**MINISTRY OF EDUCATION**

**EFOTEC DATE:9/4/2021**

**FOR S5 (MCB, PCB, PCM /100 MARKS**

**SECTION A /70 marks.**

**1.Shoose the correct answer:**

**a).**What is the name of the following compound?



A. 1,1-butyl-2- mthylpropane, B. 2,2,4-trimetylpentane ,C. 2,2,4-methylpentane

D. 2,4,4-trimethylpentane ,E. none of the previous answers. **/2marks.**

**b)**.The compound that follows belongs to which class of compounds?



A ethers , B aldehydes, C ketones, D alcohols. **/2marks**.

**c**) The molecular formula of-------- fit the general formula(CnH2n-2).

A.Alkanes , B.Alkynes C.Alcohols D.Alkenes

**d**) Example of addition reactions include all but one of the following is not included. Which is not the addition reaction? **/2marks**.

A.Combustion of propene. B.Reaction of Cl2 with propene.

C.Reaction of HBr with but-2-ene. D.Polymerization of ethene. **/2marks**.

**e)** Acetylene is also called

A.Ethyne , B.Ethene, C.Ethane, D.Methane **/2marks**.

**SECTION 2 /60MARKS.**

**2).** Complete the following reactions:**/6mrks**

a. CH3CH=CH2 + HBr 





d. CH3CH2OH + PCl5 

**3).** Consider the following compounds **/ 4marks**

* 1. 2-Hexene
  2. propane
  3. Ethyne
  4. Ethanol

Answer the following questions.

* + - * 1. Which would react with chlorine, but only when heated or exposed to light?
        2. Which would decolorize bromine in the absence of sunlight?
        3. Which would absorb 2 mole of hydrogen per mole of the compound in the presence of a nickel catalyst?
        4. Which are would produce hydrogen gas when reacted with sodium metal.

**4).**(a) A substitution reaction occurs when 2-bromopropane reacts with aqueous sodium hydroxide.

(i) Draw the structure of the organic product of this reaction and give its name.**/2marks**

(ii)Name and outline the mechanism for this reaction. **/3marks**

(b)Under different conditions, 2-bromopropane reacts with sodium hydroxide to produce propene.

(i) Name the mechanism for this reaction.**/1mark**

(ii) State the role of sodium hydroxide in this reaction.**/ 2mark**

**5) .**(a) (i) Write an equation for the reaction of butan-2-ol with ethanoic acid, showing clearly the structure of the organic product/**2marks**.

(ii)Name the type of organic compound formed in part (a)(i) and suggest a use for this compound. **/2marks**

(iii) Give a homogeneous catalyst for the reaction in part (a)(i) and state the meaning of the term *homogeneous.***/2marks**

(b) Write an equation for the complete combustion of butan-2-ol in an excess of oxygen.**/2marks**

(c) But-1-ene and other products can be made by the dehydration of butan-2-ol.

(i) Outline a mechanism for the dehydration of butan-2-ol into but-l-ene.**/4marks.**

(ii) Explain why but-1-ene does not show geometrical isomerism.**/2marks**

(iii) An alternative dehydration of butan-2-ol produces geometrical isomers.  
Draw the structure of one of these geometrical isomers and give its full name. **/2marks**

**6).**Consider the sequence of reactions below.



(a) Name a mechanism for Reaction **1**. **/2marks**

(b) (i) Name compound **Q** /**2mark**

(ii)The molecular formula of **Q** is C4H7NO. Draw the structure of the isomer of **Q** which shows geometrical isomerism and is formed by the reaction of ammonia with an acyl chloride. **/2marks**

(c) Draw the structure of the main organic product formed in each case when **R** reacts separately with the following substances:

(i) methanol in the presence of a few drops of concentrated sulphuric acid; **/2marks**.

(ii) acidified potassium dichromate(VI); **/2marks.**

(iii) concentrated sulphuric acid in an elimination reaction.**/2marks.**

**7.) .**A compound **(A)** **C5H12O**does not give a precipitate with 2,4-dinitro phenyl hydrazine. Oxidation of **(A)** with **K2Cr2O7** gives **(B) C5H10O.** Compound **(B)** reacts readily with

2,4-dinitrophenyl hydrazine but does not give Tollens’s test. The original compound **(A)** can be dehydrated with **H2SO4**to give a hydrocarbon **(C) C5H10.** Ozonolysis of the hydrocarbon **(C)** gives acetone and acetaldehyde. Deduce the structural formulas and names of **(A), (B)** and **(C) /6mrks.**

**8)**Three compounds **E, F,** and **G** all have the molecular formula C3H6O. **E** is an alcohol, **F** is ketone and **G** is aldehyde.

Draw all possible structural formulae for **E, F,** and **G.**

(ii)Describe tests (reagents and conditions and observations with each compounds) that would allow you to show that.

1. E is an alcohol whereas F and G aren’t
2. F and G are carbonyl compounds whereas E isn’t
3. G is aldehyde, whereas E and F aren’t.

b) (i)One of the compounds responsible for the flavor of butter is butane-2,3-dione.

Give the structural formula butane-2,3-dione.

(ii)Give the structural formula of the organic products formed when butane-2,3-dione react with

H2/Ni

**SECTION 3 ATTEMPT ANY 3 QUESTIONS /30MARKS.**

**9).**This question is about compounds **A, B, C, D** and **E** and their interconversions. Some of these are shown in the diagram below.



a)(i) Give the names of compounds **B** and **C.** **/2marks.**

(ii)Draw the structural formula and name the organic product formed when compound **B** reacts with ammonia.**/2marks**

(iii)When compound **C** is heated in water, it is hydrolysed to a carboxylic acid. Write the equation for the reaction that occurs **/2marks.**

(b) Compounds **A, B** and **C** will each react with the same alcohol to form compound **D.**

Give the name of the alcohol and the name of compound **D.** **/2marks**

(ii)State the appropriate reaction conditions for the formation of compound **D** from each of the compounds **B** and **C.** **/2marks**

**10**).Consider the following reaction scheme and then answer the questions below.



(a) Draw the structure formula of propanoic acid. **/1mark.**

(b) Propanoic acid may be converted into compound **Y** by an esterification reaction.

(i)Give the reagent(s) and condition(s) required for the formation of compound **Y** from propanoic acid. **/2marks.**

(ii) Give the name of compound **Y**. **/1mark**

(iii) Write an equation for the esterification reaction. **/2marks**.

(c) Propyl ethanoate is an ester that is structurally isomeric with compound **Y**. When propyl ethanoate is heated with aqueous sodium hydroxide, two products are formed.

(i)Explain what is meant by the term *structural isomerism.* **/2marks**

(ii) Give the names or structures of the two products of this reaction. **/2marks.**

**11).**Consider the following reaction scheme and answer the questions below.



(a) The reaction of compound **C** with **D** produces compound **E**.

(i) Draw the structural formula of **C./2marks**.

(ii) State the compound type to which **E** belongs. **/2marks.**

(b) Compound **F** may be prepared by the reaction of **A** with hydrogen gas in the presence of a platinum catalyst.

(i) Give the name of **F**. **/2mark**

(ii) Suggest the type of reaction involved in the conversion of **A** into **F**. **/2marks.**

(c) Compounds **D** and **F** react readily together. Write an equation for the reaction between them. **/2marks.**

**12**.a)The amino acid **R** is shown below.

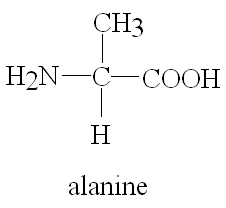


(i)Draw the structure of the zwitterion formed by **R**.**/3marks.**

(ii) Draw the structure of the major organic product formed when an excess of **R** is reacted with bromomethane.

(iii) Name the mechanism of the reaction which results in the formation of the product given in part (ii).**/2marks.**

**b)**The amino acid *alanine* is shown below.



A sample of alanine is dissolved in water.

(i)Draw the structure of the main alanine species present in this aqueous solution and give the name of this type of species**/2marks.**

(ii) Draw the structure of the alanine species formed when an excess of hydrochloric acid is added to the solution. **/3marks.**