COORDINATION COMPOUNDS

1. What is the oxidation state of the central metal ion in the compound: $[Fe(H_2O)_6]Cl_2$?
a) +2 b) +3 c) +4 d) 0

2. What is the oxidation state of the central metal ion in the compound: $K_2[PtCl_6]$?
a) +2 b) +4 c) +7 d) 0

3. What is the oxidation state of the central metal ion in the compound: $[Cu(NH_3)_4]Cl_2$?
a) +2 b) +4 c) +9 d) 0

4. What is the oxidation state of the central metal ion in the compound: $Na_2[PdBr_4]$?
a) +2 b) +5 c) 0 d) +6

5. What is the oxidation state of the central metal ion in the compound: $K[Au(CN)_2]$?
a) +2 b) +3 c) 0 d) +5

6. What is the central metal ion in the compound: $[Fe(H_2O)_6]Cl_2$?
a) Fe b) H_2O c) Cl_2 d) O

7. What is the central metal ion in the compound: $K_2[PtCl_6]$?
a) K b) Pt c) Cl d) Na

8. What is the central metal ion in the compound: $[Cu(NH_3)_4]Cl_2$?
a) Cu b) NH_3 c) Cl d) N

9. What is the central metal ion in the compound: $Na_3[CoBr_6]$?
a) Na b) Co c) Br d) K

10. What is the central metal ion in the compound: $K[Au(CN)_2]$?
a) K b) Au c) CN d) C

11. What is the name of the compound: $[Fe(H_2O)_6]Cl_2$?
a) hexaaquaferrum (II) chloride b) chloropentaamminecobalt (III) chloride
c) ammonium hexachlorotitanate (IV) d) tribromotriaquacobalt (III)

12. What is the name of the compound: $K_2[PtCl_6]$?
a) hexaamineferrum (II) chloride b) potassium hexachloroplatinate (IV)
c) tricholorotriaquacobalt (III) bromide d) hexaqauaferrum (III) hydroxide

13. What is the name of the compound: $[Cu(NH_3)_4]Cl_2$?
a) chloropentaamminecobalt (III) chloride b) hexaaquaferrum (II) hydroxide
c) tetraamminecopper (II) chloride d) ammonium hexachlorotitanate (IV)

14. What is the name of the compound: $Na_3[CoBr_6]$?
a) sodium hexabromocobaltate (III) b) ammonium hexachlorotitanate (IV)
c) chloropentaamminecobalt (III) chloride d) potassium hexachloroplatinate (IV)

15. What is the name of the compound: $K[Au(CN)_2]$?

a) potassium dicyanoaurate (III) b) podium hexabromocobalte (III)
c) chloropantaamminecobalt (III) chloride d) potassium hexachloroplatinate (IV)

16. What is the formula of the compound potassium tetracyanonickelate (II)?
a) $Cu_2[Fe(CN)_6]$ b) $K_2[Ni(CN)_4]$ c) $Na_2[PtCl_6]$ d) $[Fe(H_2O)_4Cl_2]Cl$

17. What is the formula of the compound sodium hexachlorocobaltate (III)?
a) $[Fe(H_2O)_6]Cl$ b) $K_2[Ni(CN)_4]$ c) $Na_3[CoCl_6]$ d) $[Cu(NH_3)_4]Cl_2$

18. What is the formula of the compound tetraamminecopper (II) chloride?
a) $[Fe(NH_3)_6]Br_2$ b) $[Cu(NH_3)_4]Cl_2$ c) $Na_2[PtCl_6]$ d) $K[Ag(CN)_2]$

19. What is the formula of the compound potassium hexachloroplatinate (IV)?
a) $Na_2[PtCl_6]$ b) $K_2[PtCl_6]$ c) $[Co(NH_3)_3Cl_3]$ d) $K_3[CoBr_6]$

20. What is the formula of the compound hexaaquaferrum (II) bromide?
a) $K_2[PtCl_6]$ b) $[Co(NH_3)_3Br_3]$ c) $[Fe(H_2O)_6]Br_2$ d) $[Cu(NH_3)_4]Br_2$

SOLUTIONS

1. A solution is 15.0% by mass magnesium nitrate (Mg $(NO_3)_2$. Calculate how many grams of $Mg(NO_3)_2$ are dissolved in 250g of solution.
a) 37.5 b) 0.06 c) 16.7 d) 15

2. 10 grams of magnesium nitrate (Mg $(NO_3)_2$ are dissolved in 200 g of solution. Calculate mass percent of this solution.
a) 10 b) 5 c) 20 d) 15

3. A solution is 10.0% by mass sodium hydroxide (NaOH). Calculate how many grams of NaOH are dissolved in 150g of solution.
a) 10 b) 20 c) 15 d) 30

4. 100 grams of hydrochloric acid (HCl) are dissolved in 500 g of solution. Calculate mass percent of this solution.
a) 10 b) 100 c) 0.2 d) 20

5. A solution is 20.0% by mass nitric acid (HNO_3). Calculate how many grams of HNO_3 are dissolved in 250g of solution.
a) 50 b) 20 c) 25 d) 10

6. 10 grams of sulfuric acid (H_2SO_4) are dissolved in 50 g of solution. Calculate mass percent of this solution.
a)10 b) 20 c) 60 d) 0.5

7. A solution is 38.0% by mass hydrochloric acid (HCl). Calculate how many grams of HCl are dissolved in 200g of solution.
a) 38 b) 19 c) 76 d) 7.6

8. 5 grams of sodium chloride (NaCl) are dissolved in 100 g of solution. Calculate mass percent of this solution.
a) 10 b) 0.5 c) 15 d) 5

9. A solution is 25.0% by mass calcium nitrate ($Ca(NO_3)_2$). Calculate how many grams of $Ca(NO_3)_2$ are dissolved in 200g of solution.
a) 50 b) 25 c) 8 d) 0.125

10. 15 grams of potassium hydroxide (KOH) are dissolved in 150 g of solution. Calculate mass percent of this solution.
a) 10 b) 20 c) 0.15 d) 15

11. How many moles of the solute are present in 5 liters of a 0,5M solution?
a) 2.5 b) 0.5 c) 5 d) 1

12. How many moles of the solute are present in 3 liters of a 0,3M solution?
a) 1 b) 0.9 c) 0.3 d) 3

13. 98 grams of sulfuric acid (H_2SO_4) are dissolved in 1 liter of solution. Calculate molarity of this solution (molar mass of H_2SO_4 is 98 g/mol)
a) 2 b) 0.5 c) 1 d) 98

14. 40 grams of sodium hydroxide (NaOH) are dissolved in 2 liters of solution. Calculate molarity of this solution (molar mass of NaOH is 40 g/mol)
a) 1 b) 40 c) 2 d) 0.5

15. 36.5 grams of hydrochloric acid (HCl) are dissolved in 1 liters of solution. Calculate molarity of this solution (molar mass of HCl is 36.5 g/mol)
a) 1 b) 2 c) 0.5 d) 36.5

16. The molarity of sulfuric acid (H_2SO_4) solution is 1M. Calculate mass of sulfuric acid (H_2SO_4) in 1 liter of solution (molar mass of H_2SO_4 is 98 g/mol)
a) 49 b) 98 c) 1 d) 2

17. The molarity of sodium hydroxide (NaOH) solution is 2M. Calculate mass of sodium hydroxide (NaOH) in 2 liters of solution (molar mass of NaOH is 40 g/mol)
a) 40 b) 20 c) 80 d) 10

18. The molarity of nitric acid (HNO_3) solution is 1M. Calculate mass of nitric acid (HNO_3) in 0.5 liter of solution (molar mass of HNO_3 is 63 g/mol)
a) 63 b) 126 c) 6.3 d) 31.5

19. The molarity of potassium hydroxide (KOH) solution is 1M. Calculate mass of potassium hydroxide (KOH) in 1 liter of solution (molar mass of KOH is 56 g/mol)
a) 56 b) 112 c) 28 d) 14

20. 98 g of sulfuric acid H_2SO_4 diluted to a volume of 2 liters. Determine the molar concentration of acid in solution (molar mass of H_2SO_4 is 98 g/mol)
a) 1 b) 2 c) 4 d) 0.5

21. Calculate $[H^+]$ in 0.01 M HNO_3.
a) 0.01 b) 0.1 c) 0.02 d) 0.005

22. Calculate $[H^+]$ in 0.01 M H_2SO_4
a) 0.01 b) 0.02 c) 0.005 d) 0.03

23. Calculate $[OH^-]$ in 0.1 M NaOH.
a) 0.2 b) 0.3 c) 0.1 d) 0.05

24. Calculate $[OH^-]$ in 0.1 M $Ca(OH)_2$
a) 0.1 b) 0.2 c) 0.3 d) 0.4

25. What is the H^+ concentration of a solution that has a pH of 3?
a) 3 b) 11 c) 10^{-11} d) 10^{-3}

26. What is the H^+ concentration of a solution that has a pH of 9?
a) 10^{-9} b) 10^{-5} c) 9 d) 5

27. What is the H^+ concentration of a solution that has a pH of 4?
a) 4 b) 10^{-4} c) 10^{-10} d) 10

28. Calculate the pOH of a 0.01 M solution of KOH.
a) 12 b) 14 c) 2 d) 10^{-2}

29. Calculate the pH of a 0.01 M solution of HCl.
a) 12 b) 14 c) 2 d) 10^{-2}

30. Calculate pH of a solution that contains 0.00001 M HNO_3.
a) 9 b) 10^{-9} c) 10^{-4} d) 5

OXIDATION-REDUCTION REACTIONS

1. What is the oxidation state of N in NH_3?
a) +2 b) -3 c) 0 d) +5

2. What is the oxidation state of P in H_3PO_4?
a) +2 b) -3 c) 0 d) +5

3. What is the oxidation state of S in K_2SO_4?
a) +6 b) -3 c) +5 d) 0

4. What is the oxidation state of Br in $HBrO_3$?
a) -3 b) +5 c) +3 d) 0

5. What is the oxidation state of Mn in $KMnO_4$?
a) -3 b) +7 c) -2 d) 0

6. What is the oxidation state of C in Na_2CO_3?
a) +2 b) +1 c) +4 d) 0

7. Complete the process: $Mn^{+7} + ... \rightarrow Mn^{+4}$.

a) $+3\bar{e}$ b) $+7\bar{e}$ c) 0 d) $+5\bar{e}$

8. Complete the process: $Cr^{+2} - ... \rightarrow Cr^{+6}$.
a) $-3\bar{e}$ b) $-4\bar{e}$ c) 0 d) $-1\bar{e}$

9. Complete the process: $N^{0} + ... \rightarrow N^{-3}$.
a) $+3\bar{e}$ b) $+7\bar{e}$ c) 0 d) $+2\bar{e}$

10. Complete the process: $Cl^{0} - ... \rightarrow Cl^{+5}$.
a) $-6\bar{e}$ b) $-1\bar{e}$ c) 0 d) $-5\bar{e}$

11. Complete the process: $P^{+5} + ... \rightarrow P^{-3}$.
a) $+8\bar{e}$ b) $+1\bar{e}$ c) 0 d) $+10\bar{e}$

12. Complete the process: $Fe^{+3} + ... \rightarrow Fe^{0}$.
a) $+2\bar{e}$ b) $+3\bar{e}$ c) 0 d) $+10\bar{e}$

13. Complete the process: $Si^{-4} - ... \rightarrow Si^{+4}$.
a) $-2\bar{e}$ b) $-3\bar{e}$ c) $-8\bar{e}$ d) 0

14. Choose the oxidation process:
a) $NO_2^- + 1\bar{e} \rightarrow NO$ b) $N_2O_5 + 0\bar{e} \rightarrow KNO_3$
c) $HNO_3 + 8\bar{e} \rightarrow NH_4^+$ d) $NO_2^- - 2\bar{e} \rightarrow NO_3^-$

15. Choose the oxidation process:
a) $IO_3^- + 6\bar{e} \rightarrow I^-$ b) $I_2^0 + 2\bar{e} \rightarrow 2I^-$
c) $HIO + 0\bar{e} \rightarrow KIO$ d) $I_2^0 - 5\bar{e} \rightarrow 2IO_3^-$

16. Choose the reduction process:
a) $Fe^{3+} - 3\bar{e} \rightarrow FeO_4^{2-}$ b) $Fe(OH)_2 - 1\bar{e} \rightarrow Fe_2(SO_4)_3$
c) $Fe_2O_3 + 1\bar{e} \rightarrow FeSO_4$ d) $FeCl_2 + 0\bar{e} \rightarrow Fe(OH)_2$

17. Choose the reduction process:
a) $P^0 + 3\bar{e} \rightarrow PH_3$ b) $H_3PO_2 - 2\bar{e} \rightarrow H_3PO_3$
c) $H_3PO_4 + 0\bar{e} \rightarrow Ca_3(PO_4)_2$ d) $PH_3 - 8\bar{e} \rightarrow PO_4^{3-}$

18. Choose the reduction process:
a) $MnO_4^{2-} - 1\bar{e} \rightarrow MnO_4^-$ b) $MnO_4^{2-} + 2\bar{e} \rightarrow MnO_2$
c) $MnO_2 + 0\bar{e} \rightarrow MnO_3^{2-}$ d) $Mn^0 - 2\bar{e} \rightarrow Mn^{2+}$

19. Choose the oxidation process:
a) $HCOOH - 2\bar{e} \rightarrow CO_2$ b) $CO + 6\bar{e} \rightarrow CH_4$
c) $Na_2CO_3 + 0\bar{e} \rightarrow CO_2$ d) $H_2C_2O_4 + 1\bar{e} \rightarrow HCOO^-$

20. Choose the reduction process:
a) $SO_3^{2-} + 4\bar{e} \rightarrow S^0$ b) $SO_3 + 0\bar{e} \rightarrow Na_2SO_4$
c) $SO_3^{2-} - 1\bar{e} \rightarrow SO_4^{2-}$ d) $H_2S - 0\bar{e} \rightarrow S^{2-}$

THERMODYNAMICS

1. Given the reaction $SO_{2(g)} + NO_{2(g)} \leftrightarrow SO_{3(g)} + NO_{(g)}$. What is ΔH^0 of this reaction?

ΔH_f^0 kj/mol	$SO_{2(g)}$	$NO_{2(g)}$	$SO_{3(g)}$	$NO_{(g)}$
	-296.9	33.5	-396.1	90.2

a) -42.5 b) -636.3 c) 42.1 d) -569.3

2. Given the reaction $2CO_{(g)} + 2H_{2(g)} \rightarrow CH_{4(g)} + CO_{2(g)}$ What is ΔH^0 of this reaction?

ΔH_f^0 kj/mol	$CO_{(g)}$	$2H_{2(g)}$	$CH_{4(g)}$	$CO_{2(g)}$
	-111	0	-75	-393.5

a) 579 b) -357c) 357 d) -246,5

3. Given the reaction $2CH_{4(g)} \rightarrow C_2H_{2(g)} + 3H_{2(g)}$ What is ΔH^0 of this reaction?

ΔH_f^0 kj/mol	$CH_{4(g)}$	$C_2H_{2(g)}$	$H_{2(g)}$
	-75	227.0	0

a) 77 b) 377 c) -77 d) -377

4. Given the reaction $2Cl_{2(g)} + 2H_2O_{(g)} \leftrightarrow 4HCl_{(g)} + O_{2(g)}$ What is ΔH^0 of this reaction?

ΔH_f^0 kj/mol	$Cl_{2(g)}$	$H_2O_{(g)}$	$HCl_{(g)}$	$O_{2(g)}$
	0	-241.8	-91.8	0

a) -850.8 b) 850.8 c) 116.6 d) 333.6

5. Given the reaction $2NO_{(g)} + 2H_{2(g)} \leftrightarrow 2H_2O_{(g)} + N_{2(g)}$ What is ΔH^0 of this reaction?

ΔH_f^0 kj/mol	$NO_{(g)}$	$H_{2(g)}$	$H_2O_{(g)}$	$N_{2(g)}$
	90.2	0	-241.8	0

a) -850.8 b) 850.8 c) 664 d) -664

6. Given the reaction $NH_{3(g)} + HNO_{2(l)} \leftrightarrow N_2 + 2H_2O_{(l)}$ What is ΔH^0 of this reaction?

ΔH_f^0 kj/mol	$NH_{3(g)}$	$HNO_{2(l)}$	N_2	$H_2O_{(l)}$
	-46.2	-119.2	0	-285.8

a) -406.2 b) 406.2 c) -120.4 d) -857.4

7. Given the reaction $2PbS_{(s)} + 4O_{2(g)} \leftrightarrow 2PbO_{(s)} + 2SO_{3(g)}$ What is ΔH^0 of this reaction?

ΔH_f^0 kj/mol	$PbS_{(s)}$	$4O_{2(g)}$	$PbO_{(s)}$	$SO_{3(g)}$
	-100.4	0	-219.3	-396.1

a) -733.91 b)-1030 c) -120.4 d)-244.3

8. Given the reaction $SO_{2(g)} + 2H_2S_{(g)} \leftrightarrow 2S_{(s)} + 2H_2O_{(g)}$ What is ΔH^0 of this reaction?

ΔH_f^0 kj/mol	$SO_{2(g)}$	$H_2S_{(g)}$	$S_{(s)}$	$H_2O_{(g)}$
	-296.9	-21	0	-241.8

a) 76.1 b) -144.7 c) 152.2 d) -152.2

9. Given the reaction $CO_{2(g)} + 2SO_{3(g)} \leftrightarrow CS_{2(g)} + 4O_{2(g)}$ What is ΔH^0 of this reaction?

ΔH_f^0 kj/mol	$CO_{2(g)}$	$SO_{3(g)}$	$CS_{2(g)}$	$O_{2(g)}$
	-393.5	-396.1	88	0

a) 877.6 b) -701.6 c) -1095.1 d) 1273.7

10. Given the reaction $PCl_{3(g)} + 3H_2O_{(g)} \leftrightarrow H_3PO_{3(l)} + 3HCl_{(g)}$ What is ΔH^0 of this reaction?

ΔH_f^0 kj/mol	$PCl_{3(g)}$	$H_2O_{(g)}$	$H_3PO_{3(l)}$	$HCl_{(g)}$
	-287	-241.8	-964.8	-91.8

a) -227.8 b) 227.8 c) 918.2 d) 631.2

11. What is ΔS^0 of this reaction: $CO_{(g)} + H_2O_{(l)} \rightarrow CO_{2(g)} + H_{2(g)}$

	$CO_{(g)}$	$H_2O_{(l)}$	$CO_{2(g)}$	$H_{2(g)}$
S^0, J/mol K	197,54	70,8	213,68	130,58

a) -75.92 b) 75.92 c) 351.44 d) 612.6

12. What is ΔS^0 of this reaction: $Fe_3O_{4(s)} + CO_{(g)} \rightarrow 3FeO_{(s)} + CO_{2(g)}$

	$Fe_3O_{4(s)}$	$CO_{(g)}$	$FeO_{(s)}$	$CO_{2(g)}$
S^0, J/mol K	146,4	197,54	58,79	213,68

a) -46.11 b) -71.47 c) 46.11 d) -13.53

13. What is ΔS^0 of this reaction: $2C_2H_{2(g)} + 5O_{2(g)} \rightarrow 4CO_{2(g)} + 2H_2O_{(g)}$

	$C_2H_{2(g)}$	$O_{2(g)}$	$CO_{2(g)}$	$H_2O_{(g)}$
S^0, J/mol K	200,8	205,04	213,68	188,7

a) 808.22 b) -3.46 c) 194.68 d) -194.68

14. What is ΔS^0 of this reaction: $C_2H_{4(g)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 2H_2O_{(g)}$

	$C_2H_{4(g)}$	$O_{2(g)}$	$CO_{2(g)}$	$H_2O_{(g)}$
S^0, J/mol K	219,4	205,04	213,68	188,7

a) -29.76 b) -22.06 c) 22.06 d) 29.76

15. What is ΔS^0 of this reaction: $2H_2O_{2(l)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$

	$H_2O_{2(l)}$	$H_2O_{(g)}$	$O_{2(g)}$
S^0, J/mol K	109,6	188,7	205,04

a) 284.14 b) 363.24 c) -284.14 d) -363.24

16. What is ΔG^0 of this reaction: $CH_{4(g)} + 4CI_{2(g)} \rightarrow CCI_{4(g)} + 4HCI_{(g)}$

	$CH_{4(g)}$	$CI_{2(g)}$	$CCI_{4(g)}$	$HCI_{(g)}$
ΔG^0, kJ/mol	-50,79	0	-64,6	-95,27

a) -367.27 b) 367.27 c) -394.89 d) -109.08

17. What is ΔG^0 of this reaction: $2H_2S_{(g)} + 3O_{2(g)} \rightarrow 2H_2O_{(g)} + SO_{2(g)}$

	$H_2S_{(g)}$	$O_{2(g)}$	$H_2O_{(g)}$	$SO_{2(g)}$
ΔG^0, kJ/mol	-33,01	0	-228,61	-300,4

a) 691.6 b) -562.02 c) -496 d) -691.6

18. What is ΔG^0 of this reaction: $CS_{2(g)} + 3O_{2(g)} \rightarrow CO_{2(g)} + SO_{2(g)}$

	$CS_{2(g)}$	$O_{2(g)}$	$CO_{2(g)}$	$SO_{2(g)}$
ΔG^0, kJ/mol	67	0	-394,38	-300,4

a) -761.78 b) 761.78 c) -627.78 d) -927.78

19. What is ΔG^0 of this reaction: $2CH_3OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 4H_2O_{(g)}$

	$CH_3OH_{(l)}$	$O_{2(g)}$	$CO_{2(g)}$	$H_2O_{(g)}$
ΔG^0, kJ/mol	-166,23	0	-394,38	-228,61

a) 456.76 b) -1370.74 c) 1370.74 d) -456.76

20. What is ΔG^0 of this reaction: $CH_{4\,(g)} + 4CI_{2\,(g)} \rightarrow CCI_{4(g)} + 4HCI_{(g)}$

	$CH_{4(g)}$	$CI_{2\,(g)}$	$CCI_{4(g)}$	$HCI_{(g)}$
ΔG^0, kJ/mol	-50,79	0	-64,6	-95,27

a) -109.08 b) 109.08 c) -394.89 d) 394.89

CHEMICAL KINETICS

1. Choose the forward reaction for $2NO_{(g)} + Cl_{2(g)} \rightleftharpoons 2NOCl_{(g)}$.

a) $2NOCl_{(g)} \rightarrow 2NO_{(g)} + Cl_{2(g)}$ b) $2NO_{(g)} + Cl_{2(g)} \rightarrow 2NOCl_{(g)}$

c) $K_{eq} = \dfrac{[NOCl]^2}{[NO]^2[Cl_2]}$

2. Choose the forward reaction for $4NH_{3(g)} + 5O_{2(g)} \rightleftharpoons 4NO_{(g)} + 6H_2O_{(g)}$.

a) $4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)}$ b) $4NO_{(g)} + 6H_2O_{(g)} \rightarrow 4NH_{3(g)} + 5O_{2(g)}$

c) $K_{eq} = \dfrac{[NO]^4[H_2O]^6}{[NH_3]^4[O_2]^5}$

3. Choose the forward reaction for $CH_{4(g)} + 2Cl_{2(g)} \rightleftharpoons CH_2Cl_{2(g)} + 2HCl_{(g)}$.

a) $K_{eq} = \dfrac{[CH_2Cl][HCl]^2}{[CH_4][Cl_2]^2}$

b) $CH_2Cl_{2(g)} + 2HCl_{(g)} \rightarrow CH_{4(g)} + 2Cl_{2(g)}$ c) $CH_{4(g)} + 2Cl_{2(g)} \rightarrow CH_2Cl_{2(g)} + 2HCl_{(g)}$

4. Choose the forward reaction for $4HCl_{(g)} + O_{2(g)} \rightleftharpoons 2H_2O_{(g)} + 2Cl_{2(g)}$.

a) $4HCl_{(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)} + 2Cl_{2(g)}$ b) $2H_2O_{(g)} + 2Cl_{2(g)} \rightarrow 4HCl_{(g)} + O_{2(g)}$

c) $K_{eq} = \dfrac{[H_2O]^2[Cl_2]^2}{[HCl]^4[O_2]}$

5. Choose the forward reaction for $SO_{2(g)} + 2H_2S_{(g)} \rightleftharpoons 2S_{(g)} + 2H_2O_{(g)}$.

a) $2S_{(g)} + 2H_2O_{(g)} \rightarrow SO_{2(g)} + 2H_2S_{(g)}$ b) $SO_{2(g)} + 2H_2S_{(g)} \rightarrow 2S_{(g)} + 2H_2O_{(g)}$

c) $K_{eq} = \dfrac{[S]^2[H_2O]}{[SO_2][H_2S]^2}$

6. Choose the rate expression of forward reaction for $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$.

a) $\text{rate} = k[N_2][H_2]^3$ b) $\text{rate} = k[NH_3]^2$

c) $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$ d) $2NH_{3(g)} \rightarrow N_{2(g)} + 3H_{2(g)}$

7. Choose the rate expression of forward reaction for $2F_{2(g)} + 2H_2O_{(g)} \rightleftharpoons 4HF_{(g)} + O_{2(g)}$.

a) $\text{rate} = k[HF]^4[O_2]$ b) $\text{rate} = k[F_2]^2[H_2O]^2$

c) $2F_{2(g)} + 2H_2O_{(g)} \rightarrow 4HF_{(g)} + O_{2(g)}$ d) $4HF_{(g)} + O_{2(g)} \rightarrow 2F_{2(g)} + 2H_2O_{(g)}$

8. Choose the rate expression of forward reaction for $4HCl_{(g)} + O_{2(g)} \rightleftharpoons 2H_2O_{(g)} + 2Cl_{2(g)}$.

a) $4HCl_{(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)} + 2Cl_{2(g)}$ b) $2H_2O_{(g)} + 2Cl_{2(g)} \rightarrow 4HCl_{(g)} + O_{2(g)}$

c) $\text{rate} = k[HCl]^4[O_2]$ d) $\text{rate} = k[H_2O]^2[Cl_2]^2$

9. Choose the rate expression of forward reaction for $2NO_{(g)} + O_{2(g)} \rightleftharpoons 2NO_{2(g)}$.

a) $\text{rate} = k[NO_2]^2$ b) $\text{rate} = k[NO]^2[O_2]$

c) $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ d) $2NO_{2(g)} \rightarrow 2NO_{(g)} + O_{2(g)}$

10. Choose the rate expression of forward reaction for $H_{2(g)} + I_{2(g)} \rightleftharpoons HI_{(g)}$.

a) $H_{2(g)} + I_{2(g)} \rightarrow HI_{(g)}$ b) $HI_{(g)} \rightarrow H_{2(g)} + I_{2(g)}$

c) $\text{rate} = k[HI]^2$ d) $\text{rate} = k[H_2][I_2]$

11. Choose the equilibrium constant expression for the reaction: $2NOCl_{(g)} \rightleftharpoons 2NO_{(g)} + Cl_{2(g)}$.

a) $K_{eq} = \dfrac{[NO]^2[Cl_2]}{[NOCl]^2}$ b) $K_{eq} = \dfrac{[NOCl]^2}{[NO]^2[Cl_2]}$

c) $K_{eq} = [NO]^2[Cl_2]$ d) $K_{eq} = [NOCl]^2$

12. Choose the equilibrium constant expression for the reaction: $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$.

a) $K_{eq} = \dfrac{[N_2][O_2]}{[NO]^2}$ b) $K_{eq} = \dfrac{[NO]^2}{[N_2][O_2]}$

c) $K_{eq} = [N_2][O_2]$ d) $K_{eq} = [NO]^2$

13. Choose the equilibrium constant expression for the reaction: $2N_2O_{5(g)} \rightleftharpoons 4NO_{2(g)} + O_{2(g)}$.

a) $K_{eq} = [N_2O_5]^2$ b) $K_{eq} = [NO_2]^4[O_2]$

c) $K_{eq} = \dfrac{[N_2O_5]^2}{[NO_2]^4[O_2]}$ d) $K_{eq} = \dfrac{[NO_2]^4[O_2]}{[N_2O_5]^2}$

14. Choose the equilibrium constant expression for the reaction: $4H_{2(g)} + 2NO_{2(g)} \rightleftharpoons 4H_2O_{(g)} + N_{2(g)}$.

a) $K_{eq} = \dfrac{[H_2O]^4[N_2]}{[H_2]^4[NO_2]^2}$ b) $K_{eq} = \dfrac{[H_2]^4[NO_2]^2}{[H_2O]^4[N_2]}$

c) $K_{eq} = [H_2]^4[NO_2]^2$ d) $K_{eq} = [H_2O]^4[N_2]$

15. Choose the equilibrium constant expression for the reaction: $F_{2(g)} + 2ClO_{2(g)} \rightarrow 2FClO_{2(g)}$.

a) $K_{eq} = [F_2][ClO_2]^2$ b) $K_{eq} = [FClO_2]^2$

c) $K_{eq} = \dfrac{[FClO_2]^2}{[F_2][ClO_2]^2}$ d) $K_{eq} = \dfrac{[F_2][ClO_2]^2}{[FClO_2]^2}$

16. Determine the direction in which the equilibrium will be shifted by increasing the concentration of CO in the reaction $CO_{(g)} + Cl_{2(g)} \rightleftharpoons COCl_{2(g)}$.

a) shifts to left b) shifts to right c) no change

17. Determine the direction in which the equilibrium will be shifted by increasing the pressure in the reaction $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$.

a) shifts to left b) shifts to right c) no change

18. Determine the direction in which the equilibrium will be shifted by increasing the temperature in the reaction $H_2 + Cl_2 \rightleftharpoons 2HCl$; $\Delta H \prec 0$.

a) shifts to left b) shifts to right c) no change

19. Determine the direction in which the equilibrium will be shifted by increasing the concentration of $CO_{2(g)}$ in the reaction $CO_{2(g)} + C_{(g)} \rightarrow 2CO_{(g)}$.

a) shifts to left b) shifts to right c) no change

20. Determine the direction in which the equilibrium will be shifted by increasing the pressure in the reaction $CO_{2(g)} + H_{2(g)} \rightleftharpoons CO_{(g)} + H_2O_{(g)}$.

a) no change b) shifts to right c) shifts to left