YEAR 11/12 CHEMISTRY

MULTIPLE CHOICE ANSWER SHEET
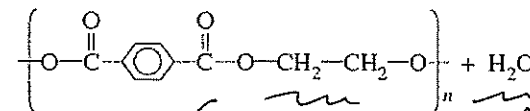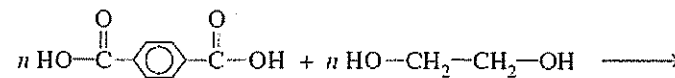
Chose the alternative answer you think is the best and indicate it by writing an "X" in the appropriate box below.

Q	A	B	C	D
1				X
2				X
3		X		
4				X
5			X	
6	X			
7				X
8			X	
9		X		
10		X		

Candidates Name: 3 BCHE CARBON CHEM

Test title: SOLUTIONS 2011

Q10. The type of polymerisation shown in the following reaction is

$n\ HO-\overset{O}{\underset{}{C}}-\bigcirc-\overset{O}{\underset{}{C}}-OH + n\ HO-CH_2-CH_2-OH \longrightarrow$

$\left[O-\overset{O}{\underset{}{C}}-\bigcirc-\overset{O}{\underset{}{C}}-O-CH_2-CH_2-O \right]_n + H_2O$

- A. Addition
- B. Condensation
- C. Esterification
- D. Hydrolysis

B & C in Q11. ALTERNATIVELY ADD MnO_4^-/H^+ or $Cr_2O_7^{2-}/H^+$ A CHANGE IN COLOUR INDICATES OXIDATION. ALKANE DOES NOT REACT WHEREAS THE ALKENE TURNS THE PERMANGATE FROM PURPLE TO COLOURLESS or DICHROMATE FROM ORANGE TO DEEP GREEN. + APPROPRIATE EQUATION.

END OF PART A

PART B: SHORT ANSWER QUESTIONS (15 marks)

Q11. You have carried out a first-hand investigation to compare the reactivity of an alkene with its corresponding alkane. ACCEPT ANY ALKENE/ALKANE

A. State the name of the alkene. CYCLOHEXENE
(1 mark)

B. Outline a procedure to compare the reactivity of this alkene with its corresponding alkane.

ADD BROMINE WATER/SOLUTION to BOTH // A CHANGE IN COLOUR INDICATES THE PRESENCE OF (C=C) CARBON TO CARBON DOUBLE BOND.
(2 marks)

C. Describe the results obtained from this first-hand investigation and include relevant chemical equations.

WITH THE ALKENE: THE BROWN SOLUTION TURNED COLOURLESS // WITH THE ALKANE: THE BROWN SOLUTION REMAINED BROWN

relevant chemical equations
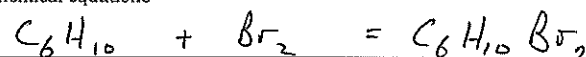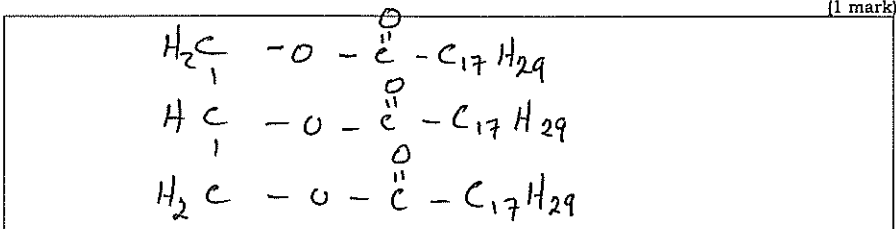
$C_6H_{10} + Br_2 = C_6H_{10}Br_2$
(3 marks)

Q12. Punicic acid, $C_{17}H_{29}COOH$, is the main alkanoic (carboxylic) acid found in pomegranate seeds. It is an unsaturated straight chain compound.

A.   Deduce the number of carbon to carbon double bonds in punicic acid.

3 DouBLE BonDs

(1 mark)

B.   A triglyceride can be made from punicic acid and glycerol (propan-1,2,3-triol)

Draw the structure of this triglyceride. You should represent the hydrocarbon chains in punicic acid as $C_{17}H_{29}$.

(1 mark)

$$H_2C - O - \overset{\displaystyle O}{\overset{\|}{C}} - C_{17}H_{29}$$
$$HC - O - \overset{\displaystyle O}{\overset{\|}{C}} - C_{17}H_{29}$$
$$H_2C - O - \overset{\displaystyle O}{\overset{\|}{C}} - C_{17}H_{29}$$

Name the **two** types of functional groups in the triglyceride in B above.
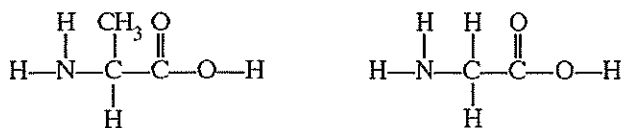
ESTER   &   ALKENE

(2 marks)

C.   Explain why this triglyceride is soluble in non-polar solvents such as hexane.
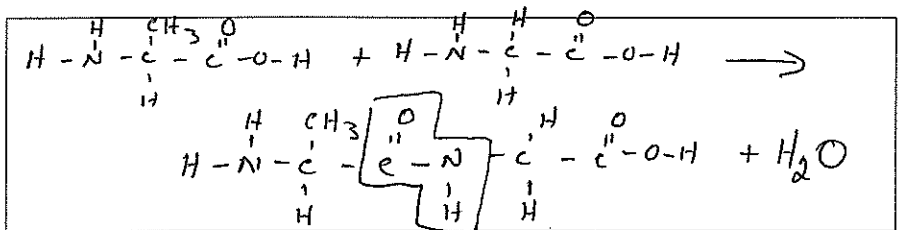
THE NON-POLAR HYDROCARBON CHAINS FORM
FORCES OF ATTRACTION WITH THE NON-POLAR
HYDROCARBON HEXANE // DISPERSION FORCES

(2 marks)

Q13. To what class of compounds do these molecules belong? AMINO ACIDS

(1 mark)

$$H-\overset{\displaystyle H}{\overset{|}{N}}-\overset{\displaystyle CH_3}{\overset{|}{C}}-\overset{\displaystyle O}{\overset{\|}{C}}-O-H \qquad H-\overset{\displaystyle H}{\overset{|}{N}}-\overset{\displaystyle H}{\overset{|}{C}}-\overset{\displaystyle O}{\overset{\|}{C}}-O-H$$

Using the two compounds above describe the formation of a peptide bond with a chemical equation.

(1 mark)

$$H-\overset{H}{\underset{H}{N}}-\overset{CH_3}{C}-\overset{O}{C}-O-H \; + \; H-\overset{H}{N}-\overset{H}{C}-\overset{O}{C}-O-H \longrightarrow$$
$$H-\overset{H}{\underset{H}{N}}-\overset{CH_3}{C}-\boxed{C-N}-\overset{H}{C}-\overset{O}{C}-O-H \; + \; H_2O$$

Clearly indicate the peptide bond by circling it

(1 mark)

Q14. Two different compounds A and B are isomers with the molecular formula C3H8O. A and B undergo a series of reactions as shown below.
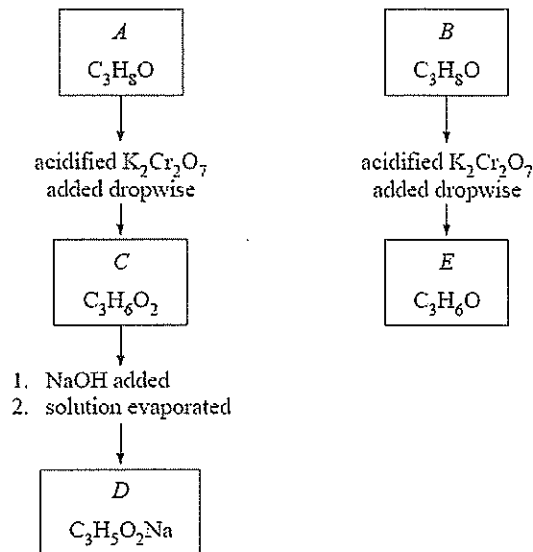
A.   Give the structural formula for C and E

(2 marks)
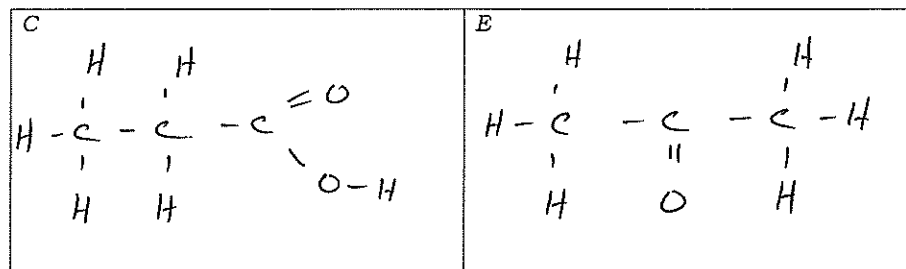
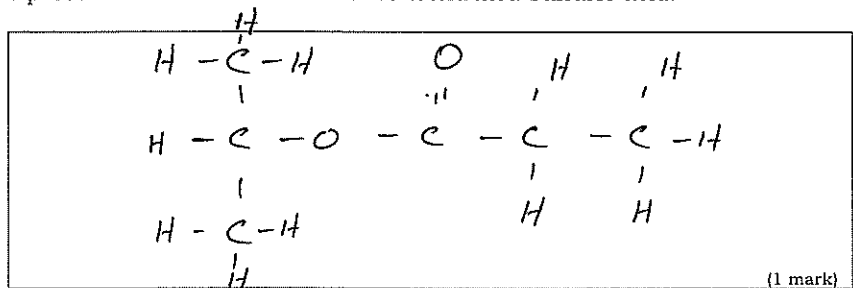B.   How is compound A different from compound B?

(2 marks)

A IS A 1° ALCOHOL (2 HYDROGINS
ATTACHED TO C WITH -OH GROUP)//
B IS A 2° ALCOHOL (1 HYDROGIN ATTACHED)

C.   Describe the colour change seen in going from A to C.

THE ORANGE SOLUTION TURNS DEEP GREEN

(1 mark)

THIS QUESTION CONTINUED OVERLEAF

D. Give the structural formula and name for the compound produced if *B* and *C* react in the presence of a small amount of concentrated sulfuric acid.

```
          H
          |
    H  — C — H          O     H    H
          |            ‖      |    |
    H  —  C  — O  —  C  —  C  —  C  — H
          |                   |    |
    H  —  C — H               H    H
          |
          H
```
(1 mark)

Name:

1 METHYL ETHYL PROPANOATE

(or) 2 PROPYL PROPANOATE
(1 mark)

Q15. Thiophene is a liquid compound of the elements C, H and S.

A sample of thiophene weighing 7.96 g was burned in oxygen, giving 16.65 g CO_2.

Another sample was subjected to a series of reactions that transformed all of the sulphur in the compound to barium sulfate. If 4.31 g of thiophene gave 11.96 g of barium sulfate, what is the empirical formula of thiophene?

$$\{Mark\} \quad m(C) = \frac{16.65}{12.01 + 2(16)} \times 12.01 = \frac{16.65}{44.01} \times 12.01 = 4.543g ✓$$

$$\{Mark\} \quad \%(C) = \frac{4.543}{7.96} \times 100\% = 57.08\%$$

$$\{Mark\} \quad m(S) = \frac{11.96}{137.3 + 32.06 + 4(16)} \times 32.06 = \frac{11.96 \times 32.06}{233.36} = 1.643g ✓$$

$$\{Mark\} \quad \%(S) = \frac{1.643}{4.31} \times 100\% = 38.12\%$$

$$\{Mark\} \quad \%(H) = 100 - [38.12 + 57.08] = 4.8\%$$

$$n(C) = \frac{57.08}{12.01} = 4.752 \quad \rightarrow 3.99$$
$$n(S) = \frac{38.12}{32.06} = 1.189 \quad \div 1.189 \rightarrow 1$$
$$n(H) = \frac{4.8}{1.008} = 4.761 \quad \rightarrow 4$$

$$\{Mark\} \quad \text{EMPIRICAL FORMULA} : C_4H_4S$$

(6 marks)

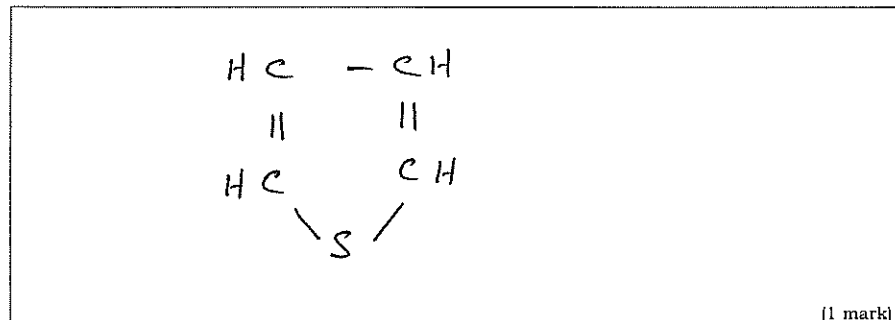**THIS QUESTION CONTINUED OVERLEAF**

Thiophene's molecular mass is 84 amu. What is its molecular formula?

$$\text{EMPIRICAL FORMULA MASS} = 4(12.01) + 4(1.008) + 32.06$$
$$= 84.132$$

$$\text{EMPIRICAL FORMULA MASS} = M_r$$

$$\therefore \text{MOLECULAR FORMULA} : C_4H_4S$$
(1 mark)

Given that thiophene is a ring or cyclic compound, draw a possible structural formula.

```
    HC  —  CH
    ‖       ‖
   HC      CH
     \     /
       S
```
(1 mark)

END OF TEST