MC SQUARE EDUCATION PVT.LTD

PAPER-02

DATE-23/02/2017

NEET 2017 FINAL TEST SERIES

TOTAL MARK: 720

SR. NO	STUDENT NAME	CHEMISTRY		PHYSICS		BIOLOGY		TOTAL MARKS
1	ADWAIT GOKHALE	27	10	23	13	36	34	287
2	RUTUJA VETHEKAR	00	00	00	00	00	00	ABSENT
3	JOSHNA CHOUDHARI	18	8	18	9	27	17	218
4	VARUN BELORIA							
5	MAMTA RAJAWAT	13	9	12	5	18	27	131
6	AKSHATA SHINDE							
7	RIDDHI RAUT	12	11	13	12	21	30	131
8	ARUNDHATI GOTEKAR	7	17	10	19	28	42	102
9	KOMAL SABBANI	5	19	7	13	32	37	107
10	SHREYA PAREKH	15	12	17	8	30	23	205
11	POOJA UPASE	17	8	10	7	20	24	149
12	ADITYA SASANE	7	8	4	7	36	19	154
13	RUTUJA SASANE	7	13	8	10	32	33	188
14	VIVEK RATHORE	00	00	00	00	00	00	ABSENT
15	SONAM SINGH	0	3	1	3	32	21	105
16	WAJID RAY							
17	RUSHIKESH GHUTUGADE	8	8	9	6	40	29	185
18	SUMIT BORA	19	8	23	11	48	25	316
19	ROHAN PAWAR	7	19	7	15	40	40	142
20	PAWAN KHAMKAR	8	7	8	5	39	26	182
21	SUMIT KAMBLE	7	7	5	7	25	36	98
22	SHIVANI SINGH							
23	VAIBHAV INGOLE							
24	RENUKA KATTIMANI	11	15	9	18	23	53	86
25	HARSHA SHINDE	4	9	5	13	36	34	124
26	PAYAL MANE	3	1	3	1	18	9	85
27	AMRUTA MULE	16	8	13	4	13	35	121
28	SHRUTI BARVE	20	8	24	7	48	13	340
29	SIMRAN GURUBAXANI	6	6	23	15	53	23	284
30	SAYALI JADHAV	18	9	15	10	42	24	257
31	AYUSHEE AGARWAL	7	9	5	5	20	30	84
32	ANKITA NIMMALWAR	15	2	1	4	38	30	180
33	SNEHA LOKHANDE	11	11	3	10	28	31	116
34	NEHA CHAVAN	0	3	1	1	15	16	44
35	HIMALI CHOUDHARI	7	26	6	4	25	59	63
36	SUMIT SAWANT	00	00	00	00	00	00	ABSENT
37	MANALI UBHEDAL	00	00	00	00	00	00	ABSENT
38	ANAM PANSARE	7	18	5	19	21	53	42
39	PURVA SHEDGE	14	9	13	8	21	11	164
40	ANJALI SOLANKE							
41	AISHWARIYA NALANAGLU	5	12	4	4	37	42	126
42	AKASHA SANER							
43	SHUBHAM MANE	00	00	00	00	00	00	ABSENT
44	AMRUTA BHOSALE	9	28	9	35	21	69	24
45	MANASI KASHID							
46	HARSHADA JADHAV	14	13	8	6	14	23	102
47	RUSHIKESH AWATE	10	17	3	8	21	28	83
48	DIPALI GAIKWAD							
49	PRITI BIRADAR	8	5	8	4	23	14	133
50	SHEFALI RATHOD	7	8	8	10	12	13	
51	AISHWARYA BORHADE	12	6	5	5	13	14	95
52	NADEEM SHIKALGAR	14	31	9	36	15	75	10
53	RASHMI GAIKWAD	00	00	00	00	00	00	ABSENT
54	YASH RAGHUWANSHI	00	00	00	00	00	00	ABSENT
55	AVINASH CHENDAKE							
56	RUTUJA GHUTUGADE	10	8	4	10	20	33	136
57	NIRAJ PATIL	00	00	00	00	00	00	ABSENT
58	KETAN MORE	00	00	00	00	00	00	ABSENT
59	MADHAVI KATRE	10	12	6	12	25	25	115

SR.NO	STUDENT NAME	CHEMISTRY		PHYSICS		BIOLOGY		TOTAL MARKS
60	KETAKI SHINDE	7	5	7	7	26	20	128
61	SONAM BENDRE	4	25	7	17	17	36	34
62	AKASH BAGADE	00	00	00	00	18	44	28
63	RAHUL DESHOTWOD	4	5	0	2	18	32	49
64	ASHWINI PATEL	5	18	1	1	38	32	125
65	KANCHAN JAISWAL	7	12	3	5	31	40	107
66	SAMRAGGI HATI	0	2	5	11	23	30	69
67	SONAL KAMBLE	6	11	3	1	20	38	66
68	PRANALI GAIKWAD	0	0	4	9	36	21	130
69	VIJAYA DHUMAL	20	9	17	4	40	20	275
70	DIPTI GURAV	17	7	22	7	43	17	297
71	AKASH BHISE	00	00	00	00	00	00	ABSENT
72	AMIRTHESH	3	19	19	13	36	30	170
73								
74								
75								
76								
77								

NEET
TEST-2-SOLUTIONS

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

(1) **(C).** Since this point lies on the boundary between the liquid and gas phases of water, it corresponds to the boiling point of water at a given pressure.

(2) **(C).** Looking at the Gibbs free energy equation, we predict that if $\Delta S°$ is positive and $\Delta H°$ is negative, then $\Delta G°$ will be negative at all temperatures.
Choice (A) and choice (B) are not true since you must always know the value of both $\Delta S°$ and $\Delta H°$ in order to predict spontaneity. Choice (D) is not true since it's always possible for a favorable entropy to counteract an unfavorable enthalpy and vice versa.

(3) **(A).** Since $\Delta H°$ is positive, we know that the reaction will not be spontaneous at all temperatures. Instead, we need to increase T until the entropy part of Gibbs free energy dominates, giving a net negative value for $\Delta G°$. Looking at the equation for free energy:
$\Delta G° = \Delta H° - T\Delta S°$
If we can find the temperature for which $\Delta G° = 0$, then we know that at all temperatures above this the reaction should be spontaneous.
$0 = \Delta H° - T\Delta S°$
Solving for T: $T = \frac{\Delta H°}{\Delta S°} = \frac{31400}{94.0} = 61.0°C$
Therefore, we predict that at all temperatures above 61°C the reaction will be spontaneous. Thus, 61°C is the normal boiling point for $CHCl_3$ (chloroform).

(4) **(D).** The standard enthalpy of formation ($\Delta H_f°$) is defined as the change in enthalpy associated with the formation of a mole of a compound from its elements, with all elements in their standard state.
Therefore, $\Delta H_f°$ is zero when the substance in question is already in its standard state. Since Cl exists as Cl_2 (g) at 1 atm and 25°C, Cl_2 (g) is in its standard state and has an enthalpy of formation equal to zero.

(5) **(D).** Addition of a catalyst will affect only the activation energy, which will increase the rate of the reaction but not change any of the other thermodynamic parameters listed.

(6) **(A).** The principal requirement for a spontaneous process is that Gibbs free energy is negative. The change in entropy or enthalpy may be positive for a spontaneous process.

(7) **(C).** Only entropy may have units of J/mol-K.

(8) **(D).** Remember that even though chlorine is highly reactive, it won't easily form molecules with P or O because they are all electron donors. The effect of adding chlorine will be to increase the pressure of the system. We predict that the equilibrium will shift so as to favor the direction in which fewer moles of gaseous products are produced, in this case to the right. Therefore, we expect that the concentrations of both P_4 and O_2 will decrease, and the concentration of P_4O_{10} will increase as the new equilibrium is reached.

(9) **(C).** As the temperature is decreased, the equilibrium will shift so as to produce thermal energy, i.e., in the direction of the exothermic reaction. Since the reaction is endothermic as written, the equilibrium will shift to the left. Therefore, when the new equilibrium is reached, [NO] will have decreased, $[B_2]$ will have decreased, and [NOBr] will have increased.
The equilibrium constant $K = \frac{[NO]^2}{[NOBr]^2}$ will also have decreased.

(10) **(C).** Since Cl^- is the conjugate base of a strong acid, it is not basic and therefore will not be removed from solution by the presence of H^+. The solubility of AgCl will not be significantly affected by the pH of the solution. Choice (A) is correct since a lower K_{sp} implies that the solubility is lower, as long as the ratios of dissolved ions are the same between the two species being compared. Choice (B) is true since the dissolution of $MnCO_3$ produces CO_3^{2-}, which can undergo a neutralization reaction with H^+ and drive the equilibrium to the right. Choice (D) is true since Ag_3PO_4 will dissolve to form PO_4^{3-}, which is a basic anion. This compound should therefore be more soluble in acidic solution than in basic solution.

(11) **(B).** The reaction is endothermic, so increasing the temperature will cause a shift toward products and an increase in the value of K_{eq}.

(12) **(D).** Increasing the pressure causes a shift toward the side with fewer moles of gas, but all species will have higher concentrations after the change (though there will be fewer moles of SO_2 and O_2 than before the change, their concentrations will be higher because of the smaller space).

(13) **(D).** Adding SO_3 causes a shift toward products and increases the concentrations of SO_2 and O_2 but does not completely use up the added SO_3, so all concentrations are higher after the change.

(14) **(D).** This statement is not true, since I^- is the conjugate base of a strong acid and therefore will not be appreciably basic in solution. Choice (A) is true since HI is a strong acid and therefore will be expected to dissociate completely in aqueous solution to H^+ and I^-. Choice (B) is true since HF is a weak acid and therefore dissociates only minimally in solution.
Choice (C) is true since according to the Arrhenius definition of acids and bases, for any acid in solution $[H^+] > [OH^-]$. The solution will therefore have a pH<7.
Choice (D) is true because F^- is the conjugate base of a weak acid and will therefore be a stronger base than H_2O.

(15) **(D).** All three statements are correct regarding the concentrations of ions at equilibrium.

(16) **(C).** For any aqueous solution,
$K_w = 1.0 \times 10^{-14} = [H^+]\,[OH^-]$.

Therefore, the concentration of OH^- in this solution is given by:

$$[OH^-] = \frac{K_w}{[H^+]} = \frac{[1.0\times10^{-14}]}{[1.0\times10^{-10}]} = 1.0 \times 10^{-4}$$

(17) (D). A solution of NaCl and K_2SO_4 will have a neutral pH, since none of the ions present in solution are appreciably acidic or basic. Cl^- and SO_4^{2-} are the conjugate bases of strong acids, and therefore not appreciably basic in aqueous solution.

(18) (B). The HOAc (with a K_a of 1.75×10^{-5}) may be used to generate a buffer with acidic pH when combined with its conjugate base.

(19) (C). HNO_3 is a strong acid while $NaNO_3$ has no acid/ base properties. Therefore, this represents an unbuffered acidic solution with a low pH.

(20) (D). A Lewis base donates a lone pair of electrons to an electron-deficient atom to form a bond.

(21) (D). The oxidation number of O is –2 in Cu $(NO_3)_2$, but O in its elemental form O_2. Therefore, since the oxidation number of O is becoming more positive, it is getting oxidized. The oxidation number of N is +5 in $Cu(NO_3)_2$ since the polyatomic anion NO_3^- must have a net negative charge. On the right side of the equation, the oxidation number of N is +4 in the neutral compound NO_2. Therefore, nitrogen is being reduced in the reaction.

(22) (D). Begin this question by determining what is oxidized and what is reduced. Since the oxidization number of Fe increases from +2 to +3, it is oxidized, and since the oxidization number of Mn decreases from +7 to +2, it is reduced. Next, break the unbalanced reaction into two half-reactions:

$Fe^{2+}(aq) \rightarrow Fe^{3+}(aq)$ (oxidation half-reaction)

$H_3O^+(aq) + MnO_4^-(aq) \rightarrow Mn^{2+}(aq) + H_2O(\ell)$ (reduction half-reaction)

Balance all atoms except O and H. Then, add H^+ and H_2O as needed:

$Fe^{2+}(aq) \rightarrow Fe^{3+}(aq)$

$H_3O^+(aq) + MnO_4^-(aq) + 7H^+ \rightarrow Mn^{2+}(aq) + 5H_2O(\ell)$

Balance the half-reactions for charge using electrons:

$Fe^{2+}(aq) \rightarrow Fe^{3+}(aq) + e^-$

$H_3O^+(aq) + MnO_4^-(aq) + 7H^+ + 5e^- \rightarrow Mn^{2+}(aq) + 5H_2O(\ell)$

Multiply the half-reactions so that the oxidizing agent accepts as many electrons as the reducing agent produces. Here, that means multiplying the first equation by 5 and leaving the second alone:

$5Fe^{2+}(aq) \rightarrow 5Fe^{3+}(aq) + 5e^-$

$H_3O^+(aq) + MnO_4^-(aq) + 7H^+ + 5e^- \rightarrow Mn^{2+}(aq) + 5H_2O(\ell)$

Add the half-reactions together to give the overall reaction:

$H_3O^+(aq) + MnO_4^-(aq) + 5Fe^{2+}(aq) + 7H^+ \rightarrow Mn^{2+}(aq) + 5H_2O(\ell) + 5Fe^{3+}(aq)$

Check to make sure charge and the amount of atoms are balanced. They are, so the correct answer is choice (D).

(23) (D). In $KMnO_4$, the oxidation state of Mn is +7. Mn_2O_7 is the only compound listed containing Mn in the same oxidation state. The oxidation states of Mn in the other compounds are: choice (A) +2, choice (B) +4, choice (C) +3.

(24) (D). We expect that metals that corrode more readily than Al will have more negative reduction potentials. For the reaction: Al (s) $\rightarrow Al^{3+}(aq) + 3e^-$; E° = 1.66 V Since this oxidation has a high (positive) value for E°, this implies that oxidation occurs readily for this metal. Only Mg has an oxidation half-reaction with a more positive potential:

$Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$; E° = 2.37 V

(25) (A). Endothermic reactions have the heat on the left side and a positive ΔH. Reactions with an increase in entropy also have a positive ΔS. Because the reaction in choice (A) produces two moles of gas for each mole of solid, it would have a positive ΔS.

(26) (B). Only the reaction in choice (B) has a net decrease in the number of molecules of gas and thus should have a decrease in the amount of disorder & a negative ΔS.

(27) (A). The other reactions are all reduction-oxidation reactions.

(28) (D). A disproportionation reaction is one in which an element is both oxidized and reduced. In choice (D), nitrogen goes from +3 in HNO_2 to +2 in NO and +4 in NO_2.

(29) (D). K_b for a weak base and K_a for its conjugate acid are related by the equilibrium constant for the dissociation of water, Kw, according to the following equation: $K_w = 10^{-14} = K_a \times K_b$.

(30) (A). Ammonium hydroxide and all alkali metal hydroxides are soluble. Aluminium hydroxide, $Al(OH)_3$ is insoluble in neutral solution but forms the soluble $Al(OH)_4^-$ ion in basic solutions. Many transition metal hydroxides are not soluble, including iron (II).

(31) (D). The pK_a, or dissociation constant, is a measure of the strength of an acid or a base. The pK_a allows you to determine the charge on a molecule at any given pH, or the pK_a can be calculated from the pH at the inflection points. With titration graphs, it is useful to calculate the equivalence points for the added acid or base. From the volumes and concentrations for each 20 mL of base added, one equivalent of acid is neutralized. Thus, at points A, C, and E, 1, 2, and 3 protons in H_3PO_4 are respectively neutralized. Since we are starting with H_3PO_4 at the left side of the graph, this third inflection point (D) indicates the pK_{a3} for ionization of HPO_4^{2-}.

(32) (B). At point B, 1.5 equivalents of NaOH have been added and there is an equal concentration of $H_2PO_4^-$ and HPO_4^{2-} in solution. At this point, the buffering capacity is at its highest and the pH is changed very little by the addition of base.

(33) (B). Addition of an inert gas does not affect the partial pressures of the reactants and thus doesn't affect the equilibrium. Adding a catalyst only changes the rate at which the mixture reaches equilibrium and doesn't affect the position of equilibrium. Heat can be thought of as a reactant and removing it (by cooling the reaction) shifts the equilibrium to the right (Le-Chatelier's principle).

(34) (C). $\Delta G = \Delta H - T\,\Delta S$.
For a reaction to be spontaneous, ΔG must be negative. From the equation $\Delta G = \Delta H - T\,\Delta S$, we can see that only when ΔH is positive and ΔS is negative can a reaction never be spontaneous.

(35) (D). In the spontaneous ($\Delta G = -$), endothermic ($\Delta H = +$) dissolution of ammonium nitrate, the entropy increases ($\Delta S = +$).

(36) (B). Le Chateliers principle applies; a high temperature and low pressure would shift the equilibrium to the left.

(37) (B). This equation is solved by subtracting the products (multiplied by their coefficients) from the reactants. For elements in their natural state, $\Delta G_f^o = 0$.

(38) (D). Reversing the top equation and the signs for ΔG and ΔH and adding the reversed top equation to the bottom equation satisfies the last oxidation of Cu_2S. Adding up the ΔG and ΔH gives the answer.

(39) (D). In Cl_2O_3, chlorine has an oxidation state of +3. The answers have chlorine in the following oxidation states: Choice (A) +7, choice (B) + 1, choice (C) +7, choice (D) +3.

(40) (A). NaF is a salt of a strong base (NaOH) and a weak acid (HF) and would dissolve to form a basic solution. RbCl is the salt of a strong base (RbOH) and a strong acid (HCl) and would be expected to form a neutral solution. NH_4ClO_4 is the salt of a weak base (NH_4OH) and a strong acid ($HClO_4$) and thus would form an acidic solution.

(41) (D). To determine what reactions can be expected to occur, we need to look at both sides of each reaction and determine which reagents become products and in what direction the reaction goes. Since all of these reactions appear to be going in the opposite direction of our initial table reactions, we need to reverse the sign of the net energetics of the reaction. Hence, a value of + 0.52 becomes –0.52 and a reaction that will not spontaneously occur with no other added energy. The only two reactions with negative signs will become positive and thus be highly likely to be spontaneous and likely to occur with no other added energy or reagents.

(42) (D).

	$2AB_2(g) \rightleftharpoons$	$2AB\,(g)$	$+ B_2(g)$
Initial	2	0	0
Equilibrium	$2(1-x)$	$2x$	x

Moles at equilibrium $= 2(1-x) + 2x + x$
$= 2 - 2x + 2x + x = x + 2.$

$$K_p = \frac{[P_{AB}]^2\,[P_{B_2}]}{[P_{AB_2}]} = \frac{\left(\frac{2x}{x+2}\times p\right)^2\left(\frac{x}{2+x}\times p\right)}{\left[\frac{2(1-x)}{x+2}\times p\right]^2}$$

$$= \frac{\frac{4x^3}{x+2}\times p}{4(1-x)^2} = \frac{4x^2\times p}{2}\times\frac{1}{4}$$

$$x = \left(\frac{2K_p}{p}\right)^{1/3} \qquad (\text{as } 1-x\approx 1,\ 2+x\approx 2)$$

(43) (C). $\alpha = \sqrt{\frac{K_a}{C}} = \sqrt{\frac{6.6\times10^{-4}}{0.01}} = \sqrt{6.6\times10^{-2}} = 0.257$

$[H^+] = C\alpha = 0.01\times0.257 = 2.57\times10^{-3}$

$pH = 3 - \log 2.5 = 2.60$

(44) (B). $2\overset{+7}{Mn}O_4^- + Br^- + H_2O \rightarrow 2MnO_2 + \overset{+4}{Br}O_3^- + 2OH^-$

(45) (C). Glycine $H_3N^+CH_2COO^-$ is more acidic than basic. Instead of K_b value, the second given K_a value is corresponding to the K_b value ($\because\ K_a\times K_b = 10^{-14}$). Hence, overall ionization constant,

$K = K_{a_1}\times K_{a_2} = 4.5\times10^{-3}\times1.7\times10^{-10} = 7.65\times10^{-13}$

$H^+ = \sqrt{KC} = \sqrt{7.65\times10^{-13}\times0.01}$

$= \sqrt{0.765\times10^{-14}} = 0.87\times10^{-7}\,M$

$pH = -\log(0.87\times10^{-7}) = 7.06$

(46) (A). This is a simple centripetal force problem. You need only to list the given information and decide which formula to use.
Given r = 2m and T = 1.5s, you can use

$$F = ma_c = \frac{m4\pi^2 r}{T^2} = 1{,}754.7\,N$$

(47) (A). This problem is a direct application of calculating the work using the equation $W = Fs\cos\theta$.
Here the force, F, is 20 N, and the distance, s, is 10 m. Bill is pushing downward and forward on the mower, so the force vector points forward at an angle 60° below the horizontal. The displacement vector points forward. Hence the angle, θ, between these two vectors is 60°.
Substituting these numbers gives

$W = (20\,N)(10m)(\cos 60°) = (20\,N)(10m)(0.5)$
$W = 100\,J$

The correct answer is therefore 100 J, choice (A).
Note: In this problem, the angle given turned out to be θ in the equation for work. That won't always be the case. If, for example, the angle had been expressed as 30° from the vertical, using cos 30° would have given the wrong answer.

(48) **(C).** This question requires you to understand the distinction between work and power. First, work or energy is measured in joules; power is measured in watts, which are joules per second. Thus, you should immediately eliminate (B) and (D) because neither of them is in the right units. Power is work divided by time: $P_{avg} = W/\Delta t$. The power consumption of a 100-watt light bulb is 100 W, and an hour is 3,600 seconds. Multiply the power by the time to get the total energy consumed.

$$W = P\Delta t = (100\ W)\ (3{,}600\ s) = 360{,}000\ J$$

The correct answer is therefore 360,000 J, choice (C).

(49) **(D).** This question requires you to understand the relationship between a conservative force and potential energy. The potential energy is the amount of work required to move something against the associated conservative force. Recall that work is a force times a distance. Therefore, the answer to this question should involve force multiplied by some distance. All of the answer choices for this question are force multiplied by some quantity, so this fact alone is not enough to eliminate any options. However, choice (D) is the only option that multiplies the force by a distance, making U= (aqz) x the correct answer. Notice that the question says "might," so (D) might represent the associated potential energy, but it might not. If the force is a constant, it will, but if the force varies in some way, there will likely be other numerical factors in the expression to account for the variable nature of the force. Because the question gives no information as to whether the force is constant or variable, we cannot find the exact expression.

(50) **(A).** To answer this question, you must to identify the type of collision and then recall what is conserved in each type of collision. The fact that the two cars are stuck together after the collision is important, because that statement should tell you that it is a completely inelastic collision. In a completely inelastic collision, momentum is conserved (as it is for all collisions). Kinetic energy, however, is conserved only in an elastic collision. Hence, the correct answer is that momentum is conserved but kinetic energy is not conserved.

(51) **(C).** Apply conservation of energy to answer this question. If you take the roller coaster's original level as the zero-point reference for gravitational entirely potential energy. If the roller coaster barely makes it over the top of the hill, it has no speed and consequently no kinetic energy at the top of the hill.

The final energy is therefore entirely gravitational potential energy. In this problem, the initial kinetic energy is converted to the final gravitational potential energy. So $E_i = E_f$ gives $K_i = U_{gf}$

$$\left(\frac{1}{2}\right)mv_i^2 = mgh_f$$

Here the initial speed, v_i, is 20 m/s, and the final height, h_f, is the unknown. Notice that the mass, m, of the roller coaster cancels out, so you can eliminate (D). Think about the consequences if this were not the case: all roller coaster passengers would have to be weighed before getting on the ride to make sure it had the correct mass to climb the hills. If you train yourself to do this type of thinking (i.e., to consider what else would have to be true if a certain answer choice were true), it will often help you to eliminate physically impossible and highly unlikely choices.

Now solve the equation for h_f and insert the numerical values: $h_f = \frac{v_i^2}{(2g)} = \frac{(20m/s)^2}{(2\times 10m/s^2)} = 20m$

The correct answer is therefore 20 m.

(52) **(D).** This question requires that you understand the relationship between conservative forces and potential energy. All conservative forces have an associated potential energy. Nonconservative forces do not have an associated potential energy, because these forces do not result in energy that is stored in a recoverable way. Gravitational and spring forces are examples of conservative forces. Frictional forces are not conservative; when friction acts, energy is "lost" as heat rather than being stored as potential energy. Total energy is still conserved but not in the same way that it is when a conservative force acts.

(53) **(B).** This question requires you to compute the centripetal force and to recognize that it acts in an inward direction. For the mud to stick to the tire and thus to continue moving in uniform circular motion, it must have an inward centripetal force acting on it. Hence, the choices containing outward forces can immediately be eliminated. Now compute the amount of the entripetal force, F_c, using $F_c = mv^2/r$

where m is the mass of the clump of mud, v is the linear speed of the mud, and r is the radius of the circular motion. In this case, the linear speed of the rotating tire is the same as the speed of the car because the mud is on the outside edge of the tire.

The radius of rotation is the same as the radius of the tire for the same reason. Substituting these numbers into the equation gives

$$F_c = \frac{(0.5kg)\ (10m/s)^2}{0.2m} = 250\ N$$

So the answer is 250 N inward.

(54) **(D).** To solve this problem, you need to apply the angular kinematic equations. To remember these equations, it helps to use the analogy between translational and rotational motion. The relevant equation in this case is translational motion: $v = v_0 + at$

So the analogous rotational form is where ω and ω_0 are the final and initial angular velocities, a is the angular acceleration, and t is the time. Notice the analogous form between the translational and rotational equations. Use this analogy to aid you in recalling the angular kinematic equations when you need them.

Now substitute the values from the problem into the above equation: $\alpha = 3\ rad/s^2$, t = 5s, and $\omega_0 = 2$ rad/s. The substitution gives

$\omega = 2\ rad/s + (3\ rad/s^2)(5s)$

$\omega = 2\ rad/s + 15\ rad/s = 17\ rad/s$

So the correct answer is 17 rad/s.

(55) **(A).** To answer this question, you must recall the law of conservation of angular momentum in its entirety. Many people will incompletely recall this law as stating, "Angular momentum is always conserved," which is not correct. The correct statement of the law is "When the net external torque is zero, the angular momentum of an isolated system is conserved."

You should notice that the same thing is true for the conservation of momentum in the translational case. Momentum is not always conserved; rather the momentum of an isolated system with a net external force of zero is always conserved. Conservation of angular momentum is analogous to conservation of momentum.

Now in this situation, the adult is pushing the merry-go-round. The adult is not on the merry-go-round, so he or she is supplying an external torque to it. The merry-go-round is, therefore, not an isolated system. The correct answer is that the angular momentum is not conserved because the adult is supplying an external torque to the merry-go-round.

(56) **(A).** First, look at the units. Only (A) and (C) have the correct units for tension, which should be force units. Eliminate the other choices. Here the tension, T, in the rope provides the centripetal force, F_c, needed for the circular motion, so the tension is the centripetal force:

$$T = F_c = \frac{mv^2}{r} = \frac{mv^2}{L}$$

where m is the mass of the rock and v is the linear speed. The radius, r, of the circular motion is in this case the length, L, of the rope. To find the speed, u, of the rock, note that it travels a complete circle in a time, t. The distance traveled is just the circumference of the circle, so using the speed as the distance divided by the time gives us $v = \frac{2\pi L}{t}$

Squaring the speed and substituting it into the equation for the centripetal force gives us

$$T = \frac{4\pi^2 mL^2}{t^2 L} = \frac{4\pi^2 mL}{t^2}$$

(57) **(B).** To set up this problem, we need to remember that the force of friction is no more than the coefficient of friction multiplied by the normal force. In this case, the normal force is going to be the force that keeps you moving in circular motion. Also, the force of friction that keeps you on the wall is going to have to be equal to the weight of the rider.

With this in mind, $F_f = \mu F_N$; $mg = \mu mr\omega^2$

Solving for μ gives us this: $\mu = \frac{g}{r\omega^2}$

(58) **(A).** Distance of corner mass from opposite side = r

$$r^2 = \ell^2 - \left(\frac{\ell}{2}\right)^2 = \frac{3\ell^2}{4} \; ; \; I = mr^2 = \frac{3}{4}m\ell^2$$

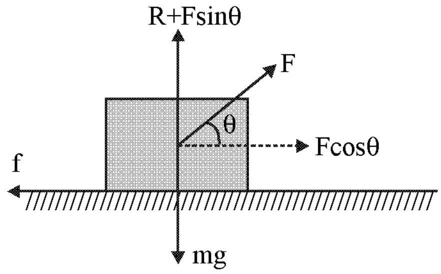
(59) **(A).** Work done by force
= Area under force-displacement graph.

$$= 3 \times 3 + \frac{1}{2} \times 3 \times 3 = 9 + 4.5 = 13.5\ J$$

(60) **(C).** At maximum compression the whole kinetic energy of ball = potential energy of spring.

$$\frac{1}{2}mv^2 = \frac{1}{2}kx^2 \Rightarrow x = v\sqrt{\frac{m}{k}} \; ; \; x = 1.5 \times \sqrt{\frac{5}{5}} = 1.5m$$

(61) **(B).** Because the block moves with a uniform velocity, the resultant force is zero. Resolving F into horizontal component F cos θ and vertical component F sin θ, we get R + F sin θ = mg or R = mg – F sin θ



Also f = μ R = μ (mg – F sin θ)

But F cos θ = f or Fcos θ = μ (mg – Fsin θ)

or F (cos θ + μ sin θ) = μ mg

$$\therefore \quad F = \frac{\mu mg}{\cos\theta + \mu \sin\theta}$$

Work, W = Fs cos θ

$$\therefore \quad W = \frac{\mu mgd\cos\theta}{\cos\theta + \mu\sin\theta} \qquad (\because \; s = d)$$

(62) **(D).** If M is mass of the square plate before cutting the holes, then mass of portion of each hole,

$$m = \frac{M}{16R^2} \times \pi R^2 = \frac{M\pi}{16}$$

∴ Moment of inertia of remaining portion about Z-axis

$$I = I_{square} - 4\ I_{hole}$$

$$= \frac{M}{12}(16R^2 + 16R^2) - 4\left[\frac{mR^2}{2} + m(\sqrt{2}R)^2\right]$$

$$= \frac{M}{12} \times 32R^2 - 10mR^2 = \frac{8}{3}MR^2 - \frac{10}{16}MR^2\pi$$

$$I = \left(\frac{8}{3} - \frac{10\pi}{16}\right)MR^2$$

(63) **(A).** Velocity of centre of mass is

$$\vec{v}_{CM} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2}{m_1 + m_2}$$

Given, $m_1 = 4$ kg, $m_2 = 5$ kg, $v_1 = 5\hat{j}$ m/s $v_2 = 3\hat{i}$ m/s

$$\therefore \quad \vec{v}_{CM} = \frac{4\times 5\hat{j} + 5\times 3\hat{i}}{5+4} = \frac{20\hat{i}}{9} + \frac{15}{9}\hat{j}$$

Hence, magnitude

$$|\vec{v}_{CM}| = \sqrt{\left(\frac{20}{9}\right)^2 + \left(\frac{15}{9}\right)^2} = \frac{25}{9} \text{ m/s}$$

(64) **(C).** Energy of balls at rest, $K_1 = mgh_1$ and $K_2 = mgh_2$

$$\text{Percentage loss in KE} = \frac{K_1 - K_2}{K_1}\times 100$$

$$\frac{25}{100} = \left(\frac{12-h_2}{12}\right) \Rightarrow \frac{25\times 12}{100} = 12 - h_2$$

$\Rightarrow \; h_2 = 12 - 3 = 9$m

(65) **(D).** Given, $I = 4$ kg-m^2, $\tau = 8$N-m and $t = 20$s

$\tau = I\alpha$

$$\Rightarrow \; \alpha = \frac{\tau}{I} = \frac{8}{4} = 2 \; ; \; \theta = \frac{1}{2}\alpha t^2 = \frac{1}{2}\times 2\times 20\times 20 = 400$$

$\omega = \tau\theta = 8\times 400 = 3200$ J

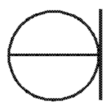
(66) **(A).** From conservation of linear momentum

$$5m\,(40\hat{i} + 50\hat{j} - 25\hat{k})$$

$$= m\,(200\hat{i} + 70\hat{j} + 15\hat{k}) + 4m\,(x\hat{i} + y\hat{j} + z\hat{k})$$

$$\Rightarrow \; x\hat{i} + y\hat{j} + z\hat{k} = 45\hat{j} - 35\hat{k}$$

(67) **(D).** The moment of inertia of a disc which is a tangent and parallel to its $\frac{5}{4}MR^2$.



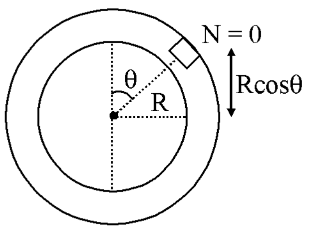
(68) **(C).** $|L_1| = mvd = mv4$; $|L_2| = 0$

$|L_3| = mv3$; $|L_4| = 0$

(69) **(B).** $a_{avg} = \frac{\Delta v}{\Delta t} = \frac{2v}{(\pi r/v)} = \frac{2v^2}{\pi R}$

(70) **(C).** By conservation of energy

$$\frac{1}{2}mu^2 = \frac{1}{2}mv^2 + mg\,(R + R\cos\theta)$$



$v^2 = u^2 - 2gR\,(1+\cos\theta)$ .... (1)

$$F_c = \frac{mv^2}{R} = mg\cos\theta$$

$v^2 = gR\cos\theta$ .... (2)

Solving (1) and (2), $\cos\theta = 2/3$

Angle with downward vertical $= \pi - \cos^{-1}(2/3)$

(71) **(D).** Impulse = Area of F – t graph

$$\int F\,dt = -2$$

$P_f - P_i = -2$

$P_f = P_i - 2 = 0$

(72) **(D).** The kinetic energy of centre of mass remains unchanged. Since external force is zero.

(73) **(A).** Work energy theorem equation

$W_{ext} - \Delta U = \Delta KE$

$W_{ext} = U_f - U_i = [20 + 2\times(4) + 4\,(4)^2] - 20 = 72$ J

(74) **(B).** As displacement of block with respect to lift is zero, hence work done by normal force is zero.

(75) **(C).** Change in KE of block = Work done by springs

$$0 - \frac{1}{2}mv^2 = -\frac{1}{2}4Kx^2$$

$$\therefore \quad Kx^2 = \frac{mv^2}{4} \Rightarrow x^2 = \frac{mv^2}{4K} \; ; \; x = \sqrt{\frac{mv^2}{4K}}$$

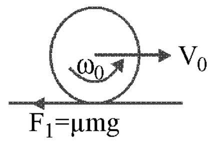
(76) **(A).** Taking moment about A ,

$$mg\times\frac{\ell}{2} + mg\ell = I_A\alpha$$

$$\alpha = \frac{\frac{3}{2}mg\ell}{\frac{m\ell^2}{3} + m\ell^2} = \frac{9}{8}\frac{g}{\ell}$$

(77) **(D).** $\vec{\tau} = \vec{r}\times\vec{F} = (-1\hat{i} + 1\hat{j})\times(-10\hat{k}) = -10\hat{i} - 10\hat{j}$

(78) **(B).** Kinetic energy can become zero only for the case shown in figure



$$\text{Torque equation : } (\mu mg)\cdot R = \frac{MR^2}{2}\alpha \Rightarrow \alpha = \frac{2\mu g}{R}$$

Therefeore, $t = \frac{\omega_0}{\alpha} = \frac{\omega_0 R}{2\mu g}$ .... (1)

For translational motion : $t = \frac{v_0}{\mu g}$ .... (2)

From eq. (1) and (2), $\frac{\omega_0 R}{2\mu g} = \frac{v_0}{\mu g}$

$$\omega_0 = \frac{2v_0}{R} = \frac{2\,(10)}{0.2} = 100 \text{ rad/sec.}$$

(79) **(B).** Acceleration $= \frac{\Sigma F}{M} = \frac{F}{M}$ (friction force is zero)

(80) **(B).** $a_{net} = \sqrt{a_t^2 + a_c^2}$

$\omega^2 = \omega_0^2 + 2\alpha\theta \qquad \because \omega_0 = 0$

So, $\omega^2 = 2\alpha\theta$; $\omega^2 R = 2\,(\alpha R\theta)$

$a_c = \omega^2 R = 2a_t\theta$

$1 = \sqrt{0.36 + (1.2 \times \theta)^2}$

$\Rightarrow 1 - 0.36 = (1.2\,\theta)^2 \Rightarrow \frac{0.8}{1.2} = \theta \Rightarrow \theta = \frac{2}{3}$ radian

(81) **(D).** $F = \frac{mv^2}{r} \Rightarrow v^2 = \frac{Fr}{m} \Rightarrow v = \sqrt{\frac{Fr}{m}}$

(82) **(C).** Loss in P.E. $= \Delta U = mg\,(h_i - h_f)$

$\therefore \frac{\Delta U}{U_i} = \frac{h_i - h_f}{h_i} = 1 - \frac{h_f}{h_i}$

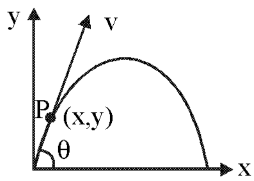
% Loss $\left(1 - \frac{h_f}{h_i}\right) = \left(1 - \frac{10}{20}\right) \times 100 = 50\%$

(83) **(A).** In figure, a block is projected at an angle θ in X-Y plane After some time particle reaches at point P, at this point, its momentum becomes p, let its mass is m.

$\therefore$ $p = mv$; $p/m = v$ (velocity at point P)

Kinetic energy,

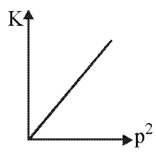
$K = \frac{1}{2}mv^2 = \frac{1}{2}\left(\frac{p^2}{m^2}\right)$



$K = \frac{1}{2}\left(\frac{p^2}{m}\right)$

$K \propto p^2$

Graph between K and p^2 will be as shown :

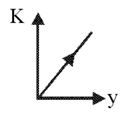


Velocity at point P, $v^2 = u^2 + 2gy$

$v^2 = 2gy$

$\therefore$ $K = \frac{1}{2}m\,(2gy)$ or $K = mgy$ or $K \propto y$

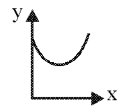
Graph between K and y will be as shown below:



$u_x = \left(\frac{x}{t}\right)$; $K_x = \frac{1}{2}mu_x^2 = \frac{1}{2}m\left(\frac{x^2}{t^2}\right) = \frac{1}{2}\frac{m}{t^2}(x^2)$

or $K_x \propto x^2$

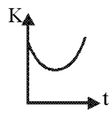
Therefore, graph between K and x will be as shown:



Also $K_y = mgy = mg\left(u_x t + \frac{1}{2}gt^2\right)$

Therefore, required graph will be as shown:

$K_y \propto t^2$

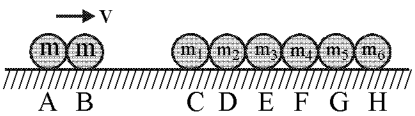


Hence, graph A is wrong.

(84) **(C).** The translational kinetic energy is $\frac{1}{2}Mv^2$, where v is the speed of the center of mass of the wheel. The rotational kinetic energy is $\frac{1}{2}I\omega^2$, where I is the moment of inertia and ω is the angular speed about the axis of rotation.

Since $I = MR^2$ and $\omega = v/R$ for rolling motion, the rotational kinetic energy is $\frac{1}{2}I\omega^2 = \frac{1}{2}(MR^2)\left(\frac{v}{R}\right)^2 = \frac{1}{2}Mv^2$, which is the same as the translational kinetic energy. Thus, the ratio of the two energies is 1.

(85) **(B).**



This is elastic collision with 1st two marbles (A, B). Then remaining marbles (E, F, G, H) remain in rest position, and 1st two marbles at the left move with velocity v.

$2mv = 2mv_1 + 2m_1v_2$

$2v = 2v_1 + 2v_2$

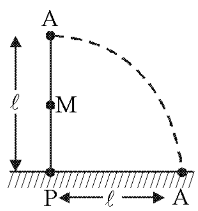
$v = v_1 + v_2$ ......(1)

Also, $v_1 - v_2 = -1\,(v)$ ......(2)

By Eqs. (1) and (2),

$2v_1 = 0 \qquad \therefore \; v_1 = 0$ and $v_2 = v$

(86) **(B).**



When rod fall on horizontal surface then rod will rotate about point P then its potential energy change into rotational kinetic energy. From law of conservation of energy, $Mg\frac{\ell}{2} = \frac{1}{2}I\omega^2$

Since, moment of inertia of rod about point P is

$I = \frac{M\ell^2}{3}$

$$\therefore \quad Mg\cdot\frac{\ell}{2}=\frac{1}{2}\left(\frac{M\ell^2}{3}\right)\omega^2 \; ; \; g\ell=\frac{\ell^2}{3}\left(\frac{v^2}{\ell^2}\right)\Rightarrow v=\sqrt{3g\ell}$$

(87) **(D).** Weight mg = 2 × 10 = 20 N
Work done by the applied force W_F = F h cos 0°.
As the angle between force and displacement is 0°, therefore W_F = 40 × 2 × 1 = 80J
Similarly, work done by its weight
W_{mg} = mg × h × cos 180° = 20 × 2 × –1 = – 40J

(88) **(B).** Let the speed of the third part be v_3.
Applying the law of conservation of momentum, we have $\sqrt{p_1^2+p_2^2}=p \Rightarrow p_1^2+p_2^2=p^2$

$\therefore \quad (m_1v_1)^2+(m_2v_2)^2=(m_3v_3)^2$

$\Rightarrow \quad (m\times v)^2+(m\times v)^2=(2m\times v_3)^2$

$\Rightarrow \quad m^2v^2+m^2v^2=4m^2v_3{}^2$

$\Rightarrow \quad 2m^2v^2=4m^2v_3{}^2 \Rightarrow v_3 = v/\sqrt{2}$

(89) **(A).** The loss in kinetic energy which is transformed into heat $=\frac{1}{2}\left(\frac{m_1m_2}{m_1+m_2}\right)(u_1+u_2)^2$

Here, m_1 = m, m_2 = m/9, u_1 = u, u_2 = 0

$$\text{Loss } \Delta E=\frac{1}{2}\left(\frac{m\times\frac{m}{9}}{m+\frac{m}{9}}\right)\times(u+0)^2=\frac{1}{2}\frac{m}{10}u^2$$

Now, initial kinetic energy = $\frac{1}{2}mu^2$.

Required fraction

$$=\frac{\text{loss in kinetic energy}}{\text{initial kinetic energy}}=\frac{\frac{1}{2}\frac{m}{10}u^2}{\frac{1}{2}mu^2}=\frac{1}{10}=0.1$$

(90) **(B).** Rotational kinetic energy = $\frac{1}{2}I\omega^2$ = 8J

$$\frac{1}{2}\times\frac{1}{2}mr^2\omega^2=8 \text{ or } \frac{1}{4}\times 2\times(1)^2\omega^2=8$$

or $\omega^2 = 16 \Rightarrow \omega = 4$ rad/s
Angular momentum,

$$L=I\omega=\frac{1}{2}mr^2\omega=\frac{1}{2}\times 2\times(1)^2\times 4=4 \text{ J-s}$$

(91) **(A).** Arthropods, like the insect the grasshopper, have open circulatory systems with hemocoels for exchange of nutrients and respiratory gases between the cells and the environment. Arthropods have spiracles, openings in the abdomen, that lead to tracheal tubes that lead into the hemocoels. Earthworms exchange respiratory gases through moist skin; so we say they have an external respiratory surface. The earthworm has a closed circulatory system. Breathing in humans is by negative pressure. Air is drawn into the lungs as the pressure of the chest cavity decreases because the volume is expanded.

(92) **(B).** Arrow A points to the endodermis surrounding the stele that contains the vascular cylinder. Each endodermal cell is surrounded by an impermeable Casparian strip. The endoderm controls what enters the vascular cylinder and, thus, what enters the entire plant.

(93) **(C).** The letter C points to the large, thick-walled, empty-looking structures. These are xylem tubes that carry water and nutrients from the soil up to the leaves.

(94) **(D).** The arrow points at the ground tissue whose function is support and storage. These are parenchymal cells. They have a thin primary cell wall only and provide support because they swell and become turgid.

(95) **(B).** In the apices of some roots, (e.g., Zea mays, maize), there is a central region of cells which normally does not divide. This central inactive region was called quiescent centre by F.A.L. Clowes (1959, 1961). The cells of this region have lesser amounts of RNA and DNA so they have small nuclei. These cells also have a lower rate of protein synthesis. Mitochondria and endoplasmic reticulum are less developed. The cells of the quiescent centre are usually inactive. However, if already existing meristematic cells are injured or become inactive due to any other reason, the cells of quiescent centre become active.

(96) **(A).** A flower may be trimerous, tetramerous or pentamerous when the floral appendages are in multiple of 3, 4 or 5, respectively. Flowers with bracts-reduced leaf found at the base of the pedicel- are called bracteate and those without bracts, ebracteate.

(97) **(C).** Ciliated epithelium is a region of epithelium consisting of columnar or cuboidal cells bearing hairlike appendages that are capable of beating rapidly. Ciliated epithelium performs the functions of moving particles of fluids over the epithelial surface. Cuboidal ciliated epithelium occurs in certain parts of uriniferous tubules whereas columnar ciliated epithelium occurs in fallopian tubules, nasal passages, bronchioles, small bronchi and buccopharyngeal cavity of frog. It often occurs in the vicinity of mucus secreting goblet cells.

(98) **(D).** The vascular system consists of complex tissues, the phloem and the xylem. The xylem and phloem together constitute vascular bundle. In dicotyledonous stems, cambium is present between phloem and xylem. Such vascular bundles because of the presence of cambium possess the ability to form secondary xylem and phloem tissues, and hence are called open vascular bundle. In the monocotyledons, the vascular bundle. have no cambium present in them. Hence, since they do not form secondary tissues they are referred to as closed.

(99) (A). The figure shows structure of lenticel which facilitates gaseous exchange and transpiration These are aerating pores in the bark of woody trees. These are surrounded by loosely arranged thin walled complementary cells enclosing intercellular spaces for gaseous exchange.

(100) (C). These are different arrangements of ovule attachment to inner surface of ovary wall. (a) represents marginal, (b) represents axile, (c) represents parietal, (d) represents free central, (e) represents basal placentation.

(101) (B). Frogs do not have external ears. Instead, they have an eardrum of sorts, called a tympanum, which is just behind each eye. Typhlosole are internal folds of the intestine or intestinal inner wall. Typhlosole occurs in bivalve mollusks, lampreys and some annelids and echinoderms. The gizzard, also referred to as the ventriculus, gastric mill, andgigerium, is an organ found in the digestive tract of some animals, including birds, reptiles, earthworms and some fish. This specialized organ constructed of thick, muscular walls is used for grinding up food; often rocks are instrumental in this process. In certain insects and mollusks, the gizzard features chitinous plates or teeth. Humans have 12 pairs of cranial nerves. Cockroach belongs to class insecta of phylum arthropoda.

(102) (D). Earthwork act as *detrivore* or decomposer because it is able to break the large compound into smaller dead decayed ones.

(103) (D). The vascular bundles in monocots are closed.

(104) (C). Xylem has wood fibres.

(105) (A). *Hibiscus* (bhindi) is an example of a capsule. A capsule fruit is formed from a syncarpous gynoecium and splits at maturity to liberate the seeds.

(106) (C). *Zizyphus* and bamboo have parallel venation. Mango has unicostate, reticulate venation.

(107) (A). Hadrocentric or amphicribal vascular bundle is a concentric vascular bundle with xylem in the centre surrounded by phloem.

(108) (A). A Collenchyma is a simple living tissue with desposition of hemicellulose pectin and cellulose.

(109) (D). Flowers showing basipetal succession are arranged in cymose inflorescence. Ceasalpinia and gold mohur have flowers in acropetal succession i.e. racemose inflorescence.

(110) (D). Rat(mammals) has enucleated (non-nucleated) erythrocytes.

(111) (D). Common duct of salivart reservoir opens at the base of the hypopharynx in cockroach.

(112) (A). Each leg is formed of 5 podomeres.

(i) Coxa is the basal stout portion of the leg, articulating with the ventral side of the thoracic segment. It is hollow internally and is filled with striated muscle fibres.

(ii) Trochanter is a small triangular segment moving freely on coxa and fixed to femur.

(iii) Femur is a long and stout part of leg but is comparatively narrower than the coxa. It is the strongest part of walking leg and is beset with stiff chitinous sensory bristles.

(iv) Tibia is comparatively longer and slender and is covered by large number of bristles.

(v) Tarsus is the lowermost five-segmented part of leg. Each segment is called tarsomere. These are small and clothed with chitinous bristles. The distal end of each tarsomere has a soft adhesive pad and plantulae. The last podomere is known as pretarsus and ends into a pair of small hooked claws.

Between the bases two claws is present a soft, hollow, hair covered pad called pulvillus or arolium.

It is used for holding smooth surface while climbing, running or walking.

(113) (A).

(114) (B). Cyathium inflorescence consists of a single central female flower surrounded by many groups of male flowers. In each group the male flowers are borne in scorpiod manner and the inflorescence is surrounded by an involucre, e.g., *Euphorbia*.

(115) (D). Isobilateral leaf is found in monocots and both the surfaces of leaf are covered by epidermis. The upper epidermis possesses gropus of larger sized, thin walled vacuolate cells called bulliform or motor cells. They help in rolling of leaves during drought.

(116) (D).

(117) (B). Hanstein 1868 recognised three embryonic zones in shoot apex and four in root apex and called them as histogen. The histogens are

(i) Dermatogen $\rightarrow$ Epidermis

(ii) Periblem $\rightarrow$ Cortex

(iii) Plerome $\rightarrow$ Stele and pith

(iv) Calyptrogen $\rightarrow$ Root cap (only in root apex)

(118) (A). Idioblasts are stellate calcium oxalate crystals usually found in the aerenchyma of aquatic plants to give support to the tissue. When the parenchyma cells in the cortex possess well developed air spaces such tissue is known as aerenchyma.

Blastomeres are the cells resulting from early cleavage of the ovum. The zygote is transformed from a single cell to a solid mass of cells called the morula, which bears blastomeres.

(119) (C). The vascular tissue in monocotyledonous root consists of alternating strands of xylem and phloem. The xylem forms discrete strands alternating with phloem strands. The centre is occupied by large pith. The bundles are numerous and referred as polyarch. The cambium is absent therefore, secondary growth is not found.

(120) (A).

(121) (B). **Adipose tissue** is modified areolar connective tissue specialized for fat storage. A few large and spherical cells occur in areolar tissue singly or in clusters arround small blood vessels and called as **adipocytes**. Each cell contains a large globule of fat surrounded by a thin peripheral layer of cytoplasm having a nucleus. The tissue, which grows on other tissue is called epithelial

tissue. In epithelial tissue the cells lie close to each other. Their functions are protection, secretion, absorption, respiration, ultrafiltration and sensory.

(122) (A). Parietal placentation is found in Brassicaceae (Cruciferae). Here carpels are fused only by their margins, placentas than appearing as internal ridges on ovary wall.

In marginal type, placenta develops along the junction of two carpels in a unilocular ovary e.g., pea

In axile placentation margins of carpels fold inwards fusion together in centre of ovary to from a single central placenta, ovary is divided into as many compartments as there are carpels, e.g., *Asphodelus, Hibiscus.*

In basal placentation the ovule are few or reduced to one and are borne at the base of ovary, the ovule when solitary often filling the cavity. The ovary is unilocular e.g., Compositae.

(123) (A). Most of the stratified epithelia in adult body are of stratified sequamous epithelium type. The cuboidal or columnar cells of germinative layer rest upon a basement membrane and continuously divide mitotically to produce new layers of cells. Cells of the surface layer are flattened (= squamous). Cells of intermediate layers are mostly polyhedral, larger and bound together by desmosomes.

The squamous stratified epithelium is of two type, i.e., keratinizing and non-keratinizing. Skin epidermis is of keratinzing type, whereas the cornea of eyes, inner surface of eye lids, lining of buccal cavity, lower past of pharynx, oesophagous, vagina and vastibule of nasal cavity are of non-keratinizing type.

(124) (B). **Cyathium** consists of an involucre of 5 fused bracts that encloses a central achlamydeous pedicellate tricarpellary syncarpous female flower surrounded by a number of centrifugally arranged scorpioid groups of achiamydeous pedicellate unistaminate male flowers, e.g., *Euphorbia, Poinsettia.*

Hypanthodium has a flask-shaped fleshy receptacle, a pore or ostiole lined by scales and a short canal bearing hair. Internally the receptacle bears male flowers towards ostiole, female flowers towards base and sterile female flowers between the two, e.g., *Ficus* (peepal, banyan, fig).

Flowers of both these inflorescence are unisexual and pollinated by insects (entomophily). The insect pollinated flowers are brightly coloured possess sweat fragrance and/or produce nectar, i.e., contain nectar glands.

(125) (C). When the development of xylem takes place towards the center of the axis or in other words the protoxylem develops towards the periphery, it is called centripetal xylem and the xylem strand as **exarch**. Exarch and polyarch condition of vascular bundle is found in monocot roots.

(126) (C). Sieve elements contain little cytoplasm and no nucleus. They combine to form a series of tubes connecting the leaves, shoots and roots in a fine network. Food materials are transported from one element to another via perforations termed sieve areas or sieve plates. Cork lacks stomata but it is interrupted by lenticels.

(127) (B). Pith (medulla) of dicot stem occupies the large central part of the dicot stem. It comprises thin walled parenchyma cells with intercellular air spaces. In between each vascular bundle is a band of parenchyma, the medullary rays which continous with the cortex and the pith. The cells of the pith or medulla functions in storage of water and starch, allow exchange of gases through the intercellular air spaces.

(128) (C). A-2, B-1, C-4, D-3

(129) (C). Thermoreceptor sensilla of cockroach are located in the 1st, IInd, IIIrd segment of the tarsus of legs.

(130) (A). The complex nervous system of insect corckroach comprises of central nervous system, perepheral and sympathetic nervous system. The later is autonomous and is also called as **somatogastric nervous system**. It contains four ganglia. Which are, frontal ganglion lies in front of the brain, hypocerebral ganglion lies on the oesophagus. This ganglion is also called as Oesophagus ganglion. Above the crop the **visceral ganglion** is present, which is called as **ingluvial ganglion** and on gizzard at posterior end, **proventricular ganglion** is present, which is converted to viceral ganglion by two nerves.

(131) (D). Pharyngeal nephridia occur between 4th to 6th segments heart and anterior loops communication between dorsal and ventral vessels is established by a pair of pulsatile heart in each of 7th, 9th, 12th and 15th segments.

(132) (A).

(a) Simple squamous epithelium : Lining of alveoli of lungs

(b) Simple cuboidal epithelium : Lining of thyroid vesicles, liver, uriniferous tubules.

(c) Non-ciliated simple columnar nor epithelium : Mucosa of stomach and intestine form, the inner surface of major portion of alimentary canal.

(d) Transitional epithelium : Ureters, wall of urethra.

(e) Pseudostratified non-ciliated columnar epithelium : Epididymis, responsible for production of gametes.

(133) (D). In dicot root, pericycle is a layer of thin walled parenchyma cells present below the endodermis. Cells are rectangular in shape and shows active cell divisions. It gives lateral roots.

- In monocot root pericycle is composed of thin walled, rectangular parenchymatous cells. The pericycle cells produce lateral roots alone. It does not involve in secondary growth. In old and mature roots, it becomes sclerenchmyatous and useful for mechanical growth.
- In dicot root some endodermal cells opposite to protoxylem have no casparian thickenings called passage cells.

- In roots, xylem is exarch or centripetal, i.e., protoxylem or first formed xylem lies towards the centre (pith).

(134) (B). The living mechanical tissue is collenchyma. It is found in young stems, petioles, peduncles, pedicels, veins, veinlets and leaf margins. It is absent in root system of all plants and stem and leaves of monocots. The cells present in collenchyma are called collocytes.

(135) (D).

(a) The apices of Stachys underground branches. Store food materials and become tuberous. These are called stem tubers. In Stachys *tubifera* the reserve food is **stachyose**.

(b) In *Mentha* and *Chrysanthmum* the underground branches grow obliquely upward from the axillary buds of nodes present below the soil. These underground branches are called suckers.

(c) In *Jasminum*, rosa and Nerium, the long slender branches, which arise from the base of the stem grow obliquely downwards. When these branches touch the soil the produce adventitious roots. These branches are called stolons.

(d) In *Hydrocotyle vulgaris, Lippia nodiflora* and *Oxalis* (weak, stemmed plants), the stems creep on the soil and are rooted at every node. When the internode breakoff, the node lead an independent life. These weak stammed plants are called runners.

(136) (C). In mammals the teeth are heterodont (ie, consists of incisors, canines, premolar and molars), thecodont (in sockets of jaw bones). The brain has 12 pair of cranial nerves.

(137) (D). The heart of cockroach lies mid-dorsally below the terga in the pericardial sinus. It consists of thirteen contractile chambers. The first three are present in the thoracic segments while the remaining ten chambers are placed in abdominal segments.

(138) (A). White fibrous connective tissue is a modified areolar connective tissue. These are formed of collagen protein which changes to gelatin protein by boiling. It gives tensile strength.

(139) (A).

(140) (B). Phellogen or cork cambium are sec lateral meristem formed during extra stellar sec. growth
Fascicular cambium is primary lateral meristem formed during primary growth. It is remaining of procambium.

(141) (D). Endodermis of monocot root, that is, Suberin – 'U' shaped thickening.

(142) (A). Statement A is correct and B is wrong
Aerenchyma is a parenchyma.

(143) (A). Complementary cells
Water stomata are hydathode
Passage cells are thin walled endodermal cells of roots
Albuminous cells are parenchyma cells associated with the sieve cells of gymnosperm.

(144) (D). Phellem is cork. Phellogen is cork cambium.

(145) (D).

(146) (A). Collateral vascular bundles are seen in stem and leaves

(147) (D). **(148) (D).** **(149) (D).** **(150) (A).**

(151) (D). i.e., bicarpellary condition

(152) (D). Plants belonging to the family Fabaceae shows descending imbricate aestivation of corolla, stamens 10 ((9) + 1 condition) and marginal placentation.

(153) (C).

(154) (B). Vermicompost is the product or process of composting using various worms, usually red wigglers, white worms, and other earthworms to create a heterogeneous mixture of decomposing vegetable or food waste, bedding materials, and vermicast.
The earthworm species most often used for composting is the Red Wiggler (Eisenia foetida or Eisenia andrei), Blueworms (Perionyx excavatus) may be used in the tropics.

(155) (D)

(156) (D). Frog has no parotid glands but toad has a pair of parotid glands.

(157) (C). Two vertical division takes place simultaneously.

(158) (A). Chitinous jaw (mandible) helps in cutting the food.

(159) (D). **(160) (D).**

(161) (B). Collaterial gland present between the third and fourth abdominal segment of female cockroach that forms egg case. Hemimetabolous type of development is incomplete metamorphosis in which young does not resemble the adult. Life cycles includes three stages namely egg, nymph and adults.

(162) (C). It is a cap-like parenchymatous multicellular structure which protects the root-apex. As the root is continuously growing downwards in to the soil, friction with soil particles wears out the root-cap while its outer cells are being constantly replaced by new growth from its base.

(163) (D). Pneumatophore roots are short which occur in mangrove plants (Halophytes of swampy saline areas near sea shores).

(164) (B). They are thin thread – like adventitious roots which often develop in groups. Fibrous roots provide better and firm anchorage to the plant, *e.g.,* Grass.

(165) (B) **(166)** (A) **(167)** (A)

(168) (C) **(169)** (C) **(170)** (D)

(171) (A) **(172)** (A)

(173) (A). (i) Septal nephridia, present on both the sides of intersegmental septa of segment 15 to the last that open into intestine, (ii) integumentary nephridia, attached to lining of the body wall of segment 3 to the last that open on the body surface and (iii) pharyngeal nephridia, present as three paired tufts in the 4th, 5th and 6th segments.

(174) (C).

(175) (B). The cuboidal epithelium is composed of a single layer of cube-like cells. This is commonly found in ducts of glands and tubular parts of nephrons in kidneys and its main functions are secretion and absorption. The epithelium of proximal convoluted tubule (PCT) of nephron in the kidney has microvilli.

(176) (C) **(177)** (C) **(178)** (B)

(179) (D) **(180)** (B)