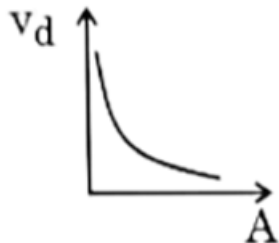
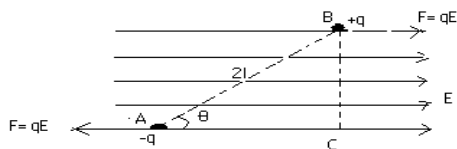




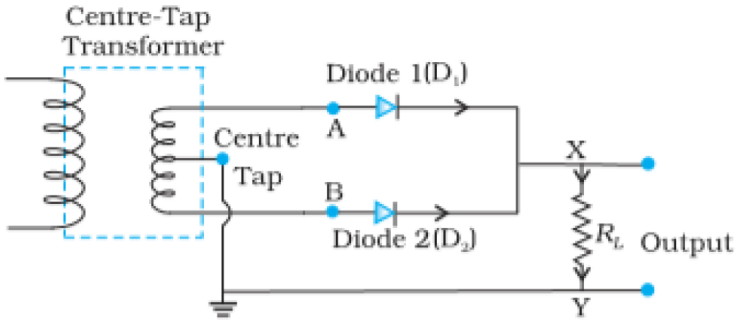
**COMMON PRE-BOARD  
EXAMINATION  
PHYSICS-Code No. 042  
Class-XII-(2025-26)  
ANSWER KEY  
SET 3**



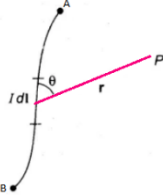
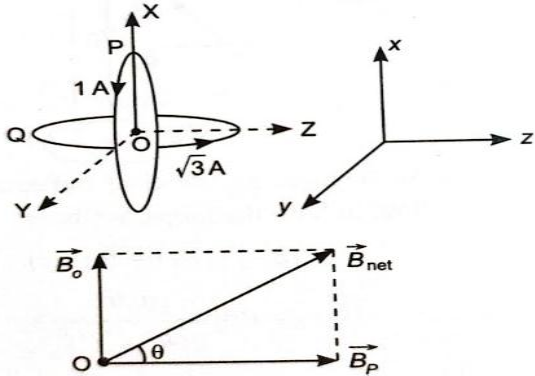
Q.NO.	ANSWERS	MARKS
1	(B) maximum in the forward direction and zero in the backward direction.	1
2	(A) 13.6 eV, -27.2eV $KE = -(\text{Total Energy})$ $KE = -(-13.6 \text{ eV})$ $KE = +13.6 \text{ eV}$ $PE = 2 \times (\text{Total Energy})$ $PE = 2 \times (-13.6 \text{ eV})$ $PE = -27.2 \text{ eV}$	1
3	(D) Capacitive and inductive respectively	1
4	(C) $\epsilon_0 \frac{d\phi_E}{dt}$	1
5	(C) 4f	1
6	(B) $\frac{Q}{\epsilon_0}$	1
7	(A) 	1
8	(A) Only P Only substance P will be attracted when taken near a magnet, as it has positive susceptibility. Substance Q is diamagnetic and will actually be repelled (though very weakly).	1
9	(D) 1  The nuclear density of all atomic nuclei is approximately constant and is independent of the mass number of the nucleus.	1
10	(D) $\frac{1}{200} \text{ s}$  $T = \frac{2\pi}{\omega}$ $T = \frac{2\pi}{100\pi} = \frac{1}{50} \text{ s.}$	1

	$t = \frac{T}{4} = \frac{1/50}{4} = \frac{1}{200} \text{ s}$	
11	(A) 0.02 Wb	1
12	(D) zero Here $\mathbf{v} \times \mathbf{B} = (4\hat{i} + 3\hat{k}) \times (4\hat{i} + 3\hat{k})$ The two vectors $\mathbf{v}$ and $\mathbf{B}$ are parallel, then their cross product is <b>zero</b> : $\mathbf{v} \times \mathbf{B} = \mathbf{0}$ Therefore: $\mathbf{F} = q(\mathbf{v} \times \mathbf{B}) = q \times \mathbf{0} = \mathbf{0}$	1
13	(D) Both Assertion and Reason are false.	1
14	(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.	1
15	(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.	1
16	(B) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion	1
	<b>SECTION-B</b>	
17	(a) The part of the electromagnetic spectrum next to the lowest frequency end of visible light is infrared radiation. (b) X-rays are produced by bombarding a metal target with high-energy electron Use of infrared radiation- Remote Controls, Infrared cameras, relieves muscle tension and pain associated with conditions like arthritis. (any one point) Use of X-rays - Diagnosing injuries, Airport screening: X-ray scanners are used to examine baggage and cargo at ports of entry to identify prohibited or restricted items. (Any one point)	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
18	EMF = 6V Internal resistance = slope of the graph $r = \frac{E - V}{I}$ $r = 6 - 4/1 = 2 \Omega$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$
19	It is a pair of equal and opposite charges separated by a small distance.  Torque = $\tau = F \times \text{perpendicular distance}$ $= qE \times BC = qE \times 2l \sin\theta = PE \sin\theta$	$\frac{1}{2}$ $\frac{1}{2}$ 1

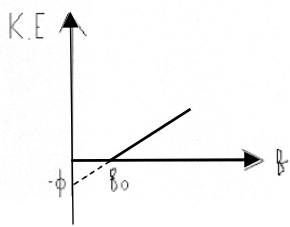
20(I)	<p>Since the magnetic susceptibility <math>\chi = -2.6 \times 10^{-5}</math> is <b>negative</b>, this is a <b>diamagnetic material</b>.</p> <p>Weak repulsion from magnetic field</p> <p>Relative permeability less than 1. It develops a magnetic moment in the opposite direction to the applied field (Any two properties)</p>	<p>1</p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p>
	OR	
20(II)	<p>(A) The magnetic force acting on a charged particle is given by:</p> <p><math>\mathbf{F} = q (\mathbf{v} \times \mathbf{B})</math></p> <p>(B) The force is <b>maximum</b> when <b><math>\sin \theta = 1</math></b>, which occurs when <b><math>\theta = 90^\circ</math></b>  <b>Condition:</b> The charged particle moves <b>perpendicular to the magnetic field (<math>\mathbf{v} \perp \mathbf{B}</math>)</b>  <b>(i) Maximum force:</b> <math>F_{\max} = qvB</math>  The force is <b>minimum</b> (zero) when <b><math>\sin \theta = 0</math></b>, which occurs when <b><math>\theta = 0^\circ</math> or <math>\theta = 180^\circ</math></b>  <b>Condition:</b> The charged particle moves <b>parallel or anti-parallel to the magnetic field (<math>\mathbf{v} \parallel \mathbf{B}</math>)</b>  <b>(ii) Minimum force:</b> <math>F_{\min} = 0</math></p>	<p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>
21(I)	<p><math>\frac{hc}{\lambda} = \phi_o + eV_o</math></p> <p><math>\phi_o = \left( \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{2270 \times 10^{-10} \times 1.6 \times 10^{-19}} - 1.3 \right) \text{eV}</math></p> <p><math>= 4.2 \text{ eV}</math> (also accept the answer in joules)</p> <p>The value of energy of red light is lesser than the work function. So no photo emission.</p>	<p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>
	OR	
21(II)	<p><math>\lambda_1 = \frac{12.3}{\sqrt{V}} \quad \lambda_2 = \frac{12.3}{\sqrt{3V}}</math></p> <p>ie <math>\lambda_2 = \frac{\lambda_1}{\sqrt{3}}</math></p>	<p>1</p> <p>1</p>
	SECTION-C	
22	<div style="border: 1px solid black; padding: 10px; width: fit-content;"> <p>Labelled circuit diagram <span style="float: right;">1½ mark</span></p> <p>Explanation <span style="float: right;">1½ mark</span></p> </div>	

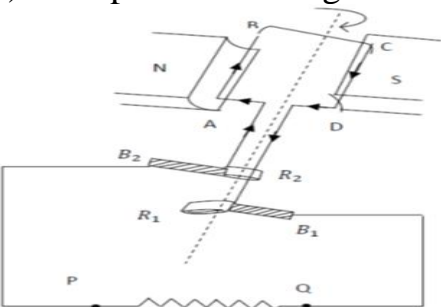
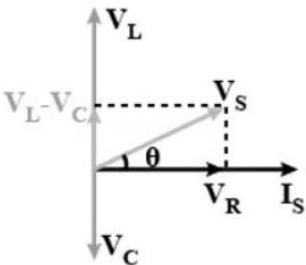
	 <p>Explanation</p> <p>During positive half of the AC input, diode D1 gets forward biased and conducts and diode D2 gets reverse biased.</p> <p>During negative half of the AC input, diode D2 gets forward biased and conducts; and diode D1 gets reverse biased.</p> <p>So, output is obtained during both positive and negative half of the cycle in the same direction.</p>	1 ½
23	<p>(A) Two sources are said to be coherent if the phase difference between them does not change with time.</p> <p>No, as the phase between them does not remain constant with time.</p> <p>(B)</p> $4\beta_2 = 5\beta_1$ $4 \times \frac{\lambda D}{d} = 5 \times \frac{\lambda_{\text{known}} D}{d}$ $\Rightarrow \lambda = \frac{5}{4} \times \lambda_{\text{known}}$ $= \frac{5}{4} \times 520$ $= 650 \text{ nm}$	½ ½ ½ ½ ½
24	<p>Number of atoms= <math>\therefore N = \frac{6.023 \times 10^{23} \times 3}{63} = 2.868 \times 10^{22} \text{ atoms}</math></p> <p>It has 29 protons and (63– 29) 34 neutrons</p> $\Delta m' = 29 \times 1.007825 + 34 \times 1.008665 - 62.9296 = 0.591935 \text{ u}$ <p>Mass defect of all atoms, <math>\Delta m = 0.591935 \times 2.868 \times 10^{22}</math></p> $= 1.69766958 \times 10^{22} \text{ u}$ <p>But 1 u = 931.5 MeV/c<sup>2</sup></p> $\therefore \Delta m = 1.69766958 \times 10^{22} \times 931.5 \text{ MeV/c}^2$ <p>Hence, the binding energy of the nuclei of the coin is given as:</p> $E_b = \Delta mc^2$ $= 1.69766958 \times 10^{22} \times 931.5 \text{ MeV}$ $= 1.581 \times 10^{25} \text{ MeV} = 2.5296 \times 10^{12} \text{ J}$	½ ½ 1 ½ ½



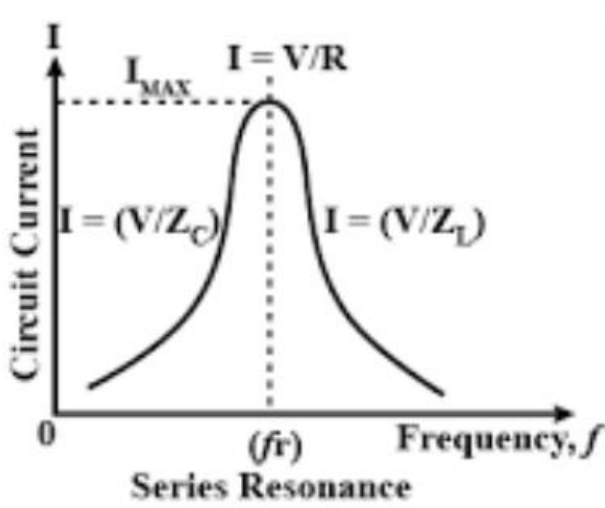
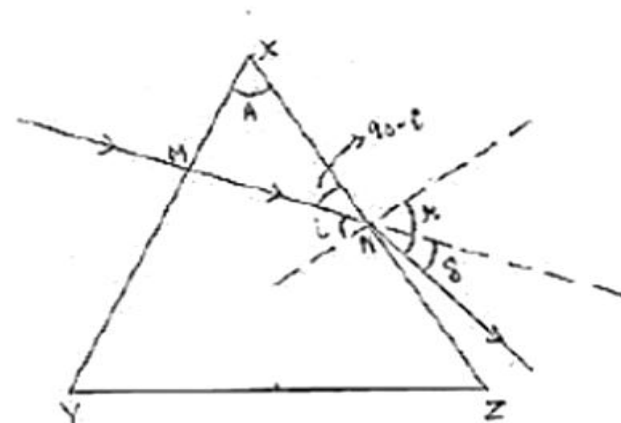
27(I)	<p>(A) Biot-Savart's law states that the magnetic field <math>d\mathbf{B}</math> produced at a point by a small current element is:</p>  <ul style="list-style-type: none"> <li>• <b>Directly proportional</b> to the current (I) and the length of the current element (dl)</li> <li>• <b>Directly proportional</b> to the sine of the angle (<math>\theta</math>) between the current element and the line joining the current element to the point</li> <li>• <b>Inversely proportional</b> to the square of the distance (<math>r^2</math>) between the current element and the point</li> </ul> $d\mathbf{B} = (\mu_0/4\pi) \times (I d\mathbf{l} \times \mathbf{r})/r^3$ <p>(C)</p>  <p><b>At centre O</b></p> <p>Magnetic field due to coil, <math>P = \vec{B}_P = \frac{\mu_0 I}{2R} \hat{k}</math></p> $\vec{B}_P = \frac{4\pi \times 10^{-7} \times 1}{2R} \hat{k}$ <p>Magnetic field due to coil,</p> $Q = \vec{B}_Q = \frac{4\pi \times 10^{-7} \times \sqrt{3}}{2R} \hat{i}$ $\therefore \vec{B}_{\text{net}} = \vec{B}_P + \vec{B}_Q = \frac{4\pi \times 10^{-7}}{2R} [\hat{k} + \sqrt{3} \hat{i}]$ $\therefore  \vec{B}_{\text{net}}  = \frac{4\pi \times 10^{-7}}{2R} \sqrt{1+3}$ $= \frac{4\pi \times 10^{-7}}{R} \text{ T}$	<p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>
	OR	

27(II)	(A) Gauss's law for magnetism states that the net magnetic flux through any closed surface is always zero. $\oint \mathbf{B} \cdot d\mathbf{A} = 0$ Significance- No Magnetic Monopoles. Magnetic Field Lines are Closed Loops. (Any significance)	1
	(B) The net magnetic moment of the combination of the two halves of the bar magnet is zero.	1
	(When the two halves are placed together, their magnetic moments will interact. Since the magnetic moments of the two halves are equal in magnitude but opposite in direction (one is upward and the other is downward), they will cancel each other out.)	1

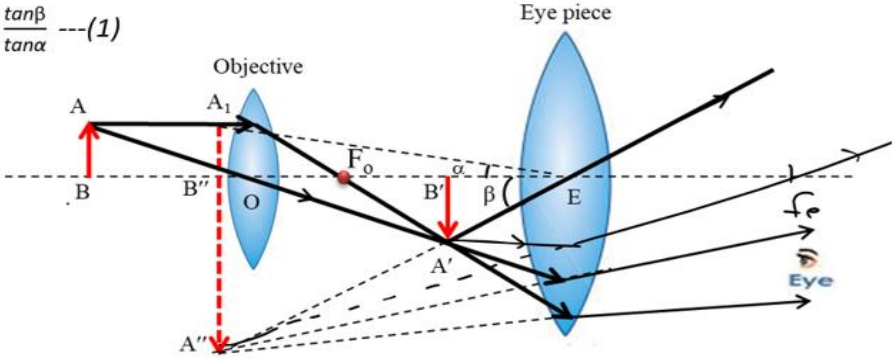
28	Power factor of A = $\frac{R}{\sqrt{R^2 + [X_L]^2}} = \frac{R}{\sqrt{R^2 + [3R]^2}} = \frac{R}{R\sqrt{10}} = \frac{1}{\sqrt{10}}$	1
	Power factor of B = $\frac{R}{\sqrt{R^2 + [X_C - X_L]^2}} = \frac{R}{\sqrt{R^2 + [R - 3R]^2}} = \frac{1}{\sqrt{5}}$	1
	Ratio = $\frac{\sqrt{10}}{\sqrt{5}} = \sqrt{2}$	1
<b>SECTION-D</b>		
29	(I) (B) $E = \frac{V_B}{d} = \frac{0.4}{4 \times 10^{-7}} = 1.0 \times 10^6 \text{ V/m}$	1
	(II) (C) Potential difference across R = $\frac{V}{I} = \frac{3 - 0.4}{20 \times 10^{-3}} = 130 \Omega$	1
	(III) (D) Immobile positive and negative ions.	1
	(IV) (B) When $V = V_0$	1
30	(I) Energy of ordinary light is less than the work function of the Metal Zinc. Energy of ordinary light is greater than the work function of sodium.	1 1
	(II) Increases	1
	(III) 	1
<b>SECTION-E</b>		

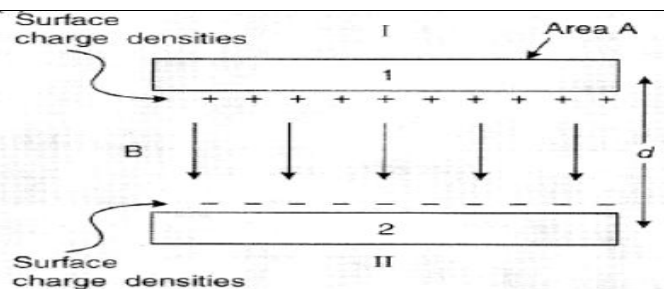
31	<p>(A) Principle: electromagnetic induction</p>  <p><u>Working:</u>          In the fig. the frame ABCD is rotating with an angular velocity <math>\omega</math>. Due to the change in flux an emf is induced and let the direction of current is clockwise. After completing half of the rotation, the direction of current changes with the help of slip rings. This will continue and will get alternating current          Initially the coil area A coincides with the magnetic field B and it is then rotated with an angular velocity '<math>\omega</math>' and makes an angle <math>\theta</math> in 't' sec  <math>\omega = \theta/t</math> or <math>\theta = \omega t</math>          Magnetic flux at that instant <math>= \phi = BA \cos \omega t</math>          Induced emf at that instant <math>= e = \frac{-d\phi}{dt} = \frac{-dB A \cos \omega t}{dt}</math>  <math>e = BAN \omega \sin \omega t</math>          when <math>\omega t = 90</math>, <math>\sin \omega t = 1</math> and <math>e = e_o = \text{max. emf}</math>  <math>e_o = BAN \omega</math>          ie <math>e = e_o \sin \omega t</math></p> <p>(B)  <math>e \frac{\Delta BA}{\Delta t} = 3.2 \times 10^{-5} \text{ V}</math>  <math>P = I^2 R</math>, <math>I = e/R</math>  <math>I = 2 \times 10^{-5} \text{ A}</math>, <math>P = 6.4 \times 10^{-10} \text{ W}</math></p>	<p>Total-5</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>
	OR	
31 (II)	<p>(A)</p>  <p style="text-align: center;"><b>Phasor Diagram</b></p> <p><math>E_o = I_o X_L + I_o X_C + I_o R</math></p>	<p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>



	$E_o^2 = [V_R]^2 + [V_c - V_L]^2$ $E_o^2 = [I_o R]^2 + [I_o X_c - I_o X_L]^2 = I_o^2 R^2 + I_o^2 \{X_c - X_L\}^2$ $E_o^2 = I_o^2 [R^2 + \{X_c - X_L\}^2] \quad \text{or} \quad I_o = \frac{E_o}{\sqrt{R^2 + [X_c - X_L]^2}}$ $\text{ie } \sqrt{R^2 + \{X_c - X_L\}^2} = Z$ <p>(A)</p>  <p>(B)</p> <p>(C)</p> $\text{Impedance } Z = \sqrt{R^2 + [X_c - X_L]^2} = 20 \text{ ohm}$ $\text{Current in circuit, } I_{rms} = \frac{V_{rms}}{R} = 200/20 = 10 \text{ A}$ $\text{Power factor } \cos\phi = \frac{R}{Z} = \frac{R}{R} = 1$ $\text{Av. power } P = I_{rms} \times E_{rms} \times \cos\phi = 200 \times 10 = 2000 \text{ W}$	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>
32	<p>(A)</p> <p>(i)</p> 	<p>Diag-1</p>

	<p>At the face XZ :-</p> $\mu \sin i = 1 \times \sin r \quad \text{---- (1)}$ $r = i + \delta \quad \text{[ from diagram] } \quad \text{---- (2)}$ <p>In <math>\triangle XMN</math>; <math>A + (90 - i) + 90 = 180</math></p> $\Rightarrow A = i \quad \text{---- (3)}$ <p>Putting eq. (3) &amp; (2) in eq. (1)</p> $\mu \sin A = \sin (A + \delta)$ $\mu = \frac{\sin (A + \delta)}{\sin A}$	1
		$\frac{1}{2}$
		$\frac{1}{2}$
(B)		
(ii.)		$\frac{1}{2}$
(1)	$\mu = \frac{\sin \left( \frac{A + \delta_m}{2} \right)}{\sin \frac{A}{2}}$ $\sqrt{2} = \frac{\sin \left( \frac{60 + \delta_m}{2} \right)}{\sin 30^\circ}$ $\Rightarrow \sin \left( \frac{60 + \delta_m}{2} \right) = \frac{1}{\sqrt{2}} = \sin 45^\circ$ $\frac{60 + \delta_m}{2} = 45^\circ \Rightarrow \delta_m = 30^\circ$	$\frac{1}{2}$
(2)	$i = \frac{A + \delta_m}{2}$ $\Rightarrow i = \frac{60 + 30}{2}$ $i = 45^\circ$	$\frac{1}{2}$
	OR	

32	<p>(A)</p> $m = \frac{\beta}{\alpha} \approx \frac{\tan \beta}{\tan \alpha} \text{ ---(1)}$  <p>in <math>\triangle A'B'E</math>, <math>\tan \beta = \frac{A'B''}{B'E}</math> and in <math>\triangle A_1B'E</math> <math>\tan \alpha = \frac{A_1B''}{B'E} = \frac{AB}{B'E}</math></p> $m = \frac{A'B''}{B'E} \times \frac{B'E}{AB} = \frac{A'B''}{AB} = \frac{A'B''}{A'B'} \times \frac{A'B'}{AB}$ $m = m_e \times m_o$ $m_e = \left(1 + \frac{d}{f_e}\right) \quad \text{and} \quad m_o = \frac{A'B'}{AB} = \frac{v_o}{-u_o}$ $m = \frac{v_o}{-u_o} \left(1 + \frac{d}{f_e}\right)$ <p>(B) <math>m = f_o/f_e</math></p> <p><math>M = 100/5 = 20.</math></p>	<p>Diag-1</p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>
33	<p>An equipotential surface is a surface where the electric potential is the same at every point. Two important properties are that the electric field is always perpendicular to the surface, and no work is done by the electric field when a charge moves along the surface.</p> <p>(i) Magnitude of electric field,</p> $E = \frac{dV}{dr} = \frac{10V}{1 \times 10^{-2}m} = 10^3 Vm^{-1}$ <p>The direction of electric field is from Y to Z.</p> <p>(ii) As surface A is an equipotential surface, the potential difference between X and Y is zero.</p> <p>Work done = <math>q \times \Delta V = q \times 0 = 0</math></p>	<p>1</p> <p>1</p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p>
	OR	



Electric field between the plates of capacitor

$$E = \frac{\sigma}{\epsilon_0} = \frac{Q}{A\epsilon_0}$$

$$\therefore V = Ed = \frac{Qd}{A\epsilon_0}$$

$$\text{Capacitance, } C = \frac{Q}{V} = \frac{\epsilon_0 A}{d}$$

Energy is stored as electrostatic potential energy in the electric field that builds up between the plates of a parallel plate capacitor as it is being charged.

(B)

When the two charged spherical conductors are connected by a conducting wire they acquire the same potential.

$$\text{i.e. } \frac{Kq_1}{R_1} = \frac{Kq_2}{R_2} \Rightarrow \frac{q_1}{q_2} = \frac{R_1}{R_2}$$

Hence, ratio of surface charge densities,

$$\frac{\sigma_1}{\sigma_2} = \frac{q_1 / 4\pi R_1^2}{q_2 / 4\pi R_2^2}$$

$$\frac{\sigma_1}{\sigma_2} = \frac{q_1 R_2^2}{q_2 R_1^2}$$

$$\frac{\sigma_1}{\sigma_2} = \frac{R_1}{R_2} \times \frac{R_2^2}{R_1^2} = \frac{R_2}{R_1}$$

Diag 1/2

1/2

1/2

1/2 + 1/2

1

1/2

1/2

1/2