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CHEMISTRY TEST - CHAPTER 8: CHEMICAL EQUILIBRIUM

Name:		Roll No.		Section:

Total Time: 2:30 Hour
Time Allowed: 150 Minutes

Total Marks: 150

PAPER OBJECTIVE
SECTION-A (MARKS 150)

NOTE: Section-A is compulsory. All parts of this section are to be answered on these pages and handed over to the center superintendent. Deleting / overwriting is not allowed. Do not use lead pencil.

Q.1 Fill the relevant bubble for each part. All parts carry one mark.

Questions	A	B	C	D	A B C D
1. A reaction in which the reactants are completely consumed and converted into products is called a(n):	dynamic reaction	reversible reaction	irreversible reaction	equilibrium reaction	○○●○
2. An irreversible reaction stops when the:	temperature is raised	catalyst is added	limiting reactant is used up	pressure is lowered	○○●○
3. A reaction that occurs in both forward and backward directions is called a:	irreversible reaction	reversible reaction	combustion reaction	nuclear reaction	○●○○
4. In a reversible reaction, the net formation of products ends:	before all of the limiting reactant is consumed	only when a catalyst is added	only at high pressure	after all the limiting reactant is consumed	●○○○
5. Reversible reactions do not go to completion even when:	stoichiometric amounts of reactants are taken	a catalyst is present	pressure is high	temperature is low	●○○○
6. A double arrow (⇌) in a chemical equation indicates that the reaction is:	irreversible	endothermic	reversible	exothermic	○○●○
7. Which of the following is a macroscopic event?	Breaking of bonds	Change in colour	Collision between molecules	Rearrangement of atoms	○●○○
8. Which of the following is a microscopic event?	Change in volume	Formation of a precipitate	Collisions between molecules	Evolution of heat	○○●○
9. Macroscopic events are the result of:	many simultaneous microscopic events	no microscopic events	a single microscopic event	nuclear changes only	●○○○
10. A change in volume or pressure of a reaction mixture is a:	atomic event	microscopic event	nuclear event	macroscopic event	○○○●
11. Loss or gain of electrons is an example of a:	microscopic event	physical event only	macroscopic event	visible event	●○○○
12. When steam and carbon monoxide are mixed, the forward reaction starts with:	constant speed	negative speed	maximum speed	zero speed	○○●○
13. When steam and carbon monoxide are mixed, the reverse reaction starts with:	infinite speed	the same speed as forward	zero speed	maximum speed	○○●○
14. As a reversible reaction proceeds towards equilibrium, the rate of forward reaction:	remains constant	gradually increases	gradually decreases	becomes zero	○○●○

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Questions	A	B	C	D	A B C D
15. As a reversible reaction proceeds towards equilibrium, the rate of the reverse reaction:	remains zero	gradually increases	gradually decreases	remains constant	○●○○
16. Chemical equilibrium is reached when the rate of forward reaction is:	twice the rate of reverse reaction	equal to the rate of reverse reaction	zero	half the rate of reverse reaction	○●○○
17. At chemical equilibrium, the concentrations of reactants and products:	become zero	become constant	keep changing	become equal	○●○○
18. Chemical equilibrium is called dynamic because:	only the forward reaction continues	the forward and reverse reactions continue at equal rates	only the reverse reaction continues	all reactions stop	○●○○
19. At equilibrium, the reaction appears to have stopped because:	the composition of the mixture does not change	no bonds are broken	the molecules have stopped colliding	the temperature is zero	●○○○
20. Which of the following is NOT a condition for equilibrium?	Reaction must be irreversible	Constant temperature	Closed system	Reaction must be reversible	●○○○
21. Equilibrium can be established only in a:	vacuum only	open system	closed system	system with an excess of products	○○●○
22. In a graph of concentration versus time, the plots of reactants and products at equilibrium become:	zig-zag	crossing each other	vertical	parallel to the time axis	○○○●
23. The law of mass action was proposed by:	Bohr and Rutherford	Guldberg and Waage	Le Chatelier and Haber	Arrhenius and Hess	○●○○
24. The law of mass action was proposed in the year:	1840	1889	1864	1905	○○●○
25. According to the law of mass action, the rate of a reaction is proportional to the product of the:	masses of the products	active masses (molar concentrations) of the reactants	temperatures of the reactants	volumes of the products	○●○○
26. The term "active mass" means the concentration of a substance in:	kg m^{-3}	g cm^{-3}	mol dm^{-3}	mol kg^{-1}	○○●○
27. For the reaction aA + bB ⇌ cC + dD, the equilibrium constant expression K_c is:	$[A]^a[B]^b$ / $[C]^c[D]^d$	$[C]^c[D]^d$ / $[A]^a[B]^b$	[C][D] / [A][B]	$[A]^c[B]^d$ / $[C]^a[D]^b$	○●○○
28. In the expression of K_c, the concentrations of products are written in the:	exponent	denominator	subscript	numerator	○○○●
29. In the expression of K_c, each concentration is raised to a power equal to its:	oxidation number	molar mass	atomic number	stoichiometric coefficient	○○○●
30. The equilibrium constant K_c is the ratio of the rate constants:	k_f / k_r	$k_f - k_r$	k_r / k_f	$k_f \times k_r$	●○○○
31. K_c for $N_2 + 3H_2 \rightleftharpoons 2NH_3$ is:	$[N_2][H_2]^3$ / $[NH_3]^2$	$[NH_3]^2$ / $[N_2][H_2]^3$	$[NH_3]^2$ / $[N_2][H_2]$	$[NH_3]$ / $[N_2][H_2]$	○●○○

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Questions	A	B	C	D	A B C D
32. K_c for $2SO_2 + O_2 \rightleftharpoons 2SO_3$ is:	$[SO_3]^2 / [SO_2]^2[O_2]$	$[SO_3]^2 / [SO_2][O_2]$	$[SO_2]^2[O_2] / [SO_3]^2$	$[SO_3] / [SO_2][O_2]$	● ○ ○ ○
33. K_c for $H_2 + I_2 \rightleftharpoons 2HI$ is:	$[HI] / [H_2][I_2]$	$[HI]^2 / [H_2][I_2]$	$[H_2][I_2] / [HI]^2$	$[HI]^2 / [H_2] + [I_2]$	○ ● ○ ○
34. K_c for $N_2O_4 \rightleftharpoons 2NO_2$ is:	$[NO_2]^2 / [N_2O_4]$	$[N_2O_4][NO_2]^2$	$[N_2O_4] / [NO_2]^2$	$[NO_2] / [N_2O_4]$	● ○ ○ ○
35. The value of K_c depends on:	volume of the container	initial concentration of products	temperature	initial concentration of reactants	○ ○ ● ○
36. For a given reaction at a given temperature, the value of K_c is:	zero	infinite	different for different initial amounts	constant	○ ○ ○ ●
37. K_c is the same whether the reaction is started with:	only products	pure reactants or pure products	only reactants	only a catalyst	○ ● ○ ○
38. If K_c is greater than 1, at equilibrium the concentration of:	products is greater than that of reactants	products is zero	products equals reactants	reactants is greater than that of products	● ○ ○ ○
39. If K_c is less than 1, at equilibrium the concentration of:	reactants is greater than that of products	reactants equals products	reactants is zero	products is greater than that of reactants	● ○ ○ ○
40. A very large value of K_c means that the reaction:	is endothermic only	is at equilibrium initially	hardly proceeds	goes nearly to completion	○ ○ ○ ●
41. The magnitude of K_c indicates the:	rate of reaction	position of equilibrium	catalyst needed	activation energy	○ ● ○ ○
42. At 500 °C, $[A_2] = 0.399$ M, $[B_2] = 1.197$ M and $[AB] = 0.203$ M for $A_2 + B_2 \rightleftharpoons 2AB$. K_c is about:	0.17	0.41	11.6	0.086	○ ○ ○ ●
43. For the reaction $2A \rightleftharpoons B$, equilibrium concentrations are [A] = 0.5 M and [B] = 0.25 M. K_c is:	0.25	1.0	2.0	0.5	○ ● ○ ○
44. For the reaction $A + B \rightleftharpoons C$, equilibrium concentrations are [A] = 0.1 M, [B] = 0.2 M and [C] = 0.4 M. K_c is:	0.2	20	2	0.02	○ ● ○ ○
45. For the reaction $A \rightleftharpoons 2B$, equilibrium concentrations are [A] = 0.1 M and [B] = 0.2 M. K_c is:	2	0.2	4	0.4	○ ○ ○ ●
46. For gases, the equilibrium constant can also be expressed in terms of:	colours	partial pressures	melting points	boiling points	○ ● ○ ○
47. The partial pressure of a gas at constant temperature is directly proportional to its:	atomic number	molar mass	density of the container	molar concentration	○ ○ ○ ●
48. K_p for $N_2 + 3H_2 \rightleftharpoons 2NH_3$ is:	$P_{N_2} P_{H_2}^3 / P_{NH_3}^2$	$P_{NH_3}^2 / P_{N_2} P_{H_2}^3$	$P_{NH_3}^2 / P_{N_2} P_{H_2}^3$	$P_{NH_3}^2 / P_{N_2} P_{H_2}$	○ ○ ● ○

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49. The relationship between K_p and K_c is:	$K_p = K_c(RT)^{\Delta n}$	$K_p = K_c + RT$	$K_p = K_c / RT$	$K_p = K_c(RT)^{-\Delta n}$	●○○○
50. In $K_p = K_c(RT)^{\Delta n}$, Δn is the:	moles of reactants minus moles of products	total moles of all species	moles of gaseous products minus moles of gaseous reactants	difference of pressures	○○●○
51. For $N_2 + 3H_2 \rightleftharpoons 2NH_3$, the value of Δn is:	0	+2	−2	−4	○○●○
52. For $2SO_2 + O_2 \rightleftharpoons 2SO_3$, the value of Δn is:	+1	0	−1	−3	○○●○
53. For $N_2O_4 \rightleftharpoons 2NO_2$, the value of Δn is:	−1	0	+1	+2	○○●○
54. For $H_2 + I_2 \rightleftharpoons 2HI$, K_p is equal to K_c because Δn is:	two	one	negative	zero	○○○●
55. For which reaction is $K_p = K_c$?	$PCl_5 \rightleftharpoons PCl_3 + Cl_2$	$2SO_2 + O_2 \rightleftharpoons 2SO_3$	$N_2 + O_2 \rightleftharpoons 2NO$	$N_2 + 3H_2 \rightleftharpoons 2NH_3$	○○●○
56. For $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, the relationship between K_p and K_c is:	$K_p = K_c(RT)^{-1}$	$K_p = K_c(RT)$	$K_p = K_c(RT)^2$	$K_p = K_c$	○●○○
57. The equilibrium constant in terms of mole fraction is represented by:	K_c	K_x	K_n	K_p	○●○○
58. The equilibrium constant in terms of number of moles is represented by:	K_n	K_c	K_a	K_x	●○○○
59. An equilibrium system in which all reactants and products are in the same phase is called:	homogeneous equilibrium	static equilibrium	heterogeneous equilibrium	dynamic equilibrium	●○○○
60. An equilibrium system involving more than one phase is called:	homogeneous equilibrium	irreversible equilibrium	static equilibrium	heterogeneous equilibrium	○○○●
61. The reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ is an example of:	solid-state reaction	heterogeneous equilibrium	homogeneous equilibrium	irreversible reaction	○○●○
62. The reaction $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ is an example of:	heterogeneous equilibrium	homogeneous equilibrium	irreversible reaction	nuclear reaction	●○○○
63. The esterification of acetic acid and ethanol in solution is an example of:	heterogeneous equilibrium	irreversible reaction	homogeneous equilibrium	decomposition	○○●○
64. The concentrations of pure solids and pure liquids are not included in the K_c expression because:	they are catalysts	their concentrations remain constant	they have no mass	they are gases	○●○○
65. K_c for $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ is:	$[CaCO_3] / [CaO][CO_2]$	$[CaO] / [CaCO_3]$	$[CaO][CO_2] / [CaCO_3]$	$[CO_2]$	○○○●

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Questions	A	B	C	D	A B C D
66. K_p for $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ is:	$1 / P_{CO_2}$	P_{CO_2}	$P_{CaO} P_{CO_2} / P_{CaCO_3}$	P_{CaCO_3} / P_{CO_2}	○●○○
67. K_c for $3Fe(s) + 4H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4H_2(g)$ is:	$[H_2] / [H_2O]$	$[Fe_3O_4][H_2]^4 / [Fe]^3[H_2O]^4$	$[H_2O]^4 / [H_2]^4$	$[H_2]^4 / [H_2O]^4$	○○○●
68. K_c for $FeO(s) + CO(g) \rightleftharpoons Fe(s) + CO_2(g)$ is:	$[CO] / [CO_2]$	$[Fe][CO_2] / [FeO][CO]$	$[FeO][CO] / [Fe][CO_2]$	$[CO_2] / [CO]$	○○○●
69. The progress of the reaction $N_2O_4 \rightleftharpoons 2NO_2$ can be followed spectrometrically because NO_2 is:	blue	colourless	reddish brown	white	○○●○
70. N_2O_4 is a:	colourless gas	green gas	reddish brown gas	yellow solid	●○○○
71. In the spectrometric method, the concentration is determined by measuring the amount of:	radiation absorbed	melting point	boiling point	mass of the sample	●○○○
72. Spectrometry is a ___ method of studying equilibrium.	mechanical	physical	nuclear	chemical	○●○○
73. The esterification of acetic acid with ethanol is studied by titrating acetic acid with standard:	$KMnO_4$ solution	H_2SO_4 solution	HCl solution	NaOH solution	○○○●
74. In titration of acetic acid against NaOH, the indicator used is:	methyl orange only	litmus paper only	phenolphthalein	starch	○○●○
75. In the esterification equilibrium, the concentration of acetic acid with time:	becomes zero	decreases and then becomes constant	increases continuously	remains constant from the start	○●○○
76. In the esterification reaction of acetic acid and ethanol, a small amount of mineral acid is added as a:	solvent	product	catalyst	reactant	○○●○
77. Le Chatelier's principle states that if a change is imposed on a system at equilibrium, the position of the equilibrium shifts in a direction that:	reduces the imposed change	has no effect	stops the reaction	increases the imposed change	●○○○
78. Le Chatelier's principle is used to predict the effect of changes in:	concentration, pressure and temperature	atomic number	colour, odour and taste	mass and volume of the container	●○○○
79. When the concentration of a reactant is increased at equilibrium, the equilibrium shifts:	neither side	towards the catalyst	towards the reactants	towards the products	○○○●
80. When the concentration of a product is increased at equilibrium, the equilibrium shifts:	towards the products	randomly	neither side	towards the reactants	○○○●
81. When a product is removed from an equilibrium mixture, the equilibrium shifts:	towards the products	neither side	towards the reactants	toward the catalyst	●○○○
82. When a reactant is removed from an equilibrium mixture, the equilibrium shifts:	towards the reactants	towards the products	randomly	neither side	●○○○

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Questions	A	B	C	D	A B C D
83. In $CO + H_2O \rightleftharpoons CO_2 + H_2$, adding CO_2 shifts the equilibrium towards the:	CO_2 side	products	reactants	none; no shift occurs	○○●○
84. In $CO + H_2O \rightleftharpoons CO_2 + H_2$, adding more H_2O shifts the equilibrium towards the:	reactants	none; no shift occurs	left side	products	○○○●
85. When more reactant is added, the rate of the forward reaction:	becomes constant at once	remains zero	increases initially	decreases initially	○○●○
86. When a change in concentration occurs, the value of K_c at constant temperature:	decreases	becomes zero	increases	remains unchanged	○○○●
87. When pressure is increased on a gaseous equilibrium, the system shifts toward the side with:	equal gas molecules	no gas molecules	fewer gas molecules	more gas molecules	○○●○
88. When pressure is decreased on a gaseous equilibrium, the system shifts toward the side with:	more gas molecules	fewer gas molecules	equal molecules	no molecules	●○○○
89. In $2SO_2 + O_2 \rightleftharpoons 2SO_3$, an increase in pressure shifts the equilibrium:	to the right	to the catalyst	neither way	to the left	●○○○
90. In $N_2 + 3H_2 \rightleftharpoons 2NH_3$, an increase in pressure shifts the equilibrium:	to the right	randomly	neither way	to the left	●○○○
91. In $N_2 + O_2 \rightleftharpoons 2NO$, a change in pressure:	shifts it to the right	has no effect on the position of equilibrium	shifts it to the left	stops the reaction	○●○○
92. In $H_2 + I_2 \rightleftharpoons 2HI$, an increase in pressure:	shifts the equilibrium to the right	shifts the equilibrium to the left	doubles K_c	has no effect on the position of equilibrium	○○○●
93. In $N_2O_4 \rightleftharpoons 2NO_2$, an increase in pressure shifts the equilibrium to the:	right	left	neither side	both sides equally	○●○○
94. In $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, a decrease in pressure shifts the equilibrium to the:	neither side	right	left	catalyst	○●○○
95. The reaction $CO + 2H_2 \rightleftharpoons CH_3OH$ is used to make methanol. To increase the yield of methanol, the pressure should be:	removed	increased	kept zero	decreased	○●○○
96. In exothermic reactions, heat is written on the:	neither side	top of the arrow	right side of the equation	left side of the equation	○○●○
97. In endothermic reactions, heat is written on the:	right side of the equation	left side of the equation	bottom of the arrow	neither side	○●○○
98. An increase in temperature favours the:	endothermic reaction	both reactions equally	neither reaction	exothermic reaction	●○○○
99. A decrease in temperature favours the:	exothermic reaction	both reactions equally	neither reaction	endothermic reaction	●○○○

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100. $2SO_2 + O_2 \rightleftharpoons 2SO_3$ is exothermic. An increase in temperature shifts the equilibrium to the:	right	neither side	catalyst	left	○○○●
101. For an exothermic reaction, an increase in temperature ___ the value of K_c.	decreases	doubles	increases	does not change	●○○○
102. $N_2O_4 \rightleftharpoons 2NO_2$ has $\Delta H = +57.2$ kJ. An increase in temperature shifts the equilibrium to the:	neither side	catalyst	left	right	○○○●
103. For an endothermic reaction, an increase in temperature ___ the value of K_c.	decreases	does not change	increases	makes it zero	○○●○
104. For $N_2O_4 \rightleftharpoons 2NO_2$, an increase in temperature causes the reddish-brown colour of the mixture to become:	darker	lighter	colourless	unchanged	●○○○
105. The only factor that changes the value of K_c for a given reaction is:	temperature	concentration	pressure	catalyst	●○○○
106. A catalyst added to an equilibrium mixture:	speeds up only the forward reaction	speeds up only the reverse reaction	speeds up forward and reverse reactions equally	shifts the equilibrium to the right	○○●○
107. A catalyst has ___ effect on the equilibrium concentrations of the reaction mixture.	an increasing	a decreasing	a large	no	○○○●
108. A catalyst is important in equilibrium reactions because it:	changes K_c	shifts equilibrium to the right	increases the yield of product	decreases the time to reach equilibrium	○○○●
109. In the Haber process, nitrogen and hydrogen react to form:	nitric acid	ammonia	methane	sulphuric acid	○●○○
110. The Haber process is represented by $N_2 + 3H_2 \rightleftharpoons 2NH_3$ with ΔH equal to:	+57.2 kJ	−92.46 kJ	−198 kJ	+92.46 kJ	○●○○
111. In the Haber process, the forward reaction is:	exothermic with a decrease in moles	endothermic with an increase in moles	endothermic with no change in moles	exothermic with an increase in moles	●○○○
112. According to Le Chatelier's principle, the yield of ammonia in the Haber process is favoured by:	high temperature and low pressure	low temperature and high pressure	high temperature and high pressure	low temperature and low pressure	○●○○
113. The suitable temperature for the Haber process in the book is about:	400 °C	25 °C	100 °C	1000 °C	●○○○
114. The most suitable pressure for the Haber process is:	2000 atm	1–2 atm	200–300 atm	10 atm	○○●○
115. The catalyst used in the Haber process is:	nickel	platinum	vanadium pentoxide	iron with metal oxides	○○○●
116. A catalyst is used in the Haber process because at low temperature the rate of ammonia formation is:	very slow	infinite	zero	very fast	●○○○

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117. The equilibrium mixture in the Haber process contains about ___ ammonia by volume.	100%	35%	10%	90%	○●○○
118. In the Haber process, ammonia is removed from the mixture by:	burning it	filtering it	liquefying it by cooling	absorbing it in sulphuric acid	○○●○
119. Ammonia is liquefied in the Haber process at about:	100 °C	0 °C	−100 °C	−33.4 °C	○○○●
120. In the Haber process, unreacted N_2 and H_2 are:	burnt	converted to water	recycled into the reaction chamber	discarded	○○●○
121. Continuous removal of ammonia shifts the equilibrium towards:	catalyst formation	no change	more reactants	more ammonia production	○○○●
122. The contact process is used to manufacture:	nitric acid	hydrochloric acid	sulphuric acid	ammonia	○○●○
123. The catalyst used in the contact process is:	nickel	iron	platinum	vanadium pentoxide (V_2O_5)	○○○●
124. In the contact process, sulphur dioxide is produced by burning:	nitrogen	carbon	hydrogen	sulphur	○○○●
125. The oxidation of SO_2 to SO_3 has ΔH equal to:	−198 kJ	+198 kJ	+57.2 kJ	−92.46 kJ	●○○○
126. In the contact process, the compromise temperature used is:	1000 °C	450–500 °C	25 °C	100 °C	○●○○
127. In the contact process, the compromise pressure used is about:	20 atm	0.1 atm	200 atm	2 atm	○○○●
128. In the contact process, the compromise temperature is used because a very low temperature:	increases yield only	slows down the reaction speed	stops the reaction completely	has no effect	○●○○
129. High pressure is not used in the contact process because it:	decreases the yield	lowers the rate	stops the reaction	is very expensive to maintain	○○○●
130. A 1:1 ratio of SO_2 and O_2 is used in the contact process because excess O_2:	reduces the concentration of SO_2 and slows the reaction	catalyses the reaction	stops the reaction	raises the temperature	●○○○
131. Only a change in ___ changes the value of the equilibrium constant.	volume	temperature	pressure	concentration	○●○○
132. An equilibrium position is defined as:	a catalyst	the temperature of the system	the value of K_c	a particular set of equilibrium concentrations satisfying K_c	○○○●
133. For a given reaction at a given temperature, the number of equilibrium positions is:	two	one	infinite	zero	○○●○

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134. Industrial chemists use Le Chatelier's principle to:	change the colour of products	maximise yield and minimise waste	lower the cost of containers only	decrease K_c	○●○○
135. At equilibrium, the number of effective collisions for the forward and reverse reactions is:	greater for the forward reaction	zero	greater for the reverse reaction	equal	○○○●
136. At equilibrium, individual molecules of reactants and products:	continue to react in both directions	only combine to form products	only break down to form reactants	stop reacting	●○○○
137. K_p for $N_2O_4 \rightleftharpoons 2NO_2$ is:	$P_{NO_2} / P_{N_2O_4}$	$P_{N_2O_4} P_{NO_2}^2$	$P_{N_2O_4} / P_{NO_2}^2$	$P_{NO_2}^2 / P_{N_2O_4}$	○○○●
138. K_p for $2SO_2 + O_2 \rightleftharpoons 2SO_3$ is:	$P_{SO_2}^2 P_{O_2} / P_{SO_3}^2$	$P_{SO_3} / P_{SO_2} P_{O_2}$	$P_{SO_3}^2 / P_{SO_2} P_{O_2}$	$P_{SO_2}^2 / P_{SO_3}^2 P_{O_2}$	○○○●
139. K_p for $H_2 + I_2 \rightleftharpoons 2HI$ is:	$P_{HI}^2 / P_{H_2} + P_{I_2}$	$P_{HI}^2 / P_{H_2} P_{I_2}$	$P_{HI} / P_{H_2} P_{I_2}$	$P_{H_2} P_{I_2} / P_{HI}^2$	○●○○
140. K_c for $2NO + O_2 \rightleftharpoons 2NO_2$ is:	$[NO_2]^2 / [NO][O_2]$	$[NO]^2[O_2] / [NO_2]^2$	$[NO_2] / [NO][O_2]$	$[NO_2]^2 / [NO]^2[O_2]$	○○○●
141. K_c for $4NH_3 + 5O_2 \rightleftharpoons 4NO + 6H_2O$ is:	$[NO][H_2O] / [NH_3][O_2]$	$[NH_3]^4[O_2]^5 / [NO]^4[H_2O]^6$	$[NO]^6[H_2O]^4 / [NH_3]^5[O_2]^4$	$[NO]^4[H_2O]^6 / [NH_3]^4[O_2]^5$	○○○●
142. K_c for $CH_4 + H_2O \rightleftharpoons CO + 3H_2$ is:	$[CO][H_2]^3 / [CH_4][H_2O]$	$[CO][H_2] / [CH_4][H_2O]$	$[CH_4][H_2O] / [CO][H_2]^3$	$[CO][H_2]^3 / [CH_4]$	●○○○
143. For $CO + 2H_2 \rightleftharpoons CH_3OH$, the value of Δn is:	-1	0	-2	$+2$	○○●○
144. For a reaction, $k_f = 2 \times 10^{-2}$ and $k_r = 1 \times 10^{-3}$. The equilibrium constant is:	200	2×10^{-5}	20	0.05	○○●○
145. If K_c for A ⇌ B is 4, then K_c for the reverse reaction B ⇌ A is:	2	0.25	16	4	○●○○
146. If K_c for A ⇌ B is 2, then K_c for 2A ⇌ 2B is:	4	1	2	8	●○○○
147. When the temperature of an equilibrium system changes, the frequency and energy of molecular collisions change, which:	has no effect	stops the reaction	shifts the equilibrium position	changes the catalyst	○○●○
148. When K_c is greater than 1, the numerator of the equilibrium expression is:	zero	smaller than the denominator	greater than the denominator	equal to the denominator	○○●○
149. In the Haber process, using a catalyst:	changes the enthalpy	increases the equilibrium yield	decreases the equilibrium yield	increases the rate at which equilibrium is reached	○○○●
150. Removal of ammonia as it is formed in the Haber process makes practically ___ conversion of N_2 and H_2 possible.	100%	10%	35%	0%	●○○○

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