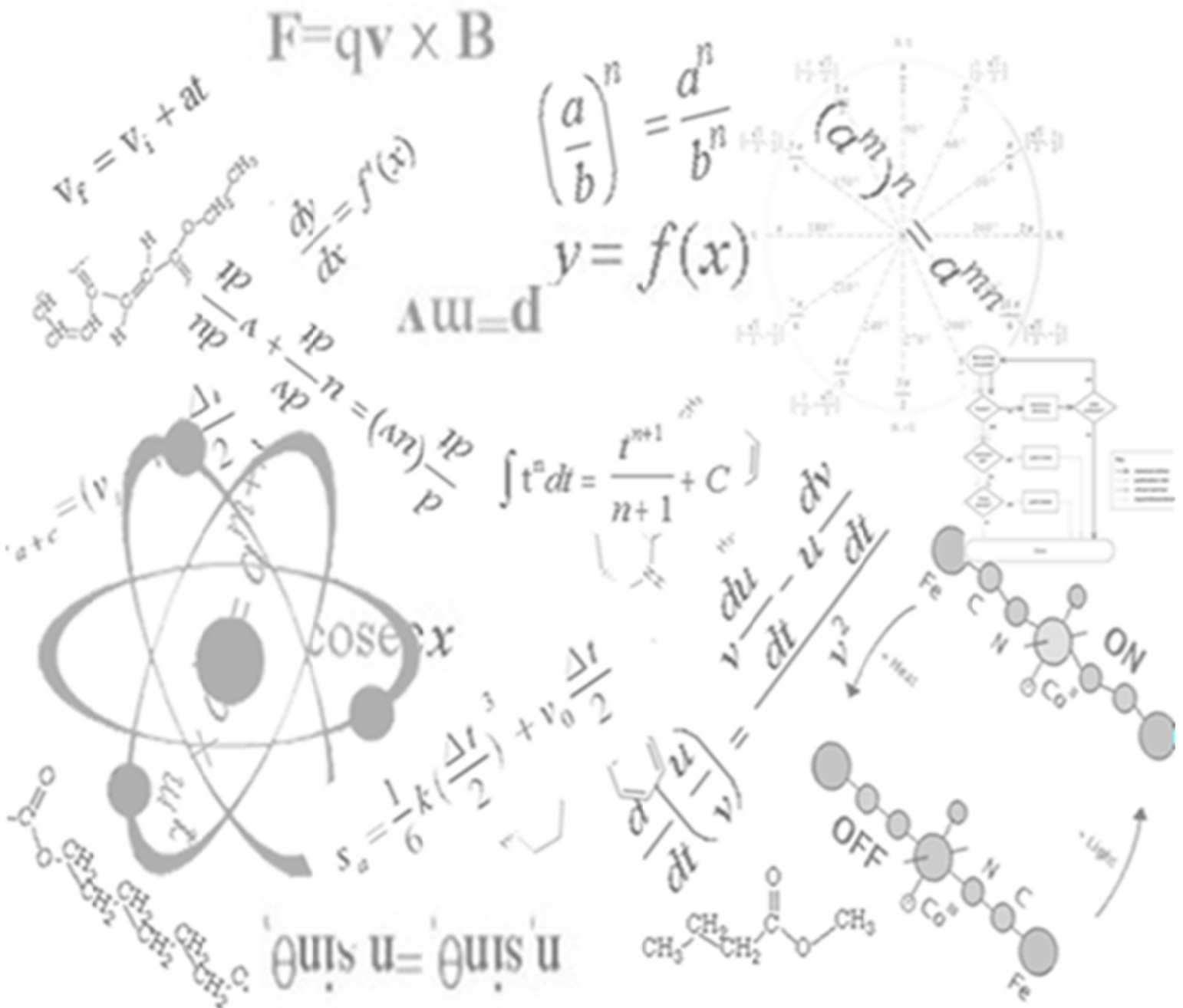


where students come first!



Year 12- Chemistry

Chemical Monitoring & Management



Chemical Monitoring exam 3 – Questions

1. The Haber Process is used in the synthesis of ammonia from gaseous hydrogen and nitrogen. The percentage conversion to ammonia at different temperatures and pressures is shown in the table below.

Temperature (°C)	Percentage Conversion to Ammonia at Pressures Indicated		
	250 atm	500 atm	1000 atm
150	94	97	99
350	44	774	83
550	12	28	34
750	6	14	17

- a. Write the equation for the Haber Process. 1 mark
 - b. Justify whether the reaction is endothermic and exothermic. 2 marks
 - c. Analyse the effect of increasing pressure on this system. 2 marks
 - d. Justify the use of high pressure and a temperature of 300-400 °C in the industrial synthesis of ammonia. 2 marks
-
2. In the internal combustion engine of a motor car, octane undergoes both complete and incomplete combustion.
- a. Write two balanced chemical equations to show the complete and incomplete combustion of octane. 2 marks
 - b. Using the equations from part a, explain what causes octane to undergo incomplete combustion. 1 mark
-
3. Water can be distinguished as being either hard or soft.
- a. Identify the cause of water hardness. 1 mark
 - b. Describe a method to test water hardness. 2 marks
-
4. Explain why monitoring the reaction vessel used in the Haber process is crucial and describe the monitoring required. 6 marks
-
5. The incomplete combustion of propane produces a highly toxic gas.
- a. Identify this gas. 1 mark
 - b. Identify two other pollutants found in the lower atmosphere and give a source for each. 2 marks
 - c. Provide a balanced reaction for the complete and incomplete combustion of propane. 2 marks

6. In the technique of AAs the identity of a metallic cation can be confirmed by a 'fingerprint' of that particular cation.
- a. In the context of AAS, explain what is meant by a fingerprint of a cation. **2 marks**
- b. Tuna fish and shellfish are regularly checked for heavy metal contamination using AAS prior to consumption. Water samples from a group of fish were found to be contaminated with 11.5 ppm of mercury (assume the density of the solution is 1 g mL^{-1}).
- i. Explain what is meant by 11.5 ppm. **1 mark**
- ii. Convert 11.5 ppm to a concentration of mol L^{-1} . **1 mark**
7. A student analysed a 4.13 gram sample of washing powder for its phosphorous content. The phosphorous was precipitated as $\text{Mg}_2\text{P}_2\text{O}_7$. The mass of the precipitate was 0.236 grams.
- a. To assure accuracy describe TWO procedures that the student needed to undertake after filtration and before determining the mass of the precipitate. **2 marks**
- b. Determine the percentage, by mass, of phosphorous in the washing powder. **2 marks**
- c. Phosphorous in detergents in the form of phosphates acts as low cost builders, but together with nitrates cause pollution in waterways through the process of eutrophication. Outline and describe the effects of eutrophication in natural waterways. **2 marks**
8. Oxygen and its allotrope, ozone, are both found in the Earth's atmosphere.
- a. Define the term allotrope. **1 mark**
- b. Draw the Lewis electron dot structures for the oxygen and ozone molecules and identify the coordinate covalent bond of the ozone molecule. **2 marks**
- c. Explain any differences between the types of bonding within the two forms of oxygen. **1 mark**
- d. Compare the properties of oxygen and ozone. **2 marks**
- e. Give one property of the oxygen free radical that is not found in oxygen. **1 mark**
9. Identify the origins of chlorofluorocarbons (CFCs) and halons in the atmosphere. **4 marks**
10. Isomers of haloalkanes exist.
- a. Explain the definition of an isomer. **1 mark**
- b. Provide 2 isomers of the alkane $\text{C}_5\text{H}_{10}\text{BrCl}$ **2 marks**
- 11.
- a. Provide evidence, which indicates changes in atmospheric ozone concentrations. **3 marks**
- b. Explain how such information was obtained. **2 marks**

12. Identify and assess the effectiveness of methods undertaken to alleviate problems associated with CFC's.

6 marks

13.

a. Describe a chemical test you could use to distinguish between solutions of the anions SO_4^{2-} and Cl^- . **2 marks**

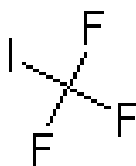
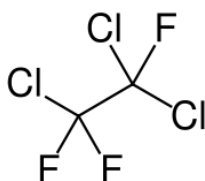
b. Describe how flame tests can be used to distinguish between two named metal ions. **3 marks**

c. Identify hazards associated with doing a flame test on lead. **2 marks**

14.

a. Name the following compounds.

2 marks



b. Draw the chemical structure for 1,1,2,2,2-pentafluoroethane.

1 mark

15. Describe the design and composition of microscopic membrane filters and explain how they purify contaminated water. **6 marks**