SCH4U: EXAM · REVIEW

SCH4U_2009 - 2010

1. The heat of a reaction is equal to:

a. enthalpy (products) + enthalpy (reactants)
b. enthalpy (reactants) – enthalpy (products)
c. enthalpy (products) – enthalpy (reactants)
d. sum of all internal molecular energies

2. Which of the following has a standard enthalpy of formation, ΔH^0_f, of 0 kJ mol^{-1} at 25ºC and 1.00 atm?

(a) $C_{(g)}$ (b) $O_{(g)}$ (c) $Fe_{(l)}$ (d) $H_{2\,(g)}$ (e) $Ne_{(l)}$

3. Consider the following equation for the combustion of hydrogen:

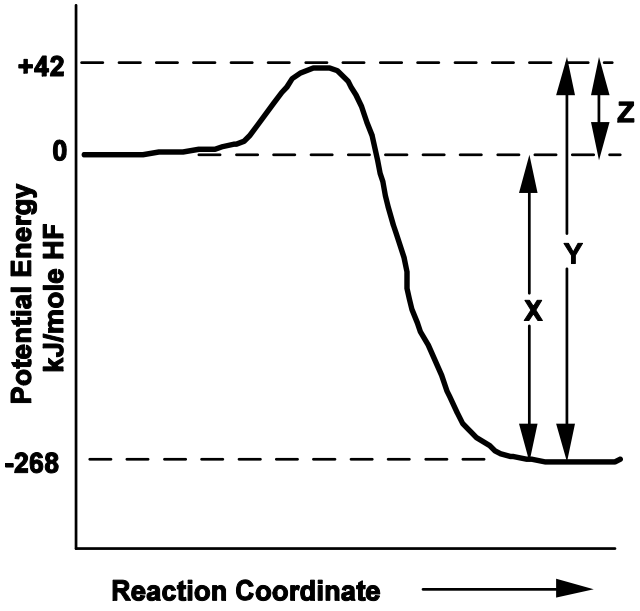
$$H_{2(g)} + {}^1/_2\, O_{2(g)} \longrightarrow H_2O_{(g)} + 243\ kJ$$

In order to produce 1215 kJ of heat, how many grams of H_2 must burn?

a. 12.0 g b. 0.100 g c. 10.0 g d. 0.250 g e. 8.00 g

4. For the following reaction $H_{2(g)} + F_{2(g)} \longrightarrow HF_{(g)} + 268.8\ kJ$

The potential energy diagram is given below.



Which of the following statements concerning the energy relations of the above system is <u>false</u>?

a) the heat of the reaction per mole of hydrogen fluoride is represented by the distance X on the graph
b) the reaction is exothermic
c) the heat of the reaction is - 268 kJ per mole of fluorine gas
d) the activation energy for the reverse reaction is + 310 kJ per mole of HF used
e) the activation energy per mole of hydrogen fluoride formed is + 42 kJ

5. Given the following thermochemical equation:

$$H_{2(g)} + 1/2\ O_{2(g)} \longrightarrow H_2O_{(l)} \qquad \Delta H^0 = -285.8\ kJ$$

How much heat is evolved when 100.0 g of $H_2O_{(l)}$ are formed from the combustion of hydrogen gas and oxygen gas?

a. - 51.44 b. - 285 kJ c. - 1587 kJ d. - 2297 kJ

6. Given the following thermochemical equation:

$$2\ Al_{(s)} + 3/2\ O_{2(g)} \longrightarrow Al_2O_{3(s)} \qquad \Delta H^0 = -400\ kJ$$

Determine ΔH^0 for: $2\ Al_2O_{3(s)} \longrightarrow 4\ Al_{(s)} + 3\ O_{2(g)}$

a. + 200 kJ b. + 400 kJ c. - 400 kJ d. + 800 kJ

7. Which one of the following equation represents the **standard enthalpy of formation**, ΔH^0_f, of nickel (II) carbonate, $NiCO_3$:

a. $Ni_{(s)} + C_{(g)} + 3/2\ O_{2(g)} \longrightarrow NiCO_{3(s)}$
b. $Ni_{(s)} + C_{(s)} + 3/2\ O_{2(g)} \longrightarrow NiCO_{3(s)}$
c. $2\ Ni_{(s)} + 2C_{(s)} + 3O_{2(g)} \longrightarrow 2\ NiCO_{3(s)}$
d. $Ni_{(s)} + CO_3^{-2}{}_{(aq)} \longrightarrow NiCO_{3(s)}$

8. The heats of formation, ΔH^0_f, of NO_2 and N_2O_4 are +33.2 and +9.2 kJ mol^{-1} respectively. Calculate the enthalpy change for the reaction:

$$2NO_{2\,(g)} \longrightarrow N_2O_{4\,(g)}$$

A. -57.2 kJ B. -24.0 kJ C. 41.4 kJ D. 75.6 kJ

9. Consider the following four equations:

1) $C_6H_{6(l)} + O_{2(g)} \longrightarrow 6\ CO_{2(g)} + 3\ H_2O_{(l)}$ ΔH^0_1

2) $6\ C_{(s)} + 3\ H_{2(g)} \longrightarrow C_6H_{6(l)}$ ΔH^0_2

3) $H_{2(g)} + O_{2(g)} \longrightarrow H_2O_{(l)}$ ΔH^0_3

4) $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ ΔH^0_4

The enthalpy change for reaction 1, ΔH^0_1, can be obtained by algebraically combining the ΔH^0 values for the other reactions in which of the following ways?

a) $6\ (\Delta H^0_4) + 3\ (\Delta H^0_3) + \Delta H^0_2$

b) $6\ (\Delta H^0_4) - 3\ (\Delta H^0_3) + \Delta H^0_2$

c) $-6\ (\Delta H^0_4) - 3\ (\Delta H^0_3) + \Delta H^0_2$

d) $6\ (\Delta H^0_4) + 3\ (\Delta H^0_3) - \Delta H^0_2$

10. Which of the following species has the highest entropy, S^0 at 25 ^{0}C ?

A. $C_3H_{8(g)}$ B. $C_2H_{4(g)}$ C. $Zn_{(s)}$ D. $SiF_{4(g)}$

11. Which one of the following processes would be expected to have a value of ΔS^o closest to zero?

A. $H_{2\,(g)} + F_{2\,(g)}$ ---> $2HF_{(g)}$

B. $C_2H_{4\,(g)} + HBr_{(g)}$ ---> $C_2H_5Br_{\,(g)}$

C. $CO_{2\,(g)}$ ---> $CO_{(g)} + 1/2\ O_{2(g)}$

D. $2NO_{2\,(g)}$ ---> $2NO_{\,(g)} + O_{2\,(g)}$

12. What is true about the signs of ΔH and ΔS for a reaction that is spontaneous at low temperatures but becomes non-spontaneous at higher temperatures?

	ΔH	**ΔS**
A.	-	-
B.	-	+
C.	+	+
D.	+	-

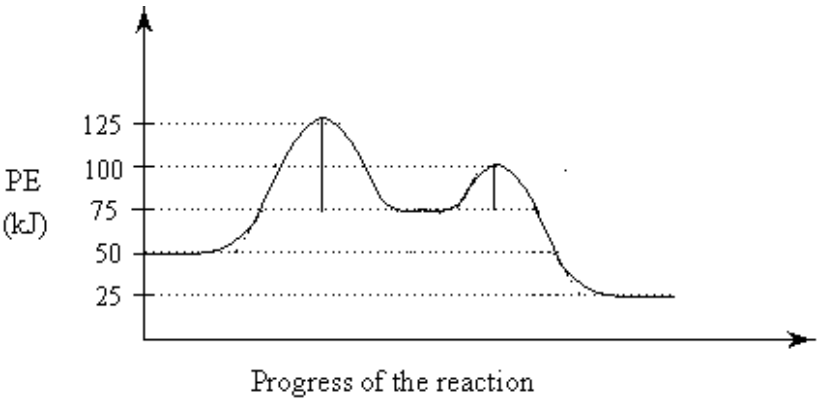
13. Which of the following combinations of enthalpy change, ΔH, entropy change, ΔS, and Gibbs Free energy change, ΔG would **always give a spontaneous reaction**?

	ΔH	**ΔS**	**ΔG**
A.	increased	increased	+
B.	increased	decreased	–
C.	decreased	decreased	+
D.	decreased	increased	–

14. In which of the following does the entropy decrease ?

A. $NaCl(s) \rightarrow Na^+(aq) + Cl^-(aq)$
B. $4\ NO(g) + 6\ H_2O(g) \rightarrow 4\ NH_3(g) + 5\ O_2\,(g)$
C. $2\ NaHCO_3\,(s) \rightarrow Na_2CO_3(s) + CO_2\,(g) + H_2O(g)$
D. $CaCO_3(g) + 2\ HCl\ (aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O\ (l)$

15. Consider the following potential energy diagram.



The activation energy for the **forward** reaction is:

A. 25 kJ B. 50 kJ C. 75 kJ D. 125 kJ

16. Consider the following reaction mechanism:

Step 1: $ICl + H_2 \rightarrow HI + HCl$ (Slow)
Step 2: $ICl + HI \rightarrow HCl + I_2$ (Fast)

The species HCl is a:

A. Product B. Catalyst C. Reactant D. Reaction intermediate

17. Determine the rate at which CO_2 is produced if butane (C_4H_{10}) is consumed at the rate of 2.0 mol/L/min.

$$C_4H_{10(g)} + O_{2(g)} \longrightarrow 4\,CO_{2(g)} + 5\,H_2O_{(g)}$$

a) 2.0 mol/L/min b) 4.0 mol/L/min
c) 5.0 mol/L/min d) 8.0 mol/L/min

18. If the half-life of a first-order process is 3.00 minutes, the rate constant for the process is:

A. 1.50 /min B. 1.05 /min C. 4.34 /min D. 0.231 /min

19. The rate of reaction increases with increasing temperature primarily because:

a. the activation energy is lowered as the temperature is increased
b. changing the temperature usually alters the mechanism
c. the heat of reaction is increased
d. a greater fraction of the molecules possess the activation energy

20. A catalyst speeds up a reaction by:

a. lowering the ΔH for the reaction b. lowering the activation energy for the reaction
c. lowering the enthalpy of the reactants d. raising the enthalpy of the reactants

21. Which of the following can be used to determine the order of a reaction?

I. Studies of reaction rate as a function of reactant concentration
II. Consideration of the balanced equation for the reaction
III. Knowledge of the activation energy for the reaction

A. I only B. II only C. Either I or II D. I, II or III

22. Which species might be behaving as a catalyst based on the equations below?

$$O_3 + Cl \longrightarrow ClO + O_2$$
$$ClO + O \longrightarrow Cl + O_2$$

A. O_2 B. Cl C. ClO D. O

23. Reaction rates generally increase in response to a decrease in:

A. catalyst concentration. B. reagent concentration
C. particle size. D. temperature.

23. The rate equation for the reaction between andO_2 and NO is: O_2

$$\text{Rate} = k\,[O_2]\,[NO]^2$$

By what factor would the rate of this reaction increase if the concentrations of O_2 and NO are both doubled?

A. 1/8 B. 3 C. 4 D. 8

24. Ammonia is produced commercially by the Haber process:

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} \qquad \Delta H = -96 \text{ kJ}$$

The yield of ammonia at equilibrium can be increased by:

A. adding a catalyst. B. increasing the temperature.
C. increasing the pressure. D. removing some H_2.

25. For the reaction below at equilibrium:

$$C_{(s)} + H_2O_{(g)} \rightleftharpoons H_{2(g)} + CO_{(g)} \qquad \Delta H = 132 \text{ kJ}$$

Which of the following changes will increase the quantity of H_2?

A. Adding C(s) B. Increasing the pressure
C. Lowering the temperature D. Removing CO

26. Consider the following equilibrium:

$$2\,SO_{3\,(g)} \rightleftharpoons 2\,SO_{2\,(g)} + O_{2\,(g)}$$

The volume of the system is decreased at a constant temperature. A new state of equilibrium is established by a shift of the original equilibrium to the:

a. Left and $[SO_3]$ increases.
b. Right and $[SO_3]$ decreases.
c. Left and $[SO_3]$ remains unchanged.
d. Right and $[SO_3]$ remains unchanged.

27. For a gaseous reaction, the equilibrium constant expression is:

$$K_c = \frac{[O_2]^5}{[NO]^4}\frac{[NH_3]^4}{[H_2O]^6}$$

Which equation corresponds to this equilibrium expression?

A. $4NH_3 + 5O_2 \rightleftharpoons 4NO + 6H_2O$
B. $4NO + 6H_2O \rightleftharpoons 4NH_3 + 5O_2$
C. $8NH_3 + 10O_2 \rightleftharpoons 8NO + 12H_2O$
D. $2NO + 3H_2O \rightleftharpoons 2NH_3 + 5/2\ O_2$

28. The following reactions occur at 500 K.

I. $2\ NOCl \rightleftharpoons 2\ NO + Cl_2$ $K_c = 1.7 * 10^{-2}$

II. $2\ SO_3 \rightleftharpoons 2\ SO_2 + O_2$ $K_c = 1.3 * 10^{-5}$

III. $2\ NO_2 \rightleftharpoons 2\ NO + O_2$ $K_c = 5.9 * 10^{-5}$

When these reactions are arranged in order of increasing tendency to proceed to completion (i.e. least to greatest tendency), the order is:

A. I > II > III B. II > III > I C. III. > II > I D. I > III > II

29. In an exothermic equilibrium reaction involving only gases, the value of K_{eq} can be **decreased** by

A. adding some reactant gas.
B. Removing some reactant gas.
C. increasing the temperature.
D. decreasing the temperature.

30. Consider the following equation:

$$4\ HCl_{(g)} + O_{2(g)} \rightleftharpoons 2H_2O_{(l)} + 2\ Cl_{2\ (g)}$$

Initially 10 moles of HCl and 4.0 moles of oxygen are allowed to react in a 1.0 dm^3 container. At equilibrium, 4.0 moles of Cl_2 are produced. Calculate the equilibrium constant, K_c, for this reaction.

A. 4.0×10^{-4} B. 2.6×10^{-2} C. 5.0×10^{-1} D. 8.0

31. The equation represents the equilibrium in a saturated solution of $Fe_2(SO_4)_3$ is:

A. $Fe_2(SO_4)_3\ (s) \rightleftharpoons 3\ Fe^{2+}(aq) + 2\ SO_4^{3-}(aq)$
B. $Fe_2(SO_4)_3\ (s) \rightleftharpoons 2\ Fe^{2+}(aq) + 3\ SO_4^{3-}(aq)$
C. $Fe_2(SO_4)_3\ (s) \rightleftharpoons 3\ Fe^{3+}(aq) + 2\ SO_4^{2-}(aq)$
D. $Fe_2(SO_4)_3\ (s) \rightleftharpoons 2\ Fe^{3+}(aq) + 3\ SO_4^{2-}(aq)$

32. The solubility of $SrSO_4$ at room temperature is 8.0×10^{-4} mol/L. The calculated K_{sp} for $SrSO_4$ is

A. 6.4×10^{-9} B. 1.6×10^{-7} C. 6.4×10^{-7} D. 4.2×10^{-5} E. 4.0×10^{-4}

33. The solubility product constant for HgS is 1.0×10^{-20}. How many grams of HgS will dissolve in 1.0 L at 25 ^oC :

A. 1.0×10^{-10} B. 2.4×10^{-8} C. 2.4×10^{-10} D. 2.4×10^{-12}

34. Which chemical species could behave as both a Bronsted base and as a Bronsted acid?

A. HSO_4^- B. CO_3^{2-} C. NH_4^+ D. Cl^{-1}

35. Which of the following is the **weakest** acid ?

A. HClO B. $HClO_2$ C. $HClO_3$ D. $HClO_4$

36. Consider the following equilibrium for the indicator bromthymol blue, HInd :

$$\underset{\text{Blue}}{HInd} \rightleftharpoons H^+ + \underset{\text{Yellow}}{Ind^-}$$

A solution of bromthymol blue is yellow. What should a student do to change the colour of the solution to blue?

A. Add a base to shift the equilibrium left.
B. Add an acid to shift the equilibrium left.
C. Add a base to shift the equilibrium right.
D. Add an acid to shift the equilibrium right.

37. Which one of the following is the strongest acid?

A. Ascorbic acid, $K_a = 8.0 \times 10^{-5}$
B. Benzoic acid, $K_a = 6.5 \times 10^{-5}$
C. 2-hydroxybenzoic acid, $K_a = 1.1 \times 10^{-3}$
D. chloroethanoic acid, $K_a = 1.4 \times 10^{-3}$

38. The $[OH^-]$ in 0.050 M HNO_3 at 25°C is:

A. 5.0×10^{-16} M B. 1.0×10^{-14} M C. 2.0×10^{-13} M D. 5.0×10^{-2} M

39. The acid dissociation constant, $K_a(HS^-)$, is the equilibrium constant for which one of the following reaction (in aqueous solution):

A. $HS^- + H_2O \Leftrightarrow H_2S + OH^-$
B. $HS^- + H_3O^+ \Leftrightarrow H_2S + H_2O$
C. $HS^- + OH^- \Leftrightarrow S^{2-} + H_2O$
D. $HS^- + H_2O \Leftrightarrow H_3O^+ + S^{2-}$

40. Which of the following 0.10 M solutions will be acidic?

A. $AlCl_3$ B. LiCl C. K_2CO_3 D. Na_3PO_4

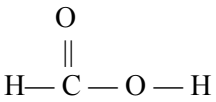
41. Consider the following data:

Solution	Initial pH	Final pH
1	1.0	4.0
2	2.0	6.0
3	6.0	3.0
4	9.0	3.0

In which solution has the $[H_3O^+]$ increased 1000 times?

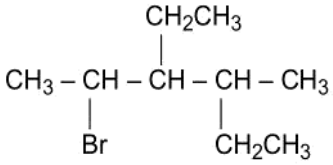
A. 1 B. 2 C. 3 D. 4

42. What is the number of sigma (σ) and pi (π) bonds and the hybridization of the carbon atom in :



	Sigma	Pi	Hybridization
A.	4	1	sp^2
B.	4	1	sp^3
C.	3	2	sp^3
D.	3	1	sp^2

43. What is the IUPAC name for the following compound?

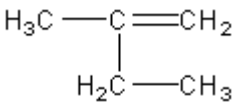


A 2-bromo-3,4-diethylpentane
B 2,3-diethyl-4-bromopentane
C 1-methyl-2,3-diethyl-3-bromobutane
D 2-bromo-3-ethyl-4-methylhexane

44. In which substance is hydrogen bonding present?
A. CH_4 B. CH_2F_2 C. CH_3CHO D. CH_3OH

45. Which type of reaction will an alkene **not** undergo?
A. addition B. dehydration C. polymerization D. hydration

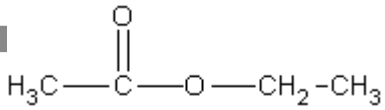
46. What is the correct name for the following compound?



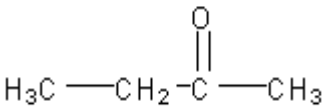
a. 2-methyl but-1-ene
b. pentene
c. 2-ethyl-1-propene
d. 3-methyl-2-butene

47. The formula for methyl ethanoate is which of the following?

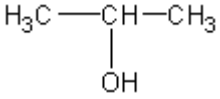
a.



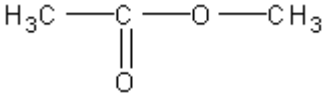
c.



b.



d.



48. When but-1-ene, $H_2C=CHCH_2CH_3$, reacts with bromine, the most likely product is:

A. $H_3CCHBr\ CH_2CH_3$
B. $H_2C=CHCH_2Br$
C. $HBrC=CBrCH_2CH_3$
D. $H_2BrCCHBrCH_2CH_3$

49. Why are **alkenes more reactive than alkanes**?

A. Both parts of the double bond in alkenes are equivalent
B. The pi bond in alkenes is weaker than the sigma bond and is more susceptible to chemical attack
C. The sigma bond in alkenes is weaker than the pi bond and is more susceptible to chemical attack
D. The pi bonds in the alkanes are too weak

50. How many different isomers can be represented by the formula C_3H_8O?

A. 2 B. 3 C. 4 D. 5

51. In a chemistry lab test, you are asked to react a solution of bromine with each of the following unknown liquids. Which one decolourizes the bromine solution?

A. 2,3-dimethylbutane B. cyclohexene C. ethanoic acid D. carbon tetrachloride

52. Correct statements about the C = C bond in ethene include:

A its bond energy is more than twice that of C–C
B it consists of two sigma bonds
C it consists of a sigma bond and a pi bond
D non-rotation of the bond results in two isomers of ethene.

53. What is the designation of an electron in an atom that can have the following set of quantum numbers ?

$n = 3, \quad l = 1$

A. 3s B. 3p C. 3d D. 3f

54. Which statements correctly describe the NO_2^- ion?

I. It can be represented by resonance structures.

II. It has two lone pairs of electrons on the N atom.

III. The N atom is sp^2 hybridized.

A. I and II only B. I and III only C. II and III only D. I, II and III

55. What is the molecular shape and the hybridization of the nitrogen atom in NH_3 ?

A. tetrahedral, sp^3
B. Trigonal planar, sp^3
C. Trigonal pyramid, sp^2
D. Trigonal pyramidal, sp^3

56. A newly discovered crystal is a non-conductor of electricity as a solid. It is found to melt at 900 ^{O}C and when retested in the liquid state, it is found to conduct electricity. To which of the following crystal types does the newly discovered crystal belong ?

A. Ionic B. Metallic C. Molecular network D. Molecular covalent

57. In which substance is hydrogen bonding present?

A. CH_4 B. CH_2F_2 C. CH_3CHO D. CH_3OH

58. Which molecule shows covalent bonding, with the least ionic character?

A. F—Be—F B. F – Li C. F — Br D. F – F

59. Silane, SiH_4, and methanol, CH_3OH, have the same molar mass, 32 g mol^{-1}. How do their boiling points compare?

A. They will be the same because they have the same molar mass.

B. The boiling point of SiH_4 would be greater because the Si atom has larger van der Waals' forces.

C. The boiling point of CH_3OH would be greater because it is more polar.

D. The boiling point of CH_3OH would be greater because it has more atoms.

60. The substances bromine, Br_2, and iodine monochloride, ICl, have almost identical molar masses yet ICl boils at 97 ºC and Br_2 boils at 59 ºC. The best explanation for the difference is boiling points is that :

A. ICl is a non-polar molecule and Br_2 is polar.

B. ICl has a stronger bond than that in Br_2.

C. ICl has a longer bond than that in Br_2.

D. ICl has a permanent dipole moment and Br_2 does not.

This is the end of the multiple-choice section.
Answer the remaining questions in Section B, directly in the spaces provided.

PART B: WRITTEN-RESPONSE

INSTRUCTIONS: You will be expected to communicate your knowledge and understanding of chemical principles in a clear and logical manners.

- Your steps and assumptions leading to a solution must be written in the spaces below the questions.
- Answers must include units where appropriate and be given to the correct number of significant figures.
- **For questions involving calculation, full marks will NOT be given for providing only an answer.**

1. a) On the graph below, draw the potential energy diagram for a reaction in which the activation energy for the forward reaction is 155 kJ mol^{-1} and the activation energy for the reverse reaction is 195 kJ mol^{-1}. Is this reaction endothermic or exothermic? Show on the graph the effect of adding a catalyst to this reaction. **6**

b) Define the term enthalpy of formation. **1**

2. Given the following thermodynamic data for the reaction:

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

Substance	ΔH_f^0 (kJ mol^{-1})	S^0 (J K^{-1} mol^{-1})
$NH_{3\ (g)}$	— 46.1	192.3
$O_{2\ (g)}$	0	205.0
$NO_{(g)}$	90.2	210.7
$H_2O_{\ (g)}$	— 241.8	188.7

(i) Calculate the value of ΔH^0 for the reaction, and explain what may be deduced from your calculated value of ΔH^0 for the reaction. 4

(ii) Predict the sign of ΔS^0 for the above reaction, (without using calculations), and give your reasoning. 2

(iii) Calculate the value of ΔS^0 for the reaction. 4

(iv) Calculate the value of ΔG^0 for the reaction, (in kJ mol^{-1}), at 298 K. 3

3. Two gases react according to the following equation:

$$X_{(g)} + 2Y_{(g)} \longrightarrow XY_{2\,(g)}$$

Experiments were performed at 500 K in order to determine the order of the reaction, the following results were obtained:

Experiment Number	Initial Concentration of X (mol dm^{-3})	Initial Concentration of Y (mol dm^{-3})	Initial Rate of Formation of XY_2 (mol dm^{-3} s^{-1})
1	0.10	0.10	0.0001
2	0.10	0.20	0.0004
3	0.10	0.30	0.0009
4	0.20	0.10	0.0001
5	0.30	0.10	0.0001

a. Determine the order of the reaction with respect to X and Y and justify your answer: 2

(i) X

(i) Y

b. Write a rate equation, (the Rate Law, i.e. the Rate Expression), for the reaction between X and Y. 1

c. Determine the numerical value for the rate constant and determine its units. 4

d. Using the rate equation predict a possible mechanism for this reaction. 2

e. If the concentration of X and Y were both halved, what would be observed for the rate of the reaction ? 1

4. Consider the following equilibrium:

$$2\ CH_{4(g)} \rightleftharpoons C_2H_{2\ (g)} + 3\ H_{2(g)}$$

A 0.180 mol sample of CH_4 is added to an empty 1.00 L container at 800 ^{O}C.
At equilibrium, the $[C_2H_2]$ is 0.0800 mol/L. Calculate the numerical value for the equilibrium constant. **4**

5. Consider the following equilibrium:

$$2\ NOCl_{(g)} \rightleftharpoons 2\ NO_{\ (g)} + Cl_{2(g)}$$

A chemist places 2.00 mol NOCl in a 1.0 L container. Describe the changes **graphically** in [NOCl], $[Cl_2]$ and [NO] when the pressure on this system is increased, at constant temperature, until the system approaches a new equilibrium. 3

6. A saturated solution of $BaSO_{\ 4}$ is given to patients needing digestive tract x-rays.

a. Write an equation that represents the solubility equilibrium. **1**

b. Calculate the $[Ba^{2+}]$ present in the saturated solution given the Ksp for $BaSO_4$ at 25 ^{O}C is 1.4×10^{-12}. 3

7. Will a precipitate form when 90.0 mL of 1.00 x 10^{-2} M $Cu(NO_3)_2$ and 10.0 mL of 1.00 x10^{-2} M $NaIO_3$ are mixed? Explain using appropriate calculations. (Ksp $Cu(IO_3)_2$ = 1.23 x 10^{-8} . 4

8. Consider te following equilibrium:

$$H_2Se_{(aq)} + HTe^-_{(aq)} \rightleftharpoons HSe^-_{(aq)} + H_2Te_{(s)}$$

The reactants are favoured in this equilibrium.

a. Identify the stronger acid. _____ 1

b. Identify the weaker base. _____ 1

9. The hydrogen carbonate ion, HCO_3^{-1}, can act as a weak base. Use calculations to determine the K_b of a solution containing 0.125 M hydrogen carbonate ion, if it has a pH 4.25. 5

10. Calculate the pH of a 0.122 M solution of vitamin C, ascorbic acid, (use the abbreviation, HAsc), a weak monoprotic acid with a $K_a = 6.90 \times 10^{-5}$ at 25 ^{O}C . 4

11. What is the K_a for a 0.155 M solution of benzoic acid, C_6H_5COOH, a weak monoprotic acid which has a pH of 4.25. 4

12. Write the **complete electron configurations** for each of the following elements:

a. $_{15}P$ _____

b. $_{29}Cu$ _____

13. 17.Write the **shorthand electronic configuration** for the following:

a. Mo^{+3} _____

b. Br^{-1} _____

14. Complete the following table: 10

	ICl_2^{-1}	SCl_6	OF_2
Lewis structure including dipoles			
Shape			
Bond angle			
Polar/Non-polar			
IMFA's			

15. Butan-1-ol, and ethoxyethane both have the same molecular formula, $C_4H_{10}O$, but they have different structural formulas. Explain which liquid will have a higher boiling point. 4

butanol: $CH_3(CH)_2CH_2(OH)$ ethoxyethane: $CH_3CH_2 — O — CH_2CH_3$

16. Butanoic acid and ethanol can be used to produce_____ and water, in the presence of concentrated sulphuric acid as a catalyst. The chemical name for the product is _____This reaction is known as_____. The balanced chemical equation for this reaction is:

17. When a secondary alcohol, such as propan-2-ol is oxidized in the presence of acidified potassium dichromate, the product obtained is _____; and the equation for the reaction is:

18. The reaction of $CH_3CH=CH-CH=CH_2$ with excess bromine will form the product _____.

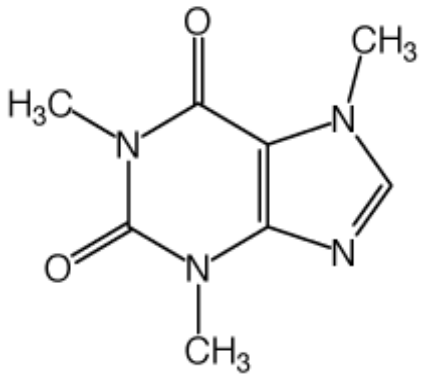
19. The formula for methyl ethanoate is: _____

20. Caffeine is a compound found in chocolate, soft drinks, coffee and tea. It acts as a stimulant to the nervous system. Using the following structure of caffeine,

a) determine the total number of sigma and pi bonds in the molecule and

b) state which bonds are stronger on their own, sigma or pi, and explain why.

c. Determine the hybridisation of the O –atom, and the C –atom in the CH_3 – group



Multiple Choice Answers

1	2	3	4	5	6	7	8	9	10
C	D	C	C	C	D	B	A	D	D
11	12	13	14	15	16	17	18	19	20
A	A	D	B	C	A	D	D	D	B
21	22	23	24	25	26	27	28	29	30
A	B	C	C	D	A	A	C	C	D
31	32	33	34	35	36	37	38	39	40
D	C	B	A	A	B	C	C	C	A
41	42	43	44	45	46	47	48	49	50
C	A	D	D	B	A	D	D	B	B
51	52	53	54	55	56	57	58	59	60
B	C	B	B	D	A	D	D	C	D