MC SQUARE EDUCATION PVT.LTD

PAPER-06

DATE-06/04/2017

NEET 2017 FINAL TEST SERIES

TOTAL MARK: 720

SR.NO	STUDENT NAME	CHEMISTRY		PHYSICS		BIOLOGY		TOTAL MARKS
1	ADWAIT GOKHALE	24	11	25	3	72	9	461
2	RUTUJA VETHEKAR	5	1	9	6	54	32	233
3	JOSHNA CHOUDHARI	8	4	13	8	57	24	276
4	VARUN BELORIA							
5	MAMTA RAJAWAT							
6	AKSHATA SHINDE							
7	RIDDHI RAUT	4	13	20	12	37	27	192
8	ARUNDHATI GOTEKAR	5	6	14	9	47	33	216
9	KOMAL SABBANI	11	3	16	15	47	28	250
10	SHREYA PAREKH	3	2	10	9	46	19	206
11	POOJA UPASE	9	4	11	11	48	24	233
12	ADITYA SASANE	3	3	16	4	68	12	341
13	RUTUJA SASANE	4	3	7	11	57	19	239
14	VIVEK RATHORE							
15	SONAM SINGH							
16	WAJID RAY							
17	RUSHIKESH GHUTUGADE	2	5	7	5	30	26	120
18	SUMIT BORA	15	9	11	1	73	9	377
19	ROHAN PAWAR							
20	PAWAN KHAMKAR	0	0	15	11	63	22	279
21	SUMIT KAMBLE	0	0	7	13	52	36	187
22	SHIVANI SINGH	1	0	4	6	49	20	190
23	VAIBHAV INGOLE							
24	RENUKA KATTIMANI							
25	HARSHA SHINDE	3	4	17	12	50	35	229
26	PAYAL MANE	2	1	8	3	44	19	193
27	AMRUTA MULE	3	2	11	10	40	33	171
28	SHRUTI BARVE	24	10	16	0	62	16	382
29	SIMRAN GURUBAXANI	21	11	2	2	64	19	316
30	SAYALI JADHAV	17	7	13	1	68	16	368
31	AYUSHEE AGARWAL	2	8	8	9	50	28	195
32	ANKITA NIMMALWAR	2	1	9	5	66	20	282
33	SNEHA LOKHANDE	3	3	6	18	50	22	193
34	NEHA CHAVAN	0	0	4	1	36	17	142
35	HIMALI CHOUDHARI	0	0	4	1	17	40	43
36	SUMIT SAWANT	21	6	19	22	47	33	287
37	MANALI UBHEDAL	12	5	19	15	57	18	314
38	ANAM PANSARE	3	14	14	15	46	38	185
39	PURVA SHEDGE	15	9	19	17	58	24	318
40	ANJALI SOLANKE							
41	AISHWARIYA NALANAGLU	2	0	6	6	60	16	250
42	AKASHA SANER							
43	SHUBHAM MANE							
44	AMRUTA BHOSALE	2	1	9	5	42	19	187
45	MANASI KASHID	2	2	9	5	33	21	148
46	HARSHADA JADHAV	1	1	7	5	54	31	211
47	RUSHIKESH AWATE	5	18	10	23	35	35	124
48	DIPALI GAIKWAD	3	0	10	7	33	31	146
49	PRITI BIRADAR	6	4	8	7	41	19	190
50	SHEFALI RATHOD	5	3	9	9	54	24	236
51	AISHWARYA BORHADE	0	1	6	5	41	19	163
52	NADEEM SHIKALGAR	6	3	11	14	51	15	240
53	RASHMI GAIKWAD	13	29	10	35	25	49	79
54	YASH RAGHUWANSHI							
55	AVINASH CHENDAKE							
56	RUTUJA GHUTUGADE	2	3	9	22	40	40	139
57	NIRAJ PATIL							
58	KETAN MORE							
59	MADHAVI KATRE	7	15	6	18	52	29	198
60	KETAKI SHINDE	0	1	9	16	41	26	157
61	SONAM BENDRE	0	1	8	12	39	23	152
62	AKASH BAGADE							
63	RAHUL DESHOTWOD	2	4	10	13	27	34	105
64	ASHWINI PATEL	1	1	11	3	47	22	210
65	KANCHAN JAISWAL	2	6	10	12	50	24	206
66	SAMRAGGI HATI							
67	SONAL KAMBLE	1	1	6	8	38	25	146
68	PRANALI GAIKWAD	3	1	3	6	48	32	177
69	VIJAYA DHUMAL	20	13	12	0	68	11	376
70	DIPTI GURAV	16	13	14	4	65	13	350
71	AKASH BHISE							
72	SHABNAM BANU	2	0	8	3	59	16	257
73	AMRITESH							
74	DARSHANA V H							
75	AISHWARYA PATIL							
76								
77								

NEET
TEST-6-SOLUTIONS

STANDARD ANSWER KEY											
Q	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
A	C	D	C	B	A	B	D	B	C	C	D
Q	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
A	C	B	D	B	B	B	D	D	A	B	C
Q	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
A	B	C	A	C	A	B	A	A	B	C	A
Q	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**
A	D	A	B	B	D	A	B	D	B	A	A
Q	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**
A	D	D	D	B	D	B	C	C	D	B	C
Q	**56**	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**	**65**	**66**
A	D	C	D	A	D	C	A	D	D	C	D
Q	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**
A	C	B	C	A	A	B	C	C	B	A	B
Q	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**
A	A	D	A	D	A	C	C	C	D	D	C
Q	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**
A	C	D	B	C	C	C	D	A	D	A	D
Q	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**
A	C	B	D	D	D	A	D	D	A	D	D
Q	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**	**121**
A	C	D	C	C	B	B	D	A	C	A	B
Q	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**
A	C	B	C	D	A	C	B	A	A	D	A
Q	**133**	**134**	**135**	**136**	**137**	**138**	**139**	**140**	**141**	**142**	**143**
A	D	C	A	A	D	A	C	D	B	D	D
Q	**144**	**145**	**146**	**147**	**148**	**149**	**150**	**151**	**152**	**153**	**154**
A	C	C	C	B	B	D	A	C	C	C	A
Q	**155**	**156**	**157**	**158**	**159**	**160**	**161**	**162**	**163**	**164**	**165**
A	A	A	D	D	B	A	A	B	B	D	A
Q	**166**	**167**	**168**	**169**	**170**	**171**	**172**	**173**	**174**	**175**	**176**
A	A	B	C	D	D	D	A	D	C	B	C
Q	**177**	**178**	**179**	**180**							
A	C	A	C	C							

(1) **(C).** Both of the solutions we are mixing contain Cl^-, so we need to figure out the total number of moles of Cl^- in the final solution.

For the HCl solution: $0.1\ L \times \left(\frac{1\ mol\ Cl^-}{L\ sol}\right)$

$= 0.1\ mol\ Cl^-$

For the NaCl solution: $0.1\ L \times \left(\frac{5\ mol\ Cl^-}{L\ sol}\right)$

$= 0.5\ mol\ Cl^-$

The total no. of moles of Cl^- is 0.6, so the molarity of the final solution is $\frac{0.6\ mol}{0.2\ L\ sol} = 3M$.

(2) **(D).** In order to solve this question, we use Raoult's law:

$P_{solution} = \chi_{solvent}\ P°_{solvent}$

We are given the vapour pressure of pure ethanol, but we need to calculate the mole fraction of ethanol in this solution.

100.0 mL ethanol

$\times \left(\frac{0.787g\ ethanol}{1\ mL\ ethanol}\right) \times \left(\frac{1\ mol\ ethanol}{46.07g\ ethanol}\right)$

= 1.71 mol ethanol

$50.00\ g\ retinol \times \left(\frac{1\ mol\ retinol}{286.5g\ retinol}\right) = 0.17\ mol\ retinol$

Therefore, the mole fraction $\chi = \frac{1.71}{1.71+0.17} = 0.910.$

The observed vapour pressure

$= (0.910) \times (44.4\ torr) = 40.4\ torr.$

(3) **(C).** To solve this question, we must determine the order of the reaction with respect to different components. Let's first look at experiments A and B. In experiment B, we are keeping the initial concentration of O_2 the same, but we are doubling the concentration of NO, from 0.050 M to 0.100 M. The result is a fourfold increase (2^2) in the initial reaction rate. Therefore, the reaction order with respect to NO is two. Looking at experiments B and C, we see that increasing the initial concentration of O_2 by a factor of four also results in a fourfold increase (4^1) in the reaction rate. Therefore, the order of the reaction with respect to O_2 is one. The reaction rate is given by:

$Rate = k\ [O_2]\ [NO]^2$

and the overall order of the reaction is three.

(4) **(B).** E_a is constant with respect to temperature. Remember that increasing the temperature increases the percentage of reactant molecules with kinetic energy > E_a, but does not change E_a itself. Choice (A) is incorrect since this statement only holds true for first-order reactions, but not for zero-order (for which the rate does not depend at all on the concentration of reactants) or second-order (for which the rate depends on the square of the concentration of reactants). Choice (C) is incorrect since k will vary according to temperature; this is how we calculate E_a using the Arrhenius equation. Choice (D) is incorrect since reaction rate depends only on E_a, not on $\Delta G°$. Remember the difference between kinetics and thermodynamics.

(5) **(A).** The concentration of ^{20}Na decreased by a factor of eight over the course of 0.30 seconds. A factor of eight (which is 2^3) corresponds to three half-lives.

Time	Half-Lives	Amount present (m mol)
0	0	2.40
0.10	1	1.20
0.20	2	0.60
0.30	3	0.30

(6) **(B).** When Q = K, the second term in the Nernst equation is equal to $E°_{cell}$ and therefore $E_{cell} = 0$. Remember that batteries don't work at equilibrium. They require a gradient and will cease to function once equilibrium is reached. The other statements are false.

(7) **(D).** The rate law is found from the slow step. Since the reactants are also the reagents found in the overall reaction, the rate = k $[H_2O_2]$ $[I^-]$ and is thus a second-order reaction.

(8) **(B).** The rate law does not contain any term for $[H^+]$, and thus the overall rate is unaffected by the pH, even though it is found in the overall reaction.

(9) **(C).** Colligative properties are properties of solutions that change with respect only to the number of ions or solute molecules in solution, not their identity. Some examples are boiling point elevation, freezing point depression, osmotic pressure, and vapor pressure.

(10) **(C).** $\frac{23.76-23.392}{23.76} = \frac{w}{342x5.65}$; w = 30g

(11) **(D).** Two half-lives occur in 14 minutes, thus $(1/2)^2$ or 1/4 of the starting material remains, or 200 torr. Also, 600 torr of N_2O_5 have reacted. For each two moles of $2N_2O_5$ reacting, seven moles of N_2 and O_2 are produced or $\left(\frac{600}{2}\right) \times 7 = 2{,}100$ torr. Because the partial pressures are additive, the total pressure would be 2,100 + 200 = 2,300 torr.

(12) **(C).** The colligative property of osmotic pressure is influenced by the number of ions or solute molecules in solution. Because each mole of $Al_2(SO_4)_3$ dissociates into five moles of ions, it has the equivalent of 1.25 M ions and thus would have the highest osmotic pressure.

(13) (B). Using the equation M = n/L, you can calculate the number of aluminum ions in the starting and final solutions. Alternatively, you can do the calculation in your head by noticing that the solution is diluted by a factor of 3, so an initial concentration of

$0.3\,M \times 2 = 0.6\,M$ would be $\frac{0.6\,M}{3} = 0.2\,M$ in the final solution.

(14) (D). This defect arises when a compound has excess metal ion. If a negative ion is absent from its lattice site leaving a hole occupied by electron. The holes occupied by electrons are called F- centres. Greater the number of F-centres greater is the intensity of colour.

(15) (B). Slowest step of mechanism decides the rate expression. Thus rate = k $[NO_2]$ $[F_2]$.

(16) (B). Weight of Ag required = V × d

$= 80 \times 5 \times 10^{-3} \times 1.05 = 0.42$

$\because \quad W = \frac{E\,i\,t}{96500}$

$\therefore \quad 0.42 = \frac{108 \times 3 \times t}{96500} \Rightarrow t = 125\text{ sec}.$

(17) (B). $E^\circ_{cell} = 0.76 - 0.41 = 0.35$ V.

(18) (D). The standard oxidation potential is 1.14 V – (–0.76 V).

(19) (D). If acid is 4.5% ionized then $\alpha = 0.45$.

ΔT_f = molality × K_f = 0.1 × 1.86 = 0.186

$\Delta T_{exp} = \Delta T_N (1 + \alpha) = 0.186\,(1 + 0.45) = 0.269°C$

(20) (A).

	A →	B +	C +	D
Initial	a	0	0	0
After time t	a – x	x	x	x

It is given that $a = P_0$ ... (i)

$a - x + x + x + x = P$

or $a + 2x = P$ ... (ii)

From (i), $P_0 + 2x = P$ or $x = \frac{P - P_0}{2}$

From rate equation,

$$k = \frac{2.303}{t}\log\frac{a}{a - x}$$

$$= \frac{2.303}{t}\log\frac{P_0}{P_0 - \left(\frac{P - P_0}{2}\right)} = \frac{2.303}{t}\log\frac{2P_0}{3P_0 - P}$$

(21) (B). Specific conductance = Cell constant × conductance

⇒ Cell constant = Resistance × sp. conductance

$= 55 \times 0.0112 = 0.616\text{ cm}^{-1}$.

(22) (C). In tetragonal system, $a = b \neq c$, $\alpha = \beta = \gamma = 90°$

(23) (B). When a solute is present in very minute amounts (trace quantities), the concentration is expressed in ppm.

$$\text{ppm of A} = \frac{\text{mass of component A}}{\text{total mass of solution}} \times 10^6$$

$$= \frac{0.025}{10^3} \times 10^6 = 25\text{ ppm}.$$

(24) (C).

(25) (A). For a first order reaction, rate = k [A], when concentration of A is doubled, the rate becomes double.

(26) (C). $\frac{W_{Ca}}{E_{Ca}} = \frac{W_{Al}}{E_{Al}} \Rightarrow \frac{40}{20} = \frac{W_{Al}}{9} \Rightarrow W_{Al} = 18$ kg

As current efficiency is 50% so, $W_{Al} = 9$ kg

(27) (A). In Schottky defect, some of the lattice points are unoccupied (vacancies or holes). The number of missing cations and anions is the same, thus crystal remains neutral.

(28) (B). Since, the adsorption process is exothermic, the physical adsorption occurs readily at low temperature and decreases with increase in temperature (Le-Chatelier's principle).

(29) (A) A half cell is prepared by dipping Ag electrode in a solution containing KCl and some AgCl. Half cell is is used as cathode during the cell reaction. Quantity of AgCl will decrease.

(30) (A). The number of tetrahedral voids formed in hcp crystal lattice is twice the number of anions of the element B and only (2/3) of the holes are occupied by the cations of the element A. Therefore, the ratio of the numbers of atoms of A to the number of atoms of B is

$2 \times \frac{2}{3} : 1$ i.e., $\frac{4}{3} : 1$ or 4 : 3.

Hence the formula of compound of A_xB_y is A_4B_3 and x = 4 and y = 3.

(31) (B). The major binding force of diamond is covalent bond

(32) (C). Due to Frenkel defect the density of ionic solid remains same.

(33) (A).

(34) (D). Molar mass of benzene C_6H_6

$= (6 \times 12 + 6 \times 1) \times 10^{-3}\text{ kg mol}^{-1}$

$p_1° = 640$ mm Hg, p = 600 mm Hg

$W_1 = 39 \times 10^{-3}$ kg, $W_2 = 2.175 \times 10^{-3}$ kg

$M_1 = 78 \times 10^{-3}\text{ kg mol}^{-1}$, M_2 = ?

$$\frac{p_1^\circ - p}{p_1^\circ} = \frac{W_2 M_1}{M_2 W_1}$$

$$\frac{640\text{mm} - 600\text{mm}}{640\text{mm}} = \frac{2.175 \times 10^{-3}\text{kg} \times 78 \times 10^{-3}\text{kg mol}^{-1}}{39 \times 10^{-3}\text{kg} \times M_2}$$

$$M_2 = \frac{2.175 \times 10^{-3}\text{kg} \times 78 \times 10^{-3}\text{kg mol}^{-1} \times 640\text{mm}}{39 \times 10^{-3}\text{kg} \times 40\text{mm}}$$

$= 69.6 \times 10^{-3}\text{ kg mol}^{-1}$

Molecular mass = 69.6

Molar mass = 69.6 g mol^{-1}.

(35) (A).

(36) **(B).** $\wedge = \frac{1000k}{C}$ or $k = \frac{\wedge \cdot C}{1000}$

$\wedge = 407.2\ \Omega^{-1}\ cm^2\ mol^{-1}$, $C = 0.02\ mol\ L^{-1}$.

$$k = \frac{407.2\ (\Omega^{-1} cm^2 mol^{-1}) \times 0.02\ (mol\ L^{-1})}{1000\ (cm^3 L^{-1})}$$

$= 8.144 \times 10^{-3}\ \Omega^{-1}\ cm^{-1}$.

Conductivity of the solution is $8.144 \times 10^{-3}\ \Omega^{-1}\ cm^{-1}$.

(37) **(B).** The rate law for the reaction is of the form,

rate = k $[A]^x [B]^y$

rate = 6×10^{-4} M/s, k = $2 \times 10^{-3}\ s^{-1}$, [A] = [B] = 0.3M.

Hence, $6 \times 10^{-4}\ (M/s) = 2 \times 10^{-3}\ (s^{-1}) \times (0.3M)^x (0.3M)^y$

or $\frac{6 \times 10^{-4} (M/s)}{2 \times 10^{-3}\ (s^{-1})} = (0.3)^{x+y} (M^{x+y})$

or $0.3\ (M) = (0.3)^{x+y}\ (M)^{x+y}$

It follows that x + y = 1.

The overall order of the reaction is 1.

(38) **(D).** First we calculate the rate constant of the reaction

$$k = \frac{2.303}{t} \log_{10} \frac{[A]_0}{[A]_t}$$

$[A]_0 = 100$, $[A]_t = 100 - 60 = 40$, t = 45 min.

$$\text{Hence, } k = \frac{2.303}{45\ (min)} \log_{10} \frac{100}{40} = \frac{2.303}{45\ (min)} \log_{10} 2.5$$

$$= \frac{2.303}{45\ (min)} \times 0.3979 = 0.0204\ min^{-1}$$

$$t_{1/2} = \frac{0.693}{k} = \frac{0.693}{0.0204\ (min^{-1})} = 34\ min$$

Half life of reaction is 34 min.

(39) **(A).** For bcc unit cell,

Distance (in pm) between centres of two closest sodirum atom in bcc lattice,

$$d = \frac{\sqrt{3}}{2} a = \frac{\sqrt{3} \times 430}{2} = 372\ pm$$

(40) **(B).** Enthalpy of chemisorption is in the range of 40 to 400 kJ mol^{-1}.

(41) **(D).** Depression in freezing point is a colligative property, i.e., depends upon the number of particles. Higher the number of particles, lower is the freezing point.

Urea $\rightarrow$ No ion

$BaCl_2 \rightarrow Ba^{2+} + 2Cl^-$

0.1   0.1   2 × 0.1

$NaNO_3 \rightarrow Na^+ + NO_3^-$

0.2

$Na_2SO_4 \rightarrow 2Na^+ + SO_4^{2-}$

2 × 0.2   0.2

= 0.4

$\therefore$ Freezing point is lowest for 0.2 M Na_2SO_4 solution.

(42) **(B).** During the electrolysis of an aqueous solution of copper sulphate using copper electrodes, both Cu^{2+} and H^+ ions move towards cathode, but the discharge potential of Cu^{2+} ions is lower than that of H^+ ions, therefore Cu^{2+} ions are discharged in preference to H^+ ions and copper is deposited on the cathode.

$Cu^{2+}(aq) + 2e^- \rightarrow Cu\ (s)$ (at cathode)

(43) **(A).** In a close packed structure (hcp or ccp)

(i) Number of octahedral voids = Number of particles present in the close packing

(ii) Number of tetrahedral voids = 2 × Number of octahedral voids.

(44) **(A).** The examples of colloidal systems are sols (solids in liquids), gels (liquids in solids), emulsions (liquids in liquids) and foams (gases in liquids) whereas aerosols are the colloidal system in which dispersed phase is liquid and dispersion medium is gas.

(45) **(D).** $E^\circ_{cell} = E^\circ_{Cu^{2+}/Cu} - E^\circ_{Zn^{2+}/Cu}$

$= +0.34 - (-0.76)\ V = 1.1\ V$

Further $E_{cell} = E^\circ_{cell} - \frac{0.059}{n} \log \frac{[products]}{[reactants]}$

For the reaction,

$CuSO_4 + Zn \rightarrow ZnSO_4 + Cu$

or $Cu^{2+} + Zn \rightarrow Zn^{2+} + Cu$

$$E_{cell} = E^\circ_{cell} - \frac{0.059}{2} \log \frac{[Zn^{2+}]}{[Cu^{2+}]}$$

$$= 1.1 - \frac{0.059}{2} \log \frac{0.1}{0.01} = 1.1 - \frac{0.059}{2} \log 10$$

$= 1.1 - 0.0295 \times 1 = 1.07\ V$ [log 10 = 1]

(46) **(D).** Resistivity can be found by RA/ℓ.

To determine the area, you can approximate π to be 3. This introduces an error of less than 5%, which is accurate enough for estimations. Also, don't forget to convert all units to meters before you calculate the area.

(47) **(D).** This question requires you to know several important physical constants. The first is the charge on the electron, 1.6×10^{-19} C. The second is the size of the hydrogen atom, 1 angstrom or 10^{-10} m. You also must have an idea of the value of $\frac{1}{4\pi\varepsilon_0}$.

For most estimating purposes, this combined constant is about $9 \times 10^9\ Nm^2/C^2$. Combine all of this with Coulomb's law and remember to use half the size of the hydrogen atom for the distance between the electron and proton. This yields 8×10^{-8} N as a result.

(48) **(B).** Since the two dielectrics fill equal volumes in the capacitor, you may treat the dielectric constant as an average of both: $K_{avg} = \frac{K_1 + K_2}{2}$.

Therefore, $C = (K_1 + K_2) \frac{\varepsilon_0 A}{2d}$

(49) **(D).** Based on the definition of E as – (dV/dx), you can determine the strength and direction of the field. All you have to do is remember that the derivative is nothing more than the slope. The spacing of the equipotentials is nice and even, and they step up by 6V each line. This makes a graph of V versus x a straight line whose slope is 6 V/cm. Because the high potential is on the right and low is on the left, the field must point to the left. Students often forget that the derivative of a linear function is just the slope, but there is no reason to get tripped up by a simple problem like this one.

(50) **(B).** The capacitance, C, of a parallel plate capacitor with plates of area, A, a distance, d, apart is given by

$$C = \frac{\varepsilon_0 A}{d}$$

The form of the equation with d in the denominator tells us that if the distance doubles, the capacitance is half as much. So the capacitor with double the separation has half the capacitance.

(51) **(C).** The brightness of the bulb will be determined by the electrical power the bulb uses. The power is the current passing through the bulb multiplied by the potential difference across the bulb. In a series circuit, the current is the same everywhere in the circuit. The potential difference across each bulb will be half the potential difference across the battery because the bulbs both have the same resistance. Thus, the bulbs will be equally bright because they have the same current passing through them and the same potential difference across them.

(52) **(C).** The capacitance of a parallel-plate capacitor is proportional to the area of its plates and inversely proportional to the plate separation. The expression for the capacitance of a parallel-plate capacitor is

$C = \frac{\varepsilon_0 A}{d}$, where d is the distance between the plates, A is the area of the capacitor's plate, and ε_0 is the vacuum permittivity constant and is equal to 8.85 $\times 10^{-12}$ $C^2/N \cdot m^2$. Capacitance is directly proportional to the area of the plates. If the plate radius is doubled, then the area (πr^2) must quadruple. Thus, the capacitance quadruples.

(53) **(D).** The power dissipated in a resistor is dependent upon the amount of resistance, the current, and the voltage drop across the resistor. This power relation can be expressed in the following ways:

$$P = IV = I^2R = V^2/R$$

For this problem, we'll use the following power expression: $P = V^2/R$

For the simple circuit given (one resistor and one battery), this gives the power dissipated by a resistor R in a circuit with a battery with voltage V (all of the emf provided by the battery must be depleted in the sole resistor). Now, we will replace this battery with a 3V battery.

$$R_{new} = \frac{(3V)^2}{R} = \frac{9V^2}{R}$$

Since, $P = V^2/R$, it follow that

$$R_{new} = 9\left(\frac{V^2}{R}\right) = 9P$$

Therefore, the power dissipated by the resistor in the 3V circuit would increase by a factor of 9.

(54) **(B).** To determine the current in the circuit, we'll need to examine the total voltage drops as we travel around the circuit following the current. Moving around the circuit in a clockwise direction starting from the upper left corner of the circuit, we'll see a potential increase of $+\varepsilon_1$, a drop in potential for $-IR_1$ across the first resistor, a potential drop across the second emf source of $-\varepsilon_2$ and another drop in potential across the second resistor of $-IR_2$. The total drop in potential will be

$$\Sigma\Delta V = +\varepsilon_1 - IR_1 - \varepsilon_2 - IR_2 = 0$$

Solving this equation for the current I, we get the following expression: $I = \frac{\varepsilon_1 - \varepsilon_2}{R_1 + R_2}$

Substituting our emf and resistance values, we find that the current in the circuit will be

$$I = \frac{\varepsilon_1 - \varepsilon_2}{R_1 + R_2} = \frac{10V - 6V}{6\Omega + 2\Omega} = \frac{4}{8A} = 0.5A$$

(55) **(C).** In the previous problem, we determined that the current in the circuit was 0.5 A. We can use this value to determine the power dissipated by each resistor by using $P = I^2 R$

Therefore, the power dissipated by each resistor can be calculated as follows:

$P_1 = I^2R_1 = (0.5\text{ A})^2 (2\Omega) = 0.5\text{ W}$ and

$P_2 = I^2R_2 = (0.5\text{ A})^2 (6\Omega) = 1.5\text{ W}$

(56) **(D).** We'll use Coulomb's law for electrostatic force between two point charges to solve this problem:

$$F_{13} = \frac{kq_1q_3}{r^2}$$

where q_1 is the charge at position 1, q_3 is the charge at position 3, and r is the distance between the two charges.

The magnitude of the distance between the charges 1 and 3 can be determined by applying the Pythagorean theorem, $r = \sqrt{(2a)^2 + a^2} = \sqrt{5a^2}$

Inserting all of our known values, we can determine the Coulomb force between the charges 1 and 3.

$$F_{13} = \frac{kq_1q_3}{r^2} = \frac{k\,(+q)\,(+q)}{(\sqrt{5a^2})^2} = \frac{kq^2}{5a^2}$$

(57) **(C).** Resistances can be measured using this device, known as a Wheatstone bridge. A resistor of unknown resistance is placed at position R_x, R_1 has an adjustable resistance, which is changed until the current across the bridge is zero and the galvanometer reads zero.
If the current passing through R_1 is I_1 and the current passing through R_2 is I_2, then we can say the following concerning the potential across each resistor in the circuit: $I_1R_1 = I_2R_2$ and $I_1R_3 = I_2R_x$
Therefore, the following ratios apply to this circuit:

$$\frac{I_1}{I_2} = \frac{R_2}{R_1} = \frac{R_x}{R_3}$$

Solving for R_x, we get $R_x = \dfrac{R_2R_3}{R_1}$

Substituting our values for R_1, R_2, and R_3, we can determine that

$$R_x = \frac{R_2R_3}{R_1} = \frac{(5\Omega)\,(6\Omega)}{(10\Omega)} = 3\Omega$$

(58) **(D).** The Coulomb force can determine the electrostatic force between two charges:

$$F_{12} = \frac{kq_1q_2}{r^2}$$

where q_1 and q_2 are the charges that are separated by a distance r.
The test charge +q experiences a force as a result of the +3q charge and the +2q charge. These forces are determined as follows:

$$F_{13} = \frac{k\,(3q)\,(q)}{R^2} = \frac{3kq^2}{R^2}$$

This repulsive force is exerted towards the right.

$$F_{12} = \frac{k\,(2q)\,(q)}{R^2} = \frac{2kq^2}{R^2}$$

This repulsive force is exerted towards the left.
The net electrostatic force acting upon the test charge +q will be $F_{net} = F_{13} - F_{12} = \dfrac{3kq^2}{R^2} - \dfrac{2kq^2}{R^2} = \dfrac{kq^2}{R^2}$

Because the net force is positive, this force will be directed towards the right.

(59) **(A).** The object in question has two forces working upon it: its weight due to the force of gravity pulling it downward and the electrical force pushing it upwards. Since the object isn't moving, the forces are in balance and must equal each other.

$F_g = F_E$

Substituting the proper expressions, we find that

mg = qE

The mass of the object can be found by solving for m:

m = qE/g

Substituting in our values for q, E, and g, we can calculate the mass of the object:

$$m = \frac{qE}{g} = \frac{(10C)\,(500N/C)}{10\ m/s^2} = 500\ kg$$

(60) **(D).** We will apply Gauss's law to this situation.

$$\int E \cdot d\vec{A} = \frac{q_{in}}{\varepsilon_0}$$

Since we are integrating over a spherical surface with a radius of r, the area will be $4\pi r^2$.
Applying this to Gauss's law, we get

$$E\,(4\pi r^2) = \frac{q_{in}}{\varepsilon_0}$$

Solving for E gives us $E = \dfrac{q_{in}}{\varepsilon_0}(4\pi r^2)$

The charge contained inside the sphere with radius a has a total charge of q. However, we are considering only a portion of that charge, which is contained within a sphere with a radius r < a. The charge contained within this region is given by

$$q_{in} = \rho V = \rho\left(\frac{4}{3}\pi r^3\right)$$

Inserting this into our electric field equation gives us

$$E = \frac{q_{in}}{\varepsilon_0}(4\pi r^2) = \rho\frac{\left(\frac{4}{3}\pi r^3\right)}{\varepsilon_0(4\pi r^2)}$$

This expression reduces to $E = \rho\,\dfrac{r}{3\varepsilon_0}$

The charge density p is for the entire sphere of charge Q with a radius a. The charge density can be expressed as $\rho = \dfrac{Q}{\frac{4}{3}\pi a^3}$. We now can make this substitution into our electric field equation.

$$E = \rho\frac{r}{3\varepsilon_0} = \frac{\left(\frac{Q}{\frac{4}{3}\pi a^3}\right)r}{3\varepsilon_0} = \frac{Qr}{4\pi\varepsilon_0 a^3}$$ Since, $k = \frac{1}{4}\pi_0$,

our electric field expression can be further simplified as $E = \dfrac{kQr}{a^3}$.

(61) **(C).** The electric field can be defined as the negative gradient of the electric potential function.

$$\vec{E} = -\nabla\vec{V}$$

We can determine $\vec{E}$ by taking the negative derivative of $\vec{V}$ with respect to each component.

$$E_x = -\frac{dV}{dx} = -\frac{d}{dx}(5x^2y - 2xy^2 + 2z^2)$$
$$= -10xy + 2y^2$$

$$E_y = -\frac{dV}{dy} = -\frac{d}{dy}(5x^2y - 2xy^2 + 2z^2)$$
$$= -5x^2 + 4xy$$

$$E_z = -\frac{dV}{dz} = -\frac{d}{dz}(5x^2y - 2xy^2 + 2z^2) = -4z$$

Therefore, the electric field for this potential will be

$$\vec{E} = (2y^2 - 10xy)\,\hat{i} + (4xy - 5x^2)\,\hat{j} + (-4z)\,\hat{k}$$

(62) **(A).** We are now asked to evaluate the magnitude of our electric field $\vec{E}$ at a point (1, 0, 0). We'll begin by calculating each component of $\vec{E}$ at this point.

$E_x = 2y^2 - 10xy = 2(0)^2 - 10(1)(0) = 0$ N/C
$E_y = 4xy - 5x^2 = 4(1)(0) - 5(1)^2 = -5$ N/C
$E_z = 4z = 4(0) = 0$ N/C

The magnitude of E is given by

$$E = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

Substituting in our magnitudes for each component, we find that $E = \sqrt{E_x^2 + E_y^2 + E_z^2}$

$$= \sqrt{(0)^2 + (-5)^2 + (0)^2} = 5 \text{ N/C}$$

(63) **(D).** A dielectric is a nonconducting material (rubber, wood, glass, etc.) that can be inserted between the plates of a capacitor. Before the dielectric is added, the capacitance of the capacitor can be found by the following equation: $C_0 = \varepsilon_0 \frac{A}{d}$

When the dielectric is inserted between the plates, the voltage drops between the plates by a factor of K:

$V = V_0/K$

where V_0 is the initial voltage of the system.

The charge on the capacitor doesn't change with the addition of the dielectric. Therefore, the capacitance changes to make this change in voltage occur.

$$C_0 = \frac{Q_0}{V} = \frac{Q_0}{V_0/K} = \frac{KQ_0}{V_0} = KC_0$$

This means that the capacitance of a dielectric increases by a factor of K.

$$C = \frac{K\varepsilon_0 A}{d}$$

In short, a dielectric will cause the voltage of a capacitor to decrease. This decrease in voltage is made possible by an increase in the capacitance of the capacitor.

(64) **(D).** The current in a conductor I is defined as the amount of charge that flows through a conductor in a certain amount of time. $I = \frac{\Delta Q}{\Delta t}$

The current I can also be represented by a combination of the number n of charges q that travel with a velocity v_d through a cross sectional area A.

$I = nqv_dA$

Solving for velocity v_d (also called the "drift velocity"), we get $v_d = \frac{I}{nqA}$

We are given the product nA = 10^{10} electrons/m of beam.

Substituting in our values for I, n, and q (the charge on an electron),

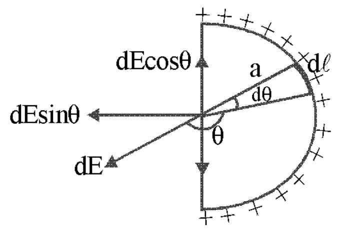
$$v_d = \frac{I}{nqA} = \frac{1.6\times10^{-5}\,A}{(10^{10})(1.6\times10^{-19}\,C)} = 10^4\,m/s$$

Therefore, the best estimate for the speed of these electrons is 10^4 m/s.

(65) **(C).** The terminal voltage of the battery is given by V= ε – Ir, where V is the terminal voltage, ε is the battery's emf, and Ir is the voltage drop across the battery's internal resistance. Since V is also the voltage drop across the resistor R, we see that IR = ε – Ir

Solving for r, we obtain $r = \frac{\varepsilon - IR}{I}$

(66) **(D).** Electric field intensity at O due to small elemental length $d\ell$ of charged ring,



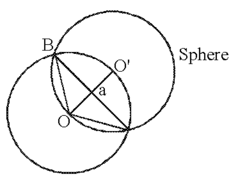
$$dE = \frac{1}{4\pi\varepsilon_0}\cdot\frac{\lambda d\ell}{a^2} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{\lambda a d\theta}{a^2} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{\lambda}{a}d\theta$$

∴ Net electric field at centre O is

$$E = \int dE\sin\theta = \int_0^{\pi}\frac{1}{4\pi\varepsilon_0}\cdot\frac{\lambda}{a}\sin\theta\, d\theta = \frac{\lambda}{4\pi\varepsilon_0 a}[-\cos\theta]_0^{\pi}$$

$$\therefore\quad E = \frac{\lambda}{2\pi\varepsilon_0 a}$$

(67) **(C).**



Charge on ring q, centre of ring = O
Centre of sphere = O'

Linear charge density of ring, $\lambda = \dfrac{q}{2\pi a}$

Charge on arc AB of ring,

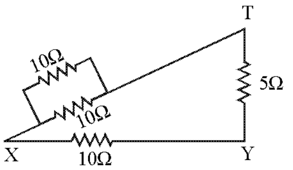
$$q_{AB} = \lambda\,(\text{arc AB}) = \frac{1}{2\pi a}\cdot a\cdot\frac{2\pi}{3}$$

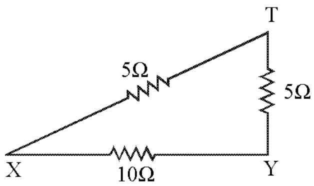
$q_{AB} = q/3$

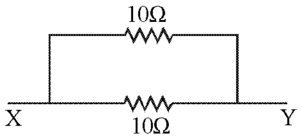
i.e., charged enclosed by sphere = q/3

$\therefore$ Flux coming out of sphere = $q/3\varepsilon_0$.

(68) (B).







$$R_{XY} = \frac{10\times 10}{10+10} = 5\Omega$$

(69) (C). When heater wires are connected in series, then equivalent resistance,

$R_s = R_1 + R_2 = 2R \qquad (\because\ R_1 = R_2)$

Rate of heat produced, $H_s = V^2/R_s$

$$H_s = \frac{V^2}{2R} \qquad \ldots (1)$$

In second case, $R_p = \dfrac{R_1R_2}{R_1+R_2} = \dfrac{R\cdot R}{2R} = \dfrac{R}{2}$

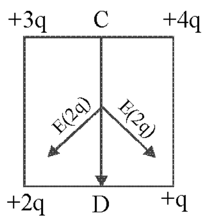
$\therefore$ Rate of heat produced, $H_p = \dfrac{V^2}{R_p}$

$$H_p = \frac{2V^2}{R} \qquad \ldots\ldots\ldots (2)$$

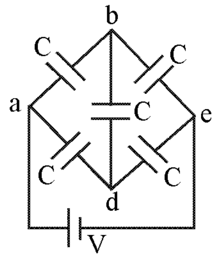
Dividing (1) by (2), we get

$$\frac{H_s}{H_p} = \frac{V^2/2R}{2V^2/R} = \frac{V^2}{2R}\times\frac{R}{2V^2} = \frac{1}{4}$$

(70) (A). The resultant electric fields due to diagonally opposite charges will act as shown. Hence the resultant field is along CD.



(71) (A). Network is redrawn as shown in figure. This is a balanced Wheatstone's network.
Equivalent capacitance $C_{eq} = C$
Charge on capacitor between the terminals a and b



$$\frac{Q}{2} = \frac{CV}{2}$$

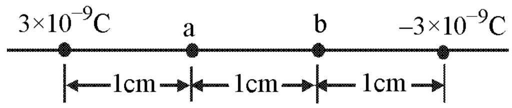
Energy stored in that capacitor

$$= \frac{1}{2}\frac{(Q/2)^2}{C} = \frac{Q^2}{8C} = \frac{C^2V^2}{8C} = \frac{CV^2}{8}$$

$$= \frac{(1\times 10^{-6})\times 10^2}{8} = \frac{100}{8}\times 10^{-6} = 12.5\,\mu J$$

(72) (B). $I_g = 0.1\,I,\ I_s = 0.9I;\ S = I_gG/I_s = 0.1\times 900/0.9 = 100\,\Omega$

(73) (C).



According to conservation of energy, we get

$K_a + U_a = K_b + U_b$

Here, $K_a = 0$ and the potential energies are

$U_a = q'V_a$ and $U_b = q'V_b$

$$\therefore\ 0 + q'V_a = \frac{1}{2}mv^2 + q'V_b$$

or $$v = \sqrt{\frac{2q'(V_a - V_b)}{m}}$$

$V_a = (9.0\times 10^9\,Nm^2C^{-2})$

$$\left(\frac{3\times 10^{-9}C}{0.01m} + \frac{-3\times 10^{-9}C}{0.02m}\right) = 1350\ V$$

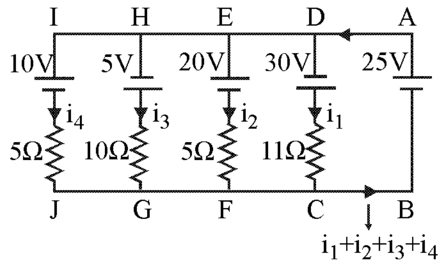
$V_b = (9.0\times 10^9\,Nm^2C^{-2})$

$$\left(\frac{3\times 10^{-9}C}{0.02m} + \frac{-3\times 10^{-9}C}{0.01m}\right) = -1350\ V$$

$$v = \sqrt{\frac{2\,(2\times 10^{-9}C)\,(2700V)}{5\times 10^{-3}kg}} = 4.65\times 10^{-2}\,ms^{-1}$$

$= 4.65\ cm\ s^{-1}$

(74) (C).



Applying KVL in loop ABCDA, ABFEA, ABGHA and ABJIA, we get

$30 - i_1 \times 11 = -25$ .... (i)

$20 + i_2 \times 5 = 25$ .... (ii)

$5 - i_3 \times 10 = -25$ .... (iii)

$10 + i_4 \times 5 = 25$ .... (iv)

Solving equations (i), (ii), (iii) and (iv) we get

$i_1 = 5$ A, $i_2 = 1$ A, $i_3 = 3$ A and $i_4 = 3$ A.

Hence, current flowing through 25V cell is 12 A.

(75) **(B).** We knows capacitance, $C = \frac{\varepsilon_0 A}{d}$

When plate is inserted

$$C' = \frac{\varepsilon_0 A}{d - \frac{d}{2}} = \frac{2\varepsilon_0 A}{d} \quad ; \quad \frac{C'}{C} = \frac{2}{1}$$

(76) **(A).** For figure I, Total resistance = 3R

I power = I^2 (3R)

For figure II, Resistance = (2R/3) Ω

II power = I^2 (2R/3)

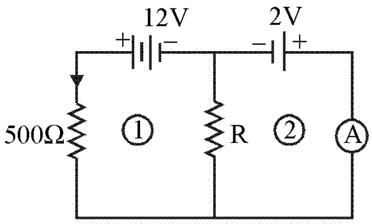
For figure III, Total resistance = (R/3) Ω

III power = I^2 (R/3)

For figure IV, Total resistance = (3/2) Ω

IV power = I^2 (3/2) R

(77) **(B).** Given circuit,



In loop (1), $12 - 500i_1 - Ri_1 = 0$

$\Rightarrow$ $12 = i_1(500 + R)$ ...... (1)

In loop (2), $12 - 500\,i_1 - 2 = 0 \Rightarrow 10 = 500\,i_1$

or $i_1 = (1/50)$ A ...... (2)

From Eqs. (1) and (2), $12 \times \frac{1}{i_1} = 500 + R$

$\Rightarrow$ $12 \times 50 = 500 + R \Rightarrow R = 100\,\Omega$

(78) **(A).** We have, $i_g = i\left(\frac{S}{G+S}\right)$, where i = total current

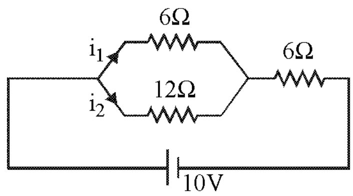
$$\text{Sensitivity} = \frac{i_g}{i} = \frac{10}{60} = \frac{1}{6} \quad \therefore \quad \frac{1}{6} = \frac{S}{G+S}$$

$\Rightarrow$ G + S = 6S $\Rightarrow$ G = 5S or S = G/5

$\Rightarrow$ S = 20/5 = 4Ω ($\because$ G = 20Ω)

(79) **(D).** The force $F = \frac{eV}{d} = \frac{1.6 \times 10^{-19} \times 10^4}{0.5 \times 10^{-2}} = 3.2 \times 10^{-13}$ N

(80) **(A).**



$$R = \frac{6 \times 12}{6 + 12} = \frac{6 \times 12}{18} = 4\Omega$$

Total resistance, $R_{eq} = 6 + 4 = 10\,\Omega$

Current, $i = \frac{v}{R} = \frac{10}{10} = 1A$

The current in 12 Ω resistor is

$$i_2 = i\left(\frac{R_1}{R_1 + R_2}\right) = 1 \times \left(\frac{6}{6+12}\right) = \frac{1}{3}$$

The potential difference in 12Ω resistor

$$V = i\,R = \frac{1}{3} \times 12 = 4\text{ V}$$

(81) **(D).** $\vec{E} = E_x\hat{i} + E_y\hat{j}$; $\Delta V = -E_x\,\Delta x - E_y\,\Delta y$

For A and B, $16 - 4 = -E_x(-2-2) - E_y(2-2)$

$E_x = 3$ V/m

For B and C, $12 - 16 = -E_x\{2 - (-2)\} - E_y(4-2)$

$E_y = -4$ V/m.

$\therefore$ $\vec{E} = (3\hat{i} - 4\hat{j})$ V / m

(82) **(A).** Potential difference

$$V_1 - V_2 = \left(\frac{1}{4\pi\varepsilon_0}\right) Q\left(\frac{1}{R} - \frac{1}{2R}\right)$$

It will be doubled.

(83) **(C).** $E_2 = 2IR$

$$I' = \frac{E_2 - E_1}{R} = 2I - \frac{E_1}{R}$$

If $E_1 < IR \Rightarrow I' > I$

If $IR < E_1 < 2IR \Rightarrow I' < I$

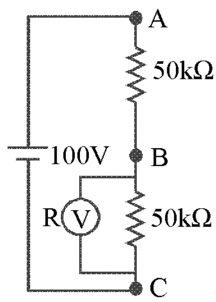
If $E_1 = 2IR \Rightarrow I' = 0$

(84) **(C).** Resultant electric field in the region marked I is

$E = E_1 + E_2$

$$\Rightarrow \quad E = \frac{\sigma_1}{2\varepsilon_0} + \frac{\sigma_2}{2\varepsilon_0} = \frac{\sigma_1 + \sigma_2}{2\varepsilon_0}\text{ N / C}$$

(85) **(C).**



Potential difference between points A and B

$$V_{AB} = 100 - \frac{100}{3} = \frac{200}{3} \text{volt}$$

Current in AB, $V_{AB} = I \times 50$; $\frac{200}{3} = I \times 50$ or $I = 4/3$

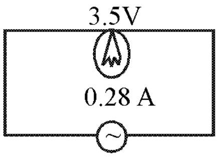
Let resultant resistance of voltmetre and BC is R'.

$$\therefore \quad \frac{1}{R'} = \frac{1}{50} + \frac{1}{R} = \frac{R+50}{50R} \Rightarrow R' = \frac{50}{50+R}$$

By Ohm's law, $V = IR'$

$$\therefore \quad \frac{100}{3} = \frac{4}{3} \times \frac{50}{50+R} \text{ or } 100 + 2R = 4R \text{ or } R = 50\,k\Omega$$

(86) **(D).** Here, $t = 425°C$, $R_0 = 4\Omega$



By ohm's law $V = IR_t$

$$\therefore \quad 3.5 = 0.28R_t \Rightarrow \frac{350}{28} = R_t$$

$\Rightarrow R_t = 12.5\,\Omega$

Resistance at temperature t°C is, $R_t = R_0\,(1 + \alpha\,t)$

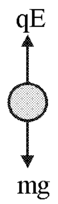
where α is temperature coefficient of resistance.

$\therefore \quad 12.5 = 4\,(1 + \alpha \times 425)$

$$\text{or} \quad \frac{12.5}{4} - 1 = \alpha \times 425 \quad \text{or} \quad \frac{8.5}{4} = \alpha \times 425$$

$$\Rightarrow \quad \alpha = \frac{8.5}{4 \times 425} = 0.5 \times 10^{-2} = 5 \times 10^{-3}\,/\,K$$

(87) **(D).** According to figure, it is clear that electrical force is balanced by weight of body, i.e,



$qE = mg$

$$\text{or} \quad ne\frac{V}{\ell} = mg$$

$$\therefore \quad n \times 1.6 \times 10^{-19} \times \frac{1200}{6 \times 10^{-3}} = 3.2 \times 10^{-14}$$

$$\text{or} \quad n = \frac{3.2 \times 10^{-13} \times 6 \times 10^{-3}}{1.6 \times 10^{-19} \times 1200} = 10$$

(88) **(C).** Let V_1 be the potential at the centre of the cube due to one charge.

$$V_1 = \frac{1}{4\pi\varepsilon_0}\frac{Q}{x} \quad \text{and} \quad x = \frac{a\sqrt{3}}{2}$$

Potential due to all eight corners of the cube

$$V = 8V_1 = 8\left[\frac{1}{4\pi\varepsilon_0}\frac{Q}{\frac{\sqrt{3}}{2} \times a}\right] = \frac{16Q}{4\pi\varepsilon_0\sqrt{3} \times a} = \frac{4Q}{a\sqrt{3}\pi\varepsilon_0}$$

(89) **(C).** Resistance = V/I

So, $R_2 > R_1 \;\therefore\; T_2 > T_1$

(90) **(D).** Current flowing through the lamp,

$$I = \frac{V}{R} = \frac{60}{20} = 3A$$

The current in the lamp must remain 3A, when it is operated at 75 V supply.

Let R be the resistance connected in series, then

$$\frac{75}{20+R} = 3 \Rightarrow 75 = 60 + 3R \Rightarrow 3R = 75 - 60$$

$\Rightarrow \quad 3R = 15 \Rightarrow R = 5\Omega$

(91) **(B).** A pollen grain, the mature male gametophyte, consists of three haploid nuclei. One sprouts a pollen tube and is called the tube nucleus. The other two, the sperm nuclei, fertilize the ovum and the two polar bodies during double fertilization. One sperm nucleus fuses with the ovum and becomes the embryo (2n). The other sperm nucleus fuses with two polar bodies and becomes the cotyledon, food for the growing embryo (3n).

(92) **(C).** The activated spermatozoan on reaching the egg plasma membrane, undergoes a number of changes in its acrosomal region. All these changes are collectively described under acrosome reaction. Acrosome reaction is calcium-dependent involving massive uptake of calcium and sodium with an efflux of hydrogen generating high pH and osmotic pressure, producing negative surface charge, and partial or total release of the acrosomal enzymes. Calcium influx may activate phospholipase resulting in accumulation of unsaturated fatty acids and fusiogenic lysophospholipids contributing to acrosome reaction.

(93) **(C).** At sexual maturity, the undifferentiated primordial germ cells divide several times by mitosis to produce a large number of spermatogonia. Each spermatogonium actively grows to a larger primary spermatocyte. Each primary spermatocyte undergoes two successive divisions, called maturation divisions. The first maturation division is reductional or meiotic. Hence, the primary spermatocyte divides into two haploid daughter cells called secondary spermatocytes. Both secondary spermatocytes now undergo second maturation division which is an ordinary mitotic division to form, four haploid spermatids. Thus each secondary spermatocyte gives rise to two spermatids that undergo transformation to form two sperms. Overall, both secondary spermatocytes give rise to four sperms.

(94) **(C).** Ripened ovary or fertilized ovary is called fruit. The wall of the ovary forms fleshy or dry fruit wall known as pericarp. It means that the pericarp is developed from pistil or carpel.

(95) **(D).** Great apes, humans goes through a menstrual cycle while monkey goes through estrous cycle. Urine is light yellow colored watery fluid which is slightly acidic. Bile juice does not contain any digestive enzymes.

(96) (A) **(97)** (D)

(98) (A) **(99)** (D)

(100) **(C).** Wheat, Coconut and sunflower are example of endospermic seed, whereas groundnut is an nonendospermic seed.

(101) **(B).** Stamens are one of the four main organs of flowers, along with pistils, sepals, and petals. The stamen is the male reproductive organ.

(102) **(D).** Entomophily i.e. Pollination with the help of insects is found in salvia.

(103) **(D).** In begonia, Kalancohe and bryophyllum vegetative reproduction occurs by leaves and in oxalis it occurs by bulbils.

(104) **(D).** Grafting is an artificial method of vegetative reproduction.

(105) **(A).** Gymnospermic endosperm are haploid and developed from female gametophyte and angiospermic endosperm is triploid and developed as a result of triple fusion.

(106) **(D).** Emasculation is removal of anther before its maturation. It can be done in bisexual flower, not in male flower. After emasculation, male flower is converted into male sterile flower.

(107) **(D).** This shows female gametophyte development, in which polar nuclei and egg cell result from mitotic division.

(108) **(A).** Yeast - Budding
Penicillium - Conidia
Filamentous algae - Fragmentation
Chalomydomonas - Zoospores

(109) **(D).** Evolution is release of secondary oocyte arrested at meiosis-II.

(110) **(D).** The diploid pollen mother cells have 24 chromosomes hence pollen grains will have 12 chromosomes.
Thus the male gametes will have 12 chromosomes. The female gamete being haploid will also have 12 chromosomes. Hence, syngamy will form diploid zygote with 24 chromosomes. Triple fusion will involve three haploid nuclei with 12 chromosomes each. Thus the triploid endosperm will have 36 chromosomes.

(111) **(C).** Cleistogamous flowers are closed flowers in which only self pollination is possible.

(112) **(D).** Simple fleshy tuberous roots occur in sweet potato. Fasciculated fleshy roots occur in asparagus.

(113) **(C).** Some angiosperms have bisporic and tetrasporic embryosacs.

(114) **(C).** The first mitotic division forms tube cell and generative cell. The second mitotic division in the generative cell forms two male gametes.

(115) **(B).**

(116) **(B).** **Safe period (Rhythm method) :** 4 days before and 4 days after menstrual bleeding is considered the safe period for sexual intercourse. It reduces the chances of pregnancy by about 80 percent. It is so because:

- Ovulation generally occurs on 14th day of the menstrual cycle (range is 13- 16th day of the cycle).
- Viability period of ovum is of about two to three days.
- Viability period of sperm is of only one day.

Coitus Interruptus :

- This is the oldest method of birth control. It involves withdrwal of the penis by the male before ejaculation so that semen is not deposited in the vagina and there is no fertilization.
- This method also has some drawbacks. Before final ejaculation male produces some per-jaculating fluid. This fluid may cause fertilization.

Surgical method :

- These methods involve complete sterilization of male and female.
- It includes
  a. Vasectomy: Cutting of vas deferens in male.
  b. Castration: Surgical removal of testes.
  c. Tubectomy: Cutting of fallopian tube.
  d. Tubal ligation: Blocking of fallopian tube by laparoscope.
  e. Ovariectomy (oophrectomy): Surgical removal of ovaries.
  f. Hysterectomy: Surgical removal of uterus.

(117) **(D).** **GIFT (Gamete Intrafallopian Transfer)**
This technique was developed by Asch et al in 1984. In this procedure, washed sperms and two retrieved ova are transferred into the fallopian tube with the help of a laparoscope. Therefore, fertilisation occurs in the fallopian tube. This technique is used in those cases where husband has very low sperm count.

AIT (Artificial Insemination Technique)
In cases where husband's sperms are defective, artificial insemination donor is required. For such cases, a semen bank is operated by all artificial insemination centres. In these centres, semen of different ethnic groups with all types of blood sampling and Rh typing is kept in frozen state.

ICSI (Intracytoplasmic Sperm Injection)
In case the sperm count is very low, a single healthy sperm is injected into an ovum. It is called intracytoplasmic sperm injection.

(118) **(A).** **Week 4 :** Heart, blood vessels, blood and gut start forming. Umbilical cord developing. Embryo about 5mm long.

(119) **(C).** In angiosperms the functional megaspore is haploid, which undergoes mitotic division and form 7 celled 8 nucleate embryo sac. Therefore, each nucleus of embyro sac is haploid.
At the time of fertilization one male gamete fused with egg nucleus to form zygote (2n), whereas the second male gamete fuses with two polar nucleus (central cell) to form endosperm (3n). This type of fertilization is called double fertilization. Double fertilization is unique in angiosperms and discovered by Nawaschin (1898).

(120) **(A).** The gametogenesis of ova is termed oogenesis. It occurs in the follicles of ovaries as follow.

(a) **Multiplication phase** The primordial germinal cells of embryonic ovarian epithelium repeatedly divide mitotically to form a large number of oogonia.

(b) **Growth phase** In sexually mature female during breeding season the oogonia of some ovarian follicle rapidly grow into large primary oocyte cells by accumulating yolk as food reserve.

(c) **Maturation phase** Each primary oocyte undergoes two maturation divisions, first meiotic and second mitotic. In the first meiotic division the primary oocyte divides into a large secondary oocyte and small first polar body or polocyte. In the second maturation division the secondary oocyte again divided into a large ovum and small second polar body.

(121) (B). In angiosperms endosperm develops as a result of triple fusion from primary endosperm nucleus (fusion product of secondary nucleus and male gamete). It provides nutrition to the developing embryo.

(122) (C). In test tube baby the fertilization of ovum takes place in test tube but it develops in the uterus. The fertilized egg is implanted in the uterus.

(123) (B). Fallopian tube or oviduct is the site of fertilization in mammals. The embryo develops upto blastocyst stage in fallopian tube.

(124) (C). Binary fission is asexual mode reproduction. Progeny of the asexual mode of reproduction are genetically identical, transduction, transformation and conjugation are kind of sexual mode of reproduction, where genetic recombination.

(125) (D).

(126) (A). A = Connective, B = Endothecium, C = Pollen grain

(127) (C). Multiple fruit formed from single flower and apocarpous ovary.
Aggregate fruit formed from inflorescence.

(128) (B). The coloured petals attract the pollinating agents.

(129) (A). Geitonogamy : It is the transfer of pollen grain from anther to the stigma of another flower produced on the same plant

Xenogamy : Transfer of pollen grain from anther of a flower to the stigma of another flower produced on a different plant belonging to the same species.

(130) (A). Dicots and eudicots have two cotyledons, and monocots have one.

(131) (D).

(132) (A). 14th day of menstrual cycle, ovulation takes place.

(133) (D). Syphilis is a sexually transmitted infection caused by the spirochete bacterium Treponema pallidum subspecies pallidum. The primary route of transmission is through sexual contact; it may also be transmitted from mother to fetus during pregnancy or at birth, resulting in congenital syphilis.

(134) (C).

(135) (A). Ovulation is the release of a secondary oocyte (or an egg).

(136) (A). **(137) (D).**

(138) (A). **(139) (C).**

(140) (D).

(141) (B). The propagation through vegetative multiplication is used to maintain the genetic traits of a given plant. It gives rise to genetically uniform population or clone. In case of plants propagated through seeds, variations creep in due to chance segregation of genes during meiosis and their chance combination during fertilization.

(142) (D). During the post-pollination development, germination of pollen grain takes place. The pollen grain absorbs water and nutrients on the stigma from the stigmatic secretion through its germ pores. The tube or vegetative cell enlarges and comes out of the pollen grain through one of the germ pores or germinal furrows to form a pollen tube. Generative cell does not produces pollen tube instead it passes into the pollen tube and divides into 2 male gametes. Thus even after killing the generative cell with a laser beam, the pollen grain produces normal pollen tube because the vegetative cell has not been damaged.

(143) (D). The egg cell is one of the haploid cell of egg apparatus present in the micropylar end of embryo sac in seeded plants. It is also called oosphere and represents the single female gamete of the embryo sac. Antipodal cells are the haploid cells, usually three in number, present in embryo sac at the opposite end of micropyle. Their function is unknown and at fertilization, they may disintegrate or multiply and enlarge.

(144) (C). The testes are the gonads found in males.

(145) (C). Ripened ovary or fertilized ovary is called fruit. The wall of the ovary forms fleshy or dry fruit wall known as pericarp. It means that the pericarp is developed from pistil or carpel.

(146) (C).

(147) (B). Tapetum is the innermost one cell thick layer of microsporangium wall. The cells of this layer are radially enlarged and store food. The cells are multinucleated and provide nourishment to developing microspores or pollen grains.

(148) (B). Decrease in the vitality and productivity in the offspring.

(149) (D).

(150) (A). In maize and castor flowers are unisexual. Autogamy and geitonogamy are prevented in *Carica papaya*.

(151) (C) **(152)** (C) **(153)** (C)

(154) (A) **(155)** (A) **(156)** (A)

(157) (D)

(158) (D). The amniotic fluid is a protective substance that cushions and insulates the embryo. This fluid is held in a sac called the amnion.

(159) (B)

(160) (A)

(161) (A). When contractions of the uterus become stronger, the amniotic sac eventually tears. This releases amniotic fluid, which is known as the "water breaking."

(162) **(B).** Oogenesis takes place in the ovary.

(163) **(B).** At sexual maturity, the undifferentiated primordial germ cells divide several times by mitosis to produce a large number of spermatogonia.
Each spermatogonium then actively grows to a larger primary spermatocyte.
Each primary spermatocyte undergoes two successive divisions, called maturation divisions. The first maturation division is reductional or meiotic. Hence, the primary spermatocyte divides into the haploid daughter cells called secondary spermatocytes.

(164) **(D).** Oral contraceptive pills inhibit ovulation and implantation. They have to be taken daily for 21 days starting within the first five days of menstrual cycle. After a gap of 7 days, it has to be repeated.

(165) **(A).**

(166) **(A).** ART includes –
A. Zygote intra fallopian transfer
B. IVF and Embryo transfer
C. Artificial insemination
D. Gamete intra fallopian transfer.

(167) **(B).** Periodic shedding takes place during menstrual phase.

(168) **(C).**

(169) **(D).** Inert intrauterine devices release copper ion in the uterus that increases phagocytosis of sperms.

(170) **(D).** hCG, hPL and relaxin are produced in women only during pregnancy. FSH and LH secreted by anterior pituitary, during pregnancy progesterone inhibits secretion of GnRH.

(171) **(D).** Four sperms are formed from one primary spermatocyte but only one egg is formed from primary oocyte.

(172) (A)

(173) (D)

(174) **(C).** In the first few days of development, an embryo moves through the oviduct into the uterus. At this stage is a solid ball of cells referred to asa morula.

(175) **(B).** The picture shows that the body has rotated and is being pushed out of the mother's body through the vagina. This is called the expulsion stage of birth.

(176) **(C).** Inside the ovary depicted here, oocytes develop into eggs, or ovum. These eggs travel to the uterus through the oviduct.

(177) **(C).** (A) Leydig cells are found in the seminiferous tubules of the testis.
(B) Oogenesis takes place in the ovary.

(178) (A)

(179) **(C).** In eudicot seeds, the cotyledons absorb most of the endosperm tissue while the seed reaches maturation.

(180) (C)