaces never intersect each other.
3. Work done in moving a charge from one point to other on an equipotential surface is zero.

A I only. **B** II only. **C** I and II. **D** I, II and III.

Ans: D I, II and III.

4. I, II and III.

Q8. Two capacitors each having capacitance C and breakdown voltage V are joined in series. The capacitance and the breakdown voltage of the combination will be: **1 Mark**

A $2\mathrm{C}$ and $2\mathrm{V}$ **B** $\frac{\mathrm{C}}{2}$ and $\frac{\mathrm{V}}{2}$ **C** $2\mathrm{C}$ and $\frac{\mathrm{V}}{2}$ **D** $\frac{\mathrm{C}}{2}$ and $2\mathrm{V}$

Ans: D $\frac{\mathrm{C}}{2}$ and $2\mathrm{V}$

4. $\frac{\mathrm{C}}{2}$ and $2\mathrm{V}$

Explanation:

Since the voltage gets added up when the capacitors are connected in series, the voltage of the combination is 2V.

Also, the capacitance of a series combination is given by

$$\frac{1}{\mathrm{C_{net}}} = \frac{1}{\mathrm{C_1}} + \frac{1}{\mathrm{C_2}}$$

Here,

$\mathrm{C_{net}}$ = Net capacitance of the combination

$\mathrm{C_1} = \mathrm{C_2} = \mathrm{C}$

$\therefore \mathrm{C_{net}} = \frac{\mathrm{C}}{2}$

Q9. Which of the following statements is correct? **1 Mark**

A An electric field is a scalar quantity.
B Electric field lines are at 45 degrees to the equipotential surfaces.
C The surface of a charged conductor is equipotential.
D Field lines due to a point charge are circular.

Ans: C The surface of a charged conductor is equipotential.

3. The surface of a charged conductor is equipotential.

Explanation:

In conductors, charges are equally distributed over the surface of the conductor. Therefore the potential throughout the surface is the same, i.e. equipotential. The electric field is a vector quantity and the field lines cut the equipotential surfaces at 90 degrees. The field lines due to a point charge are radial.

Q10. Which material sheet should be placed between the plates of a parallel plate condenser in order to increase its capacitance ? **1 Mark**

A Mica **B** Copper **C** Tin **D** Iron

Ans: A Mica

1. Mica

Explanation:

Here copper, tin, iron all are conductor so they will decrease the capacitance. The mica sheet is a dielectric or insulator so it will increase the capacitance k times. Where k is the dielectric constant.

Q11. When a metal plate is introduced between the two plates of a charged capacitor and insulated from them, then which of following statement(s) is/ are correct? **1 Mark**

1. The metal plate divides the capacitor into two capacitors connected in parallel to each other.
2. The metal plate divides the capacitors into two capacitors connected in series with each other.
3. The metal plate is equivalent to a dielectric of zero dielectric constant.

A I only. **B** II only. **C** I and II. **D** I, II and III.

Ans: B II only.

2. II only.

Q12. Among identical spheres A and B having charges −15C and −16C: **1 Mark**

A −15C is at higher potential. **B** −16C is at higher potential.
C both are at equal potential. **D** no such comparison can be made.

Ans: A −15C is at higher potential.

1. −15C is at higher potential.

Explanation:

Potential at surface of a sphere of radius r is V = kQ/ r
As identical sphere so r is same for both, Thus V will depend on charge Q.
So when Q is more, potential will be more.
Since −15 C is more than −16 C, so −15 C sphere will have higher potential.

Q13. If A and B are two equipotential surfaces around a positive point charge q, what will happen if we place another point charge +Q between A and B? **1 Mark**

A It will remain stationary **B** It will move from B to A
C It will move from A to B **D** It will rotate in a circular path

Ans: C It will move from A to B

3. It will move from A to B

Explanation:

A charge always tries to move from a point of higher potential to a point of lower potential. The potential at A is greater than the potential at B because of electric potential decreases with distance from the charge. It can also be explained by the fact that a positive charge is always repelled by another positive charge.

Q14. When air in a capacitor is replaced by a medium of dielectric constant K, the capacity: **1 Mark**

A Decreases K times. **B** Increases K times. **C** Increases K2 times.
D Remains constant.

Ans: B Increases K times.

2. Increases K times.

Q15. It becomes possible to define potential at a point in an electric field because electric field: **1 Mark**

A Is a conservative field. **B** Is a non-conservative field.
C Is a vector field. **D** Obeys principle of superposition.

Ans: A Is a conservative field.

1. Is a conservative field.

Q16. For two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1 Mark**
Assertion (A): When a dielectric medium is filled between the plates of a condenser, its capacitance increases.
Reason (R): The dielectric medium reduces the potential difference between the plates of the condenser.

A Both A and R are true, and R is the correct explanation of A.
B Both A and R are true, but R is not the correct explanation of A.
C A is true, but R is false. **D** A is false, and R is also false.

Ans: A Both A and R are true, and R is the correct explanation of A.

1. Both A and R are true, and R is the correct explanation of A.
Explanation:
The dielectric molecules are polarised, producing an opposite electric field. Thus the effective electric field and hence the potential difference between the plates is reduced and consequently, the capacitance is increased $\left(\because C = \frac{Q}{V} \right)$.

Q17. How does the capacitance change with the effect of the dielectric when the battery remains connected across the capacitor? **1 Mark**

A Increases **B** Decreases **C** Zero
D Remains constant

Ans: A Increases

1. Increases
Explanation:
When a dielectric is introduced, and the battery remains connected across the capacitor, the capacitance increases from C_0 to C.
$C = kC_0$.

Q18. When a dielectric is introduced between the plates of a condenser, the capacity of condenser: **1 Mark**

A increases **B** decreases **C** remains same **D** none of these

Ans: A increases

1. increases
Explanation:
If the empty Condensor has capacity C, then its capacity with dielectric is given by C' = kC, where k is the dielectric constant of the dielectric material. k can never be less than 1.

Q19. If the capacitors having capacitance C_1 and C_2 are connected in series then their resultant capacitance is given by: **1 Mark**

A $1/C = 1/C_1 + 1/C_2$ **B** $1/C = 1/C_1 – 1/C_2$ **C** $C = C_1 + C_2$
D None

Ans: A $1/C = 1/C_1 + 1/C_2$

1. $1/C = 1/C_1 + 1/C_2$

Q20. A parallel plate condenser is immersed in an oil of dielectric constant 2. The field between the plates is: **1 Mark**

A Increased, proportional to 2. **B** Decreased, proportional to 1/ 2.
C Increased, proportional to - 2. **D** Decreased, proportional to -1/ 2.

Ans: B Decreased, proportional to 1/ 2.

2. Decreased, proportional to 1/ 2.

Q21. In parallel combination of capacitors, the effective capacitance: **1 Mark**

A Decreases. **B** Increases. **C** Remains same.
D None.

Ans: B Increases.

2. Increases.

Q22. (1): The dielectric medium between the plates of a parallel plate capacitor lowers the potential difference between the plates without a battery.
(2): The maximum electric field that a dielectric can withstand without causing it to break down is dielectric strength. **1 Mark**

A Both 1 and 2 are true, 2 is not correct explanation of 1
B Both 1 and 2 are true, 2 is correct explanation of 1.
C 1 is false, 2 is true **D** 1 is true, 2 is false

Ans: D 1 is true, 2 is false

1. Both 1 and 2 are true, 2 is not correct explanation of 1
Explanation:
Consider a capacitor with charge density σ.
The potential between its two plates is given by $\frac{\sigma d}{\epsilon_0}$
When a dielectric is inserted, the electric field inside the capacitor decrease decreasing the potential between the two plates of capacitor.
However, this is nothing to the dielectric strength of the dielectric.

Q23. In a charged capacitor, the energy is stored in: **1 Mark**

A The negative charges. **B** The positive charges.
C The field between the plates. **D** Both (a) and (b).

Ans: C The field between the plates.

3. The field between the plates.

Q24. 'X' is a substance which does not allow the flow of charges through it but permits them to exert electrostatic forces on one another through it. Identify X. **1 Mark**

A Polar molecule **B** Dielectric **C** Non-polar molecule
D Equipotential

Ans: B Dielectric

2. Dielectric
Explanation:
A dielectric is a substance which does not allow the flow of charges through it but permits them to exert electrostatic forces on one another through it. A dielectric is essentially an insulator which can be polarized through small localized displacements of its charges.

Q25. For two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1 Mark**
Assertion (A): Conductors having equal positive charge and volume, must also have same potential.

Reason (R): Potential depends only on charge and volume of conductor.

A Both A and R are true, and R is the correct explanation of A.
B Both A and R are true, but R is not the correct explanation of A.
C A is true, but R is false. **D** A is false, and R is also false.

Ans: D A is false, and R is also false.

4. A is false, and R is also false.
Explanation:
Electric potential of a charged conductor depends not only on the amount of charge and volume but also on the shape of the conductor. Hence if their shapes are different, they may have different electric potential.

Q26. For two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1 Mark**
Assertion (A): A capacitor is connected to a battery. If we move its plate further apart, work will be done against the electrostatic attraction between the plates, and the energy of the capacitor gets decreased.
Reason (R): The energy stored in capacitor is dissipated in the form of heat energy.

A Both A and R are true, and R is the correct explanation of A.
B Both A and R are true, but R is not the correct explanation of A.
C A is true, but R is false. **D** A is false, and R is also false.

Ans: B Both A and R are true, but R is not the correct explanation of A.

2. Both A and R are true, but R is not the correct explanation of A.
Explanation:
When the plates of a capacitor are moved further apart, the capacitance gets decreased. As battery remains connected, hence charge q(= CV) on the plates is decreased, and energy $\mathrm{U} = \left[\frac{1}{2}\mathrm{CV}^2\right]$ also decreases. Some charge from the plates flows to the battery i.e. some energy of capacitor is transferred to the battery. Work done against electrostatic attraction between plates is used in the transference of energy and is dissipated in the form of heat energy in connection wires.

Q27. A parallel plate capacitor is first charged and then isolated, and a dielectric slab is introduced between the plates. The quantity that remains unchanged is: **1 Mark**

A Charge Q **B** Potential V **C** Capacity C **D** Energy U

Ans: A Charge Q

1. Charge Q
Explanation:
When the capacitor is kept at a voltage, it gains charge.
Now when the system is isolated, the charge present on capacitor cannot change because of law of conservation of charge.
∴ Charge always remains constant in isolated systems.

Q28. What is the net electric field in the outer regions above the upper plate and below the lower plate in a parallel plate capacitor? **1 Mark**

A Maximum **B** Uniform **C** Zero **D** Minimum

Ans: C Zero

3. Zero
Explanation:
In the outer regions above the upper plate and below the lower plate, the electric fields due to the two charged plates cancel out. Hence, the net electric field in the outer regions above the plate and below the lower plate is zero.

Q29. A capacitor of capacitance C is charged to a potential V. The flux of the electric field through a closed surface enclosing the capacitor is: **1 Mark**

A $\frac{CV}{\epsilon_0}$ **B** $\frac{2CV}{\epsilon_0}$ **C** $\frac{CV}{2\epsilon_0}$ **D** Zero.

Ans: D Zero.

4. Zero.

Explanation:

Since the net charge enclosed by the Gaussian surface is zero, the total flux of the electric field through the closed Gaussian surface enclosing the capacitor is zero.

$\phi = \oint E.ds = \frac{q}{\epsilon_0} = 0$

Here,

$\phi =$ Electric flux

q = Total charge enclosed by the Gaussian surface.

Q30. What is the total work done on moving a test charge on an equipotential surface? **1 Mark**

A Maximum **B** Minimum **C** Constant **D** Zero

Ans: D Zero

4. Zero

Explanation:

The potential difference between any two points on an equipotential surface is zero.

Work done = Test charge x potential difference(0)

Q31. When the separation between two charges is increased the electric potential energy of the charges. **1 Mark**

A Increases. **B** Decreases. **C** Remains the same.
D May increase or decrease.

Ans: D May increase or decrease.

4. May increase or decrease.

Explanation:

When the separation between two charges is increased, the electric potential Energy of charge may incease or decrease.

If Both charge are like charge then electric potential energy of charge decreases.

$U = \frac{kq_1q_2}{r}$

If Both charge are unlike charge then electric potential energy of charge increases.

$U = \frac{-kq_1q_2}{r}$

Q32. A capacitor is charged by using a battery which is then disconnected. A dielectric slab is introduced between the plates which results in: **1 Mark**

A
Increase in the potential difference across the plates and reduction in stored energy but no change in the charge on the plates.

B
Decrease in the potential difference across the plates and reduction in the stored energy but no change in the charge on the plates.

C
Reduction of charge on the plates and Increase of potential difference across the plates.

D
Increase in stored energy but no change in potential difference across the plates.

Ans: B

Decrease in the potential difference across the plates and reduction in the stored energy but no change in the charge on the plates.

2. Decrease in the potential difference across the plates and reduction in the stored energy but no change in the charge on the plates.

Explanation:

If a dielectric slab of dielectric constant K is filled in between the plates of a capacitor after charging the capacitor (i.e., after removing the connection of battery with the plates of capacitor) the potential difference between the plates reduces to $\frac{1}{K}$ times and the potential energy of capacitor reduces to $\frac{1}{K}$ times but there is no change in the charge on the plates.

Q33. **1 Mark**

What is the total charge on the parallel plate capacitor shown?

A 2Q **B** $\frac{Q}{2}$ **C** 0 **D** $\frac{-Q}{2}$

Ans: C 0

3. 0

Explanation:

Since the total charge on a capacitor is given by sum of the charges on the two parallel plates, here charge on each plate is equal and opposite, hence –Q + Q = 0. Therefore, the total charge on the capacitor is 0.

Q34. A parallel-plate capacitor has plates of unequal area. The larger plate is connected to the positive terminal of the battery and the smaller plate to its negative terminal. Let Q_+ and Q_- be the charges appearing on the positive and negative plates respectively: **1 Mark**

A $Q_+ > Q_-$ **B** $Q_+ = Q_-$ **C** $Q_+ < Q_-$

D

The information is not sufficient to decide the relation between Q_+ and Q_-.

Ans: B $Q_+ = Q_-$

2. $Q_+ = Q_-$

Explanation:

The charge induced on the plates of a capacitor is independent of the area of the plates.

$\therefore Q_+ = Q_-$

Q35. What is the electric field in the cavity of a hollow charged conductor? **1 Mark**

A Positive **B** Negative **C** Zero

D Depends on the nature of the conductor

Ans: C Zero

3. Zero

Explanation:

By Gauss's theorem, the charge enclosed by the gaussian surface is zero. Consequently, the electric field must be zero at every point inside the cavity. Then, the entire excess charge lies on its surface.

Q36. The amount of work done in moving a unit positive charge from infinity to a given point is known as: **1 Mark**

A Nuclear potential **B** Potential energy **C** Electric potential

D Gravitational potential

Ans: C Electric potential

3. Electric potential

Explanation:
Electric potential may be defined as the amount of work done in moving a unit positive charge from infinity to a given point.

$V = \frac{W}{q}$

Q37. The electrostatic potential on the surface of a charged conducting sphere is 100V. Two statements are made in this regard S_1 at any point inside the sphere, electric intensity is zero. S_2 at any point inside the sphere, the electrostatic potential is 100V. Which of the following is a correct statement? **1 Mark**

A S_1 is true but S_2 is false. **B** Both S_1 and S_2 are false.
C S_1 is true, S_2 is also true and S_1 is the cause of S_2.
D S_1 is true, S_2 is also true, but the statements are independant.

Ans: C S_1 is true, S_2 is also true and S_1 is the cause of S_2.

3. S_1 is true, S_2 is also true and S_1 is the cause of S_2.

Q38. What is the unit of electric potential difference? **1 Mark**

A Volt **B** Coulamb **C** Joul **D** Watt

Ans: A Volt

1. Volt

Explanation:
Unit of electric potential difference is volt(V).

Q39. Work done in moving an object through an equipotential surface is: **1 Mark**

A Positive **B** Negative **C** Zero
D Depends on the field direction

Ans: C Zero

3. Zero

Explanation:
Work done is given difference in potentials. In an equipotential surface, all points will have same potential. Thus work done is zero

Q40. In a region of constant potential: **1 Mark**

A The electric field is uniform. **B** The electric field is zero.
C There can be no charge inside the region.
D
The electric field shall necessarily change if a charge is placed outside the region.

Ans: B The electric field is zero.

C There can be no charge inside the region.

2. The electric field is zero.
3. There can be no charge inside the region.

We know, the electric field intensity E and electric potential V are related as $E = -\frac{dV}{dr}$

or we can write $|E| = -\frac{\Delta V}{\Delta r}$

The electric field intensity E and electric potential V are related as E = 0 and for V = constant, $\frac{dV}{dr} = 0$ this imply that electric field intensity E = 0.

If some charge is present inside the region then electric field cannot be zero at that region, for this V = constant is not valid.