

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

Refrigerants are substances used to cool refrigerators and freezers. Until recently, many of the compounds used as refrigerants were chlorofluorocarbons (CFCs), but these are now known to form chlorine radicals. CFCs have been phased out in many countries by international agreement.

- (a) Write **two** equations to show how chlorine radicals react with ozone molecules in the upper atmosphere.

1. _____

2. _____

(2)

- (b) Chloropentafluoroethane is a CFC that has been used as a refrigerant.

Draw its displayed formula.

(1)

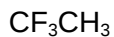
- (c) 1,1,1-trifluoroethane (CF_3CH_3) is one of the molecules that has been used as a refrigerant in place of CFCs.

Explain why 1,1,1-trifluoroethane does not lead to the depletion of the ozone in the upper atmosphere.

(1)

- (d) One of the steps in the synthesis of 1,1,1-trifluoroethane (CF_3CH_3) is the reaction of 1,1-difluoroethane (CHF_2CH_3) with fluorine in a free-radical substitution reaction.

Write **two** equations to represent the propagation steps in this conversion of CHF_2CH_3 into



Propagation step 1

Propagation step 2

(2)

- (e) A refrigerator contains 1.41 kg of 1,1,1-trifluoroethane (CF_3CH_3).

Calculate the number of molecules of 1,1,1-trifluoroethane in the refrigerator.

Give your answer to an appropriate number of significant figures.

(The Avogadro constant $L = 6.022 \times 10^{23} \text{ mol}^{-1}$)

(2)

- (f) There are growing concerns about the use of 1,1,1-trifluoroethane as a refrigerant as it is a greenhouse gas that absorbs some of Earth's infrared radiation.

Give **one** reason why bonds in molecules such as carbon dioxide and 1,1,1-trifluoroethane absorb infrared radiation.

(1)

(Total 9 marks)

Q2.

(a) Octane (C_8H_{18}) is an important compound in petrol.

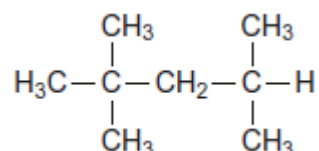
(i) Identify the homologous series to which octane belongs.

(1)

(ii) Write an equation to show the complete combustion of C_8H_{18}

(1)

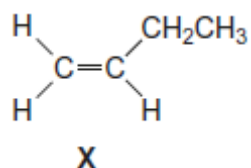
(iii) An isomer of octane used to improve the performance of car engines is shown.



Give the IUPAC name of this isomer.

(1)

(b) Compound **X** is produced when an alkane is cracked.



(i) Give the IUPAC name for compound **X**.

(1)

(ii) One molecule of an alkane is cracked to produce one molecule of compound **X**, one molecule of octane and one molecule of ethene.

Deduce the molecular formula of this alkane.

(1)

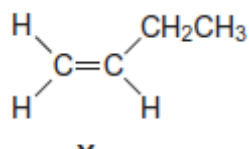
(iii) Name the type of cracking that produces a high yield of compound **X**.
Give **two** conditions required for this process.

Type of cracking _____

Conditions _____

(2)

(iv) Compound **X** has several isomers. The structure of **X** is repeated here.



Draw the displayed formula of a chain isomer, a position isomer and a functional group isomer of compound X.

Type of isomer	Displayed formula of isomer of compound X
Chain	
Position	
Functional group	

(3)
(Total 10 marks)