FIITJEE

CBSE TERM - I

ALL XIITH STUDYING BATCHES

Full Test – II

PHYSICS

(18th November 2021)

Time: 1:30 Hours **Maximum Marks: 45**

General Instructions:

1. The question paper contains three sections A, B and C
2. Section A consists of 25 questions MCQ Single Option Correct, out of which students will attempt any 20 questions only. Each question carries +1 Mark.
3. Section B consists of 24 questions MCQ Single Option Correct, out of which 5 questions are Assertion-Reasoning type. Students will attempt any 20 questions only. Each question carries +1 Mark.
4. Section C consists of 6 questions MCQ Single Option Correct out of which 4 questions are based on case studies. Students will attempt any 5 questions only. Each question carries +1 Mark.
5. There is no negative marking.

Name of the Candidate : .....

Enroll Number : .....

Date of Examination : .....

PHYSICS

SECTION – A

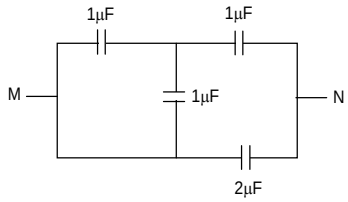
*This section contains **25 Multiple Choice Questions** number **1 to 25**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

1. After charging, parallel plate capacitor is immersed in an oil of dielectric constant 2. The field between the plate is:
   (A) Increased proportional to 2 (B) Decreased proportional to 1/2
   (C) Increased proportional to $\sqrt{2}$ (D) Decreased proportional to $1/\sqrt{2}$

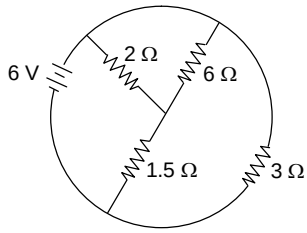
2. A parallel plate capacitor is charged by connecting to a battery and then battery is disconnected. Which of the following will increase when plates of the capacitor is moved apart
   (A) charge (B) potential
   (C) capacitance (D) None of these.

3. Two conductors each of capacitance 1μF are charged to potential 10V and 6V respectively. They are then joined together. Their common potential will be
   (A) 16 V (B) 8 V
   (C) 4 V (D) 1 V

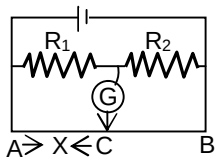
4. In the given figure the equivalent capacity between the points M and N is
   (A) 5 μF
   (B) $\frac{6}{5}$ μF
   (C) $\frac{8}{3}$ μF
   (D) none of these



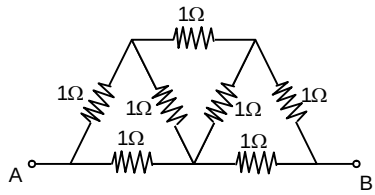
5. The total current supplied to the circuit by the battery is
   (A) 1 A
   (B) 2 A
   (C) 4 A
   (D) 6 A



6. In the shown arrangement of the experiment of the meter bridge if AC corresponding to null defection of galvanometer is x, what will be its value if the radius of the wire AB is doubled.
   (A) 4x (B) x/4
   (C) x (D) 2x



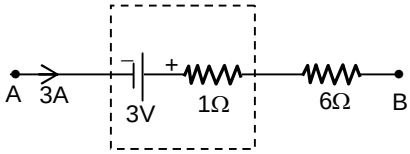
7. The effective resistance between A and B in the network of figure is



(A) $\frac{4}{3}\Omega$ (B) $\frac{3}{2}\Omega$

(C) 7Ω (D) $\frac{8}{7}\Omega$

8. Figure represents a part of closed circuit. The potential difference $(V_A - V_B)$ is



(A) 24 V (B) 0 V

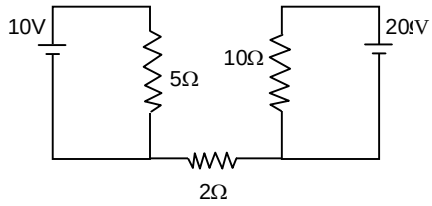
(C) 6 V (D) 18 V

9 A lamp rated 220 V, 100 W is connected to 110 V supply. Then its power reduces to

(A) 25 W (B) 50 W

(C) 75 W (D) remains same

10. Find current in 2 Ω resistor



(A) 0 (B) 2 A

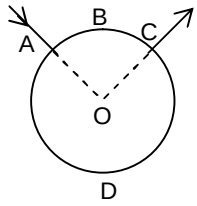
(C) 4 A (D) 1 A

11. A charged particle is projected in a magnetic field $\vec{B} = \left(3\hat{i} + 4\hat{j}\right) \times 10^{-2}$ tesla the acceleration of the particle is found to be $\vec{a} = \left(x\hat{i} + 2\hat{j}\right) m/s^2$. The value of x is

(A) 3 m/s^2 (B) – 3 m/s^2

(C) $-\frac{3}{8}\, m/s^2$ (D) $-\frac{8}{3} m/s^2$

12. A uniform wire is bent in the form of a circle of radius R. A current I enters at A and leaves at C as shown in figure. If the length ABC is half of the length ADC, the magnetic field at the centre O will be



(A) zero (B) $\frac{\mu_0 I}{2R}$

(C) $\frac{\mu_0 I}{4R}$ (D) $\frac{\mu_0 I}{6R}$

13. Two charges of 2μ C and 5 μC are placed 2.5 cm apart. The ratio of the Coulomb's force experienced by them is :

(A) 1 : 1 (B) 2 : 5

(C) $\sqrt{2} : \sqrt{5}$ (D) 4 : 25

14. A spherical charged conductor has σ as the surface density of charge. The electric field just outside its surface is E. If the radius of the sphere is doubled keeping the surface density of charge unchanged, what will be the electric field just outside the surface of the new sphere ?
(A) E/4 (B) E/2
(C) E (D) 2E

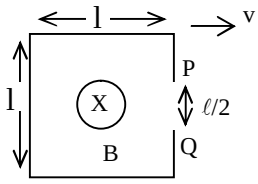
15. The work done in taking a charge q once round a circle of radius 'r' and having a charge Q at centre is :
(A) $\frac{q.Q}{4\pi\varepsilon_0(26r)}$ (B) $\frac{qQ}{4\pi\varepsilon_0 r}$
(C) $\frac{qQ}{4\pi\varepsilon_0 r^2}$ (D) zero.

16. A bulb of 100 W is connected in parallel with an ideal inductance of 1 H. This arrangement is connected to a 90 V battery through a switch. On Pressing the switch, the
(A) bulb does not glow
(B) bulb glows
(C) bulb glows after a short time and then continues to glow
(D) bulb glows for a short time and then stops glowing

17. In an LCR circuit the capacitance is changed from C to 4C. For the same resonant frequency, the inductance should be changed from L to
(A) L/4 (B) L/2 (C) 2L (D) 4L

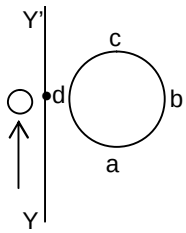
18. If a current given by $I_0\sin(\omega t - \pi/2)$ flows in ac circuit across which as ac potential of $E_0\sin(\omega t)$ has been applied, then the power consumption P in the circuit will be:
(A) $\frac{E_0 I_0}{\sqrt{2}}$ (B) $\frac{E_0 I_0}{2}$ (C) $E_0 I_0$ (D) zero

19. The loop shown moves with a velocity v in a uniform magnetic field of magnitude B, directed into the paper. The potential difference between P and Q is e (more than one option may be correct)



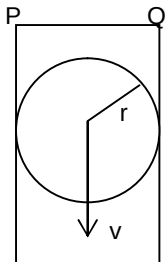
(A) $e = \frac{1}{2} B l v$
(B) $e = Blv$
(C) $e = \frac{Blv}{3}$
(D) Q is positive the w.r.t. P

20. An electron moves on a straight line path YY' as shown. a coil is kept on right of the path. What will be the direction of current induced in the coil, considering the path of electron and plane of coil in same plane.



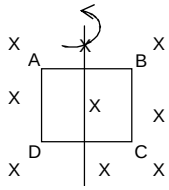
(A) clockwise
(B) anticlockwise
(C) no induced emf
(D) the direction of current will reverse when electron will pass through O

21. A vertical ring of radius 'r' and resistance 'R' slips vertically between two frictionless and resistance less vertical rails. The rails which are joined at top there is uniform magnetic field B perpendicular to plane of ring and the rails. When speed of ring is v, current induced in section PQ is



(A) zero
(B) $\frac{2Brv}{R}$
(C) $\frac{4Brv}{R}$
(D) $\frac{8Brv}{R}$

22. A square loop ABCD of area 20 cm^2 and resistance 5 Ω is rotated in a magnetic field $\vec{B} = 2$ Tesla through 180^o in 0.01 seconds. The value of charge flown through the loop will be

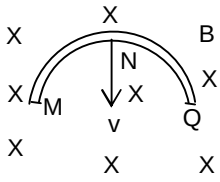


(A) 8 mc
(B) 16 μc
(C) 0.8 mc
(D) 1.6 μc

23. A straight section PQ of a circuit lies along the x-axis from $x = -(a/2)$ to $x = +(a/2)$ and carries a steady current I. The magnetic field due to the section PQ at a point $x = +a$ will be:
(A) proportional to a
(B) proportional to a^2
(C) proportional to (1/a)
(D) equal to zero

24. Lenz's law is a consequence of
(A) conservation of momentum
(B) conservation of angular momentum
(C) conservation of charge
(D) conservation of energy

25. A semicircular conducting ring of radius R is falling with its plane vertical in a horizontal magnetic induction B. At the position MNQ the speed of ring is v. The potential difference between the ends is _____ with Q at _____ potential

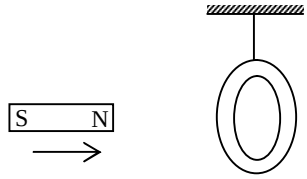


(A) 2 RBv, lower
(B) 4 RBv, higher
(C) 8 RBv, lower
(D) 2 RBv, higher

SECTION – B

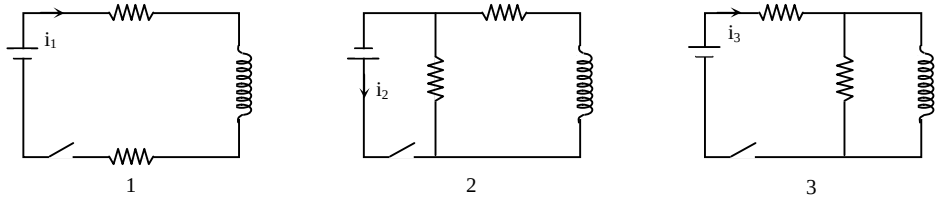
*This section contains **24 Multiple Choice Questions** number **26 to 49, out of which 5 questions are Assertion-Reasoning type.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

26. A copper ring is suspended by a thread in a vertical plane. The north pole of a magnet is brought near the ring in horizontal direction as shown in given figure. What will be effect on the ring?



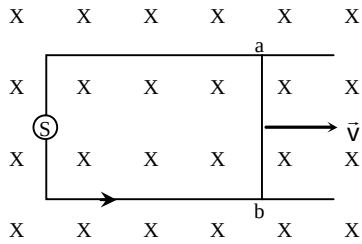
(A) ring will be attracted towards the magnet (B) ring will be repelled away
(C) ring will make simple away (D) no change in the position of ring

27. The figure shows three circuits with identical batteries, inductors and resistance. Rank the circuits according to the currents through the battery just after the switch is closed, greatest first :



(A) $i_2 > i_3 > i_1$ (B) $i_2 > i_1 > i_3$ (C) $i_1 > i_2 > i_3$ (D) $i_1 > i_3 > i_2$

28. The following diagram shows a wire ab of length l and resistance R sliding on a smooth pair of rails with a velocity v towards right. A uniform magnetic field of induction B acts normal to the plane containing the rails and the wire inwards. S is a current source providing a constant current I in the circuit. Then, the potential difference between a and b is:



(A) Bvl (B) IR
(C) $Bvl - IR$ (D) $Bvl + IR$

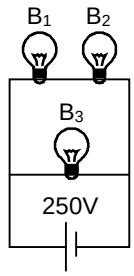
29. In a series LCR circuit, resistance R = 10 ohms and the impedance Z = 10 ohms. The phase difference between the current and the voltage is
(A) 0^0 (B) 30^0 (C) 45^0 (D) 60^0

30. The electric flux from a cube of edge l is ϕ. What will be its value if edge of cube is made 2l and charge enclosed is halved?
(A) 4ϕ (B) 2ϕ
(C) $\phi/2$ (D) ϕ

31. A bar magnet of length l and dipole moment M is bent to form a semicircle. The new dipole moment is

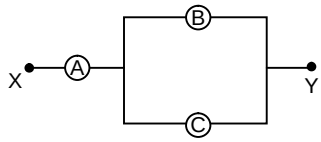
(A) $\frac{2M}{\pi}$ (B) M (C) $\frac{\pi M}{2}$ (D) None of these

32. A 100 W bulb B_1, and two 60 W bulbs B_2 and B_3, are connected to a 250 V source, as shown in the figure. Now W_1, W_2 and W_3 are the output powers of the bulbs B_1, B_2 and B_3 respectively. Then



(A) $W_1 > W_2 = W_3$ (B) $W_1 > W_2 > W_3$
(C) $W_1 < W_2 = W_3$ (D) $W_1 < W_2 < W_3$

33. A, B and C are voltmeters of resistances R, 1.5 R & 3R respectively. When some potential difference is applied between X & Y. Their readings would be



(A) $V_A = V_B = V_C$
(B) $V_A \neq V_B = V_C$
(C) $V_A = V_B \neq V_C$
(D) $V_B \neq V_A = V_C$

34. A proton and an α - particle enter a magnetic field with same KE the ratio of radius described by thin are

(A) 2:1 (B) 4:1 (C) 1:4 (D) 1:1

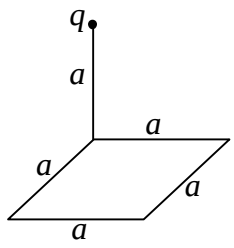
35. A current of 50 A is flowing in a copper wire if diameter 0.5×10^{-2} m. the magnetic induction on its surface will be

(A) 4×10^{-2} T (B) 4×10^{3} T (C) 4×10^{2} T (D) 4×10^{-3} T

36. A charge particle having a charge q, is moving at right angles to a magnetic field. The quantity which virus is

(A) path of motion (B) KE
(C) speed (D) angular velocity

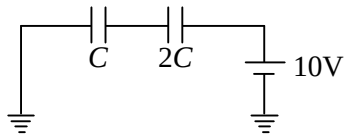
37. A point charge q is placed at a height a from vertex of square of side a as shown. The electric flux through the square is



(A) $\frac{q}{\varepsilon_0}$ (B) zero

(C) $\frac{q}{6\varepsilon_0}$ (D) $\frac{q}{24\varepsilon_0}$

38. In the circuit shown in the figure, C = 6μF. The charge stored in the capacitor of capacity C is

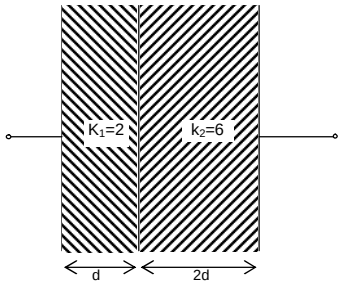


(A) zero (B) 90 μC
(C) 40 μC (D) 60 μC

39. Two identical charges are placed at the two corners of an equilateral triangle. The potential energy of the system is U. The work done in bringing an identical charge from infinity to the third vertex is

(A) U (B) 2U (C) 3U (D) 4U

40. A parallel plate capacitor has two layers of dielectrics as shown in figure. This capacitor is connected across a battery, then the ratio of potential difference across the dielectric layers is

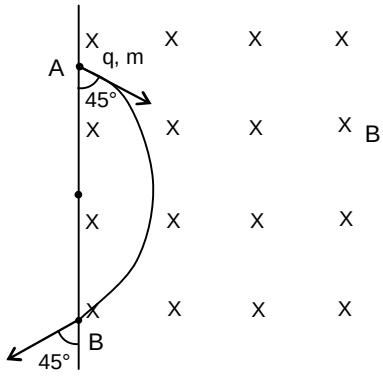


(A) 4/3 (B) 1/2
(C) 1/3 (D) 3/2

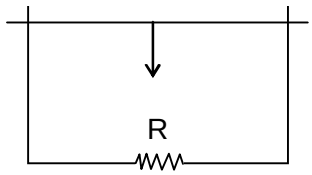
41. Find out time taken by particle in going from A to B

(A) $\frac{2\pi m}{qB}$ (B) $\frac{\pi m}{qB}$

(C) $\frac{\pi m}{2qB}$ (D) $\frac{\pi m}{4qB}$

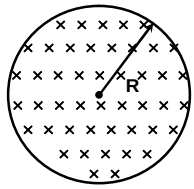


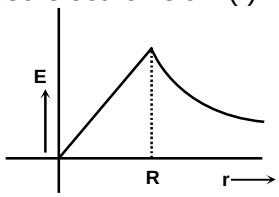
42. A straight conductor with its length in the East-West direction falls under gravity. As a result of this motion being in the Earth's magnetic field, choose the INCORRECT option.

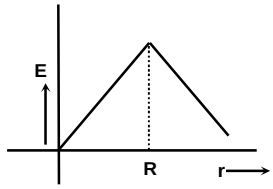


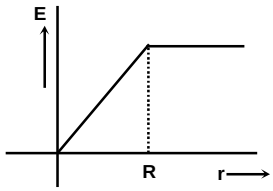
(A) induced emf develops with the East end of the conductor at higher potential than the West end.
(B) induced emf develops with the East end of the conductor at lower potential than the West end.
(C) induced current passes from East end to the West end in resistor.
(D) induced current passes from West end to the East end in rod.

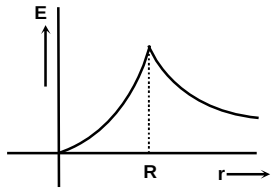
43. Figure shows a circular area of radius R where a uniform magnetic field $\vec{B}$ is going into the plane of paper and increasing in magnitude at a constant rate. In that case, which of the following graphs, drawn schematically, correctly shows the variation of the induced electric field E(r)?



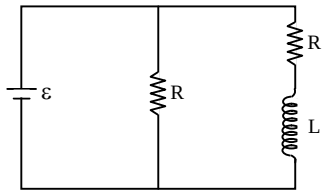
(A)


(B)


(C)


(D)


44. In an LCR AC circuit operating at certain ω, $X_L = 2X_C$. If now ω of the circuit is made $\frac{1}{\sqrt{2}}$ times keeping the same voltage:



(A) Current in the circuit will be doubled.
(B) Current in the circuit will be more than double.
(C) Current in the circuit will be less than double.
(D) None of these.

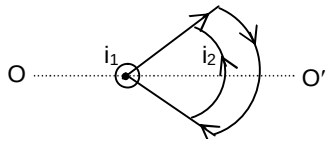
Assertion & Reason type (45 – 49)

45. **Assertion:**
Each bulb in a frill of 20 bulbs in series when connected to supply voltage will emit more light than each bulb in a frill of 19 bulbs in series when connected to same supply voltage.

Reason:
Each bulb in a frill of 20 bulbs in series will get more voltage than that in a frill of 19 bulbs.

(A) If both **Assertion** and **Reason** are true and the **Reason** is the correct explanation of the **Assertion.**
(B) If both **Assertion** and **Reason** are true but **Reason** is not a correct explanation of the **Assertion**.
(C) If **Assertion** is false but the **Reason** is true.
(D) If both **Assertion** and **Reason** are false.

46. **Assertion:**
At the centre and perpendicular to the plane of paper of an annular arc, a long straight current (outward) carrying wire is placed as shown in figure. The arc will rotate anticlockwise as viewed from O



Reason:
Magnetic field applies a torque on closed current carrying loop whose aim is to align the plane of the loop in the direction of the magnetic field.
(A) If both **Assertion** and **Reason** are true and the **Reason** is the correct explanation of the **Assertion.**
(B) If both **Assertion** and **Reason** are true but **Reason** is not a correct explanation of the **Assertion**.
(C) If **Assertion** is false but the **Reason** is true.
(D) If both **Assertion** and **Reason** are false.

47. **Assertion:**
A coaxial cable consists of a thin inner conductor fixed along the axis of a hollow outer conductor. The two conductors carry equal currents in same directions. Let B_1 be the magnetic field at a point between the two conductors, at a distance x from the axis. Let B_2 be the magnetic field at a point outside the outer conductor, at a distance 2x from the axis. Then $B_1 = B_2$
Reason:
$\int B.d\ell = \mu_o i$
(A) If both **Assertion** and **Reason** are true and the **Reason** is the correct explanation of the **Assertion.**
(B) If both **Assertion** and **Reason** are true but **Reason** is not a correct explanation of the **Assertion**.
(C) If **Assertion** is false but the **Reason** is true.
(D) If both **Assertion** and **Reason** are false.

48. **Assertion:**
The drift velocity of electrons in a metallic wire will decrease, if the temperature of the wire is increased.

Reason:
On increasing the temperature conductivity of metallic wire decreases.
(A) If both **Assertion** and **Reason** are true and the **Reason** is the correct explanation of the **Assertion.**
(B) If both **Assertion** and **Reason** are true but **Reason** is not a correct explanation of the **Assertion**.
(C) If **Assertion** is false but the **Reason** is true.
(D) If both **Assertion** and **Reason** are false.

49. **Assertion:**
When a test charge is placed inside an open circuit cell, it experience a net non-zero force
F = qE, where E is the electrostatic field in the cell inside open circuit condition.

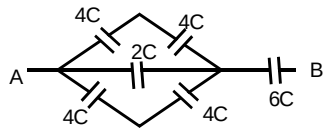
Reason:
The electrostatic field due to plates is balanced by a field produced by chemical reactions.

(A) If both **Assertion** and **Reason** are true and the **Reason** is the correct explanation of the **Assertion.**
(B) If both **Assertion** and **Reason** are true but **Reason** is not a correct explanation of the **Assertion**.
(C) If **Assertion** is false but the **Reason** is true.
(D) If both **Assertion** and **Reason** are false.

SECTION – C

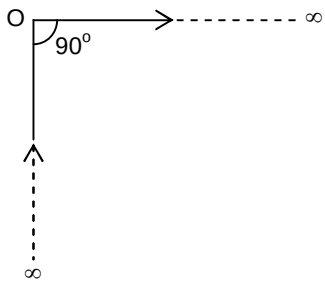
*This section contains **6 Multiple Choice Questions** number **50 to 55, out of which 4 questions are based on case studies.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

50. The equivalent capacitance between points A and B of the circuit will be



(A) 12C (B) 6 C
(C) 3 C (D) 24 C

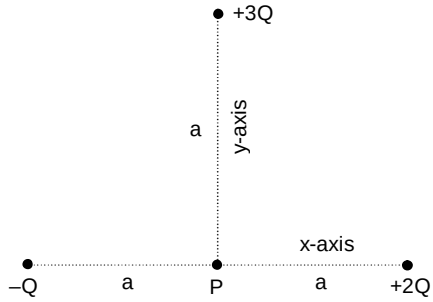
51. A very long wire carrying a current 10A is bent at right angle at O. Find the magnetic induction at a point P lying on the perpendicular line of both the wires at O. The distance of the point P from O is 35cm.



(A) 0.404×10^{-5} T
(B) 0.405×10^{-5} T
(C) 0.408×10^{-5} T
(D) 0.454×10^{-5} T

Case Study (52 – 55)

Three charges +3Q, +2Q and –Q respectively are located at a distance a from the origin as shown in the figure. The point P is located at a distance a from the origin. $\left(k=\frac{1}{4\pi\varepsilon_0}\right)$



52. The magnitude of x and y-components of the electric field $\vec{E}$ at P are

(A) $E_x=2E_y=\frac{k3Q}{a^2}$ (B) $E_x=E_y=\frac{k3Q}{a^2}$
(C) $E_x=\frac{1}{2}E_y=\frac{k3Q}{a^2}$ (D) $E_x=3E_y=\frac{k3Q}{a^2}$

53. The electric potential energy 'U' for the configuration three charges is

(A) $\frac{kQ^2}{a}\left(1-\frac{1}{\sqrt{2}}\right)$ (B) $\frac{kQ^2}{a}\left(\frac{1}{\sqrt{2}}+1\right)$
(C) $\frac{kQ^2}{a}\left(\frac{3}{\sqrt{2}}+1\right)$ (D) $\frac{kQ^2}{a}\left(\frac{3}{\sqrt{2}}-1\right)$

54. A fourth charge +3Q is slowly moved in from infinitely to point P. How much work must be done by an external agent in this process?

(A) $\frac{kQ^2}{a}\left(\frac{3}{\sqrt{2}}-1\right)$ (B) $\frac{kQ^2}{a}\left(\frac{3}{\sqrt{2}}+1\right)$

(C) $\frac{kQ^2}{a}\frac{4}{3}$ (D) $\frac{kQ^2}{a}(12)$

55. Find the energy needed to dissociate the system in its parts

(A) $\frac{kQ^2}{a}\left(\frac{1}{\sqrt{2}}+1\right)$ (B) $\frac{kQ^2}{a}\left(\frac{3}{\sqrt{2}}+1\right)$

(C) $\frac{kQ^2}{a}\left(\frac{3}{\sqrt{2}}-1\right)$ (D) No energy needed