

To provide an idea about what this book contains, only few pages taken randomly from the book are shown here.

GCE 'O' Level (Pure) Chemistry (Topical)

C O N T E N T S

Syllabus

M C Q

questions

solutions

THEORY

questions

solutions

- Topic 1** Particulate Nature of Matter, Diffusion
Topic 2 Experimental Techniques
Topic 3 Atomic Structure / Chemical Bonding
Topic 4 Stoichiometry and The Mole Concept
Topic 5 The Periodic Table
Topic 6 Metals and Non-metals
Topic 7 Acids, Bases and Salts
Topic 8 Redox Reactions
Topic 9 Electricity and Chemistry
Topic 10 Energy Changes / Speed of Reactions
Topic 11 Organic Chemistry

Revision



June **2007** Paper 1 & 2

December **2007** Paper 1 & 2



June **2008** Paper 1 & 2

December **2008** Paper 1 & 2



June **2009** Paper 1 & 2

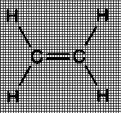
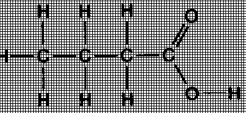
December **2009** Paper 1 & 2

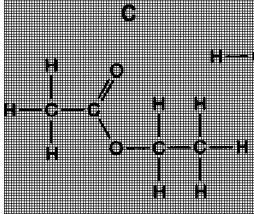
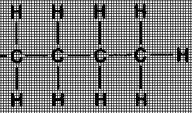


Topic 11 Organic Chemistry

MCQ Section

1. Which structure shows a compound that reacts with ethanol to give a sweet-smelling liquid?

A  **B** 

C  **D** 

2. Starch can be broken down into smaller molecules by heating with a dilute acid. What is this type of reaction called?

A cracking
B hydrogenation
C fermentation
D reduction

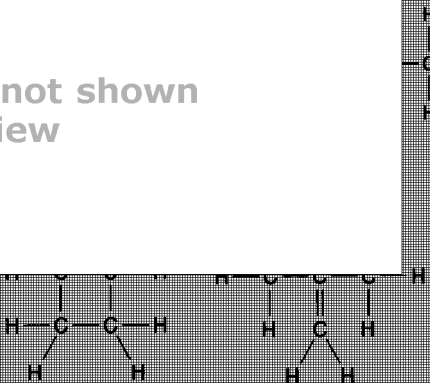
3. Vitamin is an element containing eight carbon atoms per molecule. What is its molecular formula?

A $C_{11}H_{22}$ B $C_{11}H_{24}$
C $C_{11}H_{26}$ D $C_{11}H_{28}$

4. Which of the following is an ester?

A propanoic acid B starch
C methyl propanoate D lye

5. The diagram shows four structures.



Which structures represent alkenes with the molecular formula C_2H_4 ?

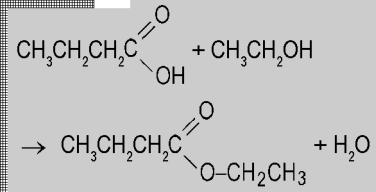
A 1 and 2 only
B 1, 3 and 4 only
C 1, 3, 4 and 5
D 3 and 4 only

6. Which of the following represents alkenes with the molecular formula C_2H_4 ?

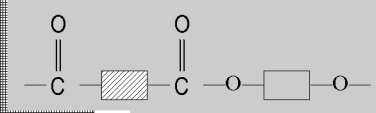
A 1 and 2 only
B 1, 3 and 4 only
C 1, 3, 4 and 5
D 3 and 4 only

Questions are not shown
in Preview

1. B A carboxylic acid reacts with an alcohol to form an ester when heated with some concentrated H_2SO_4 .



2. D Terylene has the structure



3. D Margarine is manufactured by the hydrogenation of unsaturated fats.

4. B Isomers are compounds that have the same molecular formula but different arrangements of the atoms.

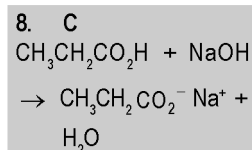
5. C Basically, the reaction is with water in the presence of an acid.

6. C Alkanes have the general formula C_nH_{2n+2} . Hence, octane is $C_8H_{2(8)+2} = C_8H_{18}$.

7. B All the 4 compounds have molecular formula C_4H_8 . However, C is not an alkene.

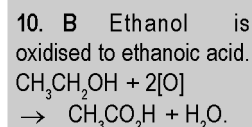
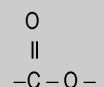


MCQ Answers



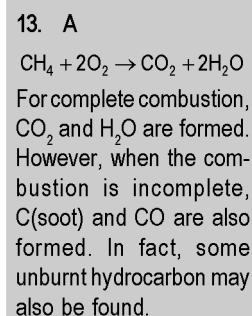
The reaction is neutralization.

9. C Terylene is a polyester and it has the ester linkage



11. D A, B and C are also butan-1-ol.

12. B X is a lighter fraction compared with Y and it contains hydrocarbons of smaller Mr. Hence, X burns more readily and it has a lower boiling point (more volatile) than Y.



10. An organic compound X reacts with sodium hydroxide to give a compound with formula $\text{C}_2\text{H}_5\text{O}_2\text{Na}$. What is compound X?

A ethanol
 B propanoic
 C propanoic acid
 D propanol

11. Which diagram represents the structure of terylene?

A $-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-$
 B $-\text{CH}_2-\underset{\text{Cl}}{\text{CH}}-\text{CH}_2-\underset{\text{Cl}}{\text{CH}}-$
 C
 D

12. The diagram shows the fractional distillation of petroleum.

Which statements about fractions X and Y are correct?

	X burns more easily than Y	X has a higher boiling point than Y
A	yes	yes
B	yes	no
C	no	yes
D	no	no

13. The structure of butan-1-ol is shown.

$$\begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ | & | & | & | \\ \text{H}-\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{OH} \\ | & | & | & | \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$$

Which structure is an isomer of that shown above?

A $\begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{OH} \\ | & | & | & | \\ \text{H}-\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{H} \\ | & | & | & | \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$



MCQ Answers

18. Study and write down all the possible combustion products of methane, CH₄.

A carbon, carbon dioxide, carbon monoxide and water
 B carbon, carbon monoxide and hydrogen
 C carbon dioxide, carbon monoxide, hydrogen and water
 D carbon monoxide and water

19. The structures of two compounds are shown.

Which description of the reaction is correct?

	type of polymer	polymer formed by
A	carbohydrate	condensation polymerisation
B	ester	addition polymerisation
C	hydrocarbon	addition polymerisation
D		condensation

20. When an animal fat is heated with aqueous sodium hydroxide, a soap and glycerol are formed.

This reaction is an example of

A saponification.
 B fermentation.
 C hydrolysis.
 D polymerisation.

21. The structure of the monomer of Polystyrene is shown.

Which description of the polymer is correct?

22. Equal masses of coconut oil, butter, margarine and palm oil are separately dissolved in an organic solvent. A few drops of aqueous bromine are added to each solution and the mixtures are shaken.

The table shows the results.

	sample	colour of mixture
A	butter	orange
B	coconut oil	dark orange
C	margarine	yellow
D	palm oil	colourless

23. Equal masses of coconut oil, butter, margarine and palm oil are separately dissolved in an organic solvent. A few drops of aqueous bromine are added to each solution and the mixtures are shaken.

The table shows the results.

Which sample contains the most unsaturation?

24. They are examples of each other.

25. Equal masses of coconut oil, butter, margarine and palm oil are separately dissolved in an organic solvent. A few drops of aqueous bromine are added to each solution and the mixtures are shaken.

The table shows the results.

Which sample contains the most unsaturation?

26. They are examples of each other.

27. The structure of the monomer of Polystyrene is shown.

Which description of the polymer is correct?

28. When an animal fat is heated with aqueous sodium hydroxide, a soap and glycerol are formed.

This reaction is an example of

29. The structure of the monomer of Polystyrene is shown.

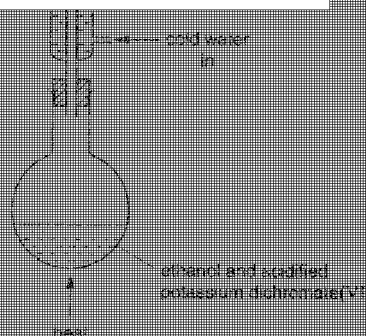
Which description of the polymer is correct?

30. A compound with more C = C double bonds and hence more unsaturated causes a greater degree of decolourisation of Br₂.

31. The animal fat (an ester) is hydrolysed when heated with aqueous NaOH to form a soap (RCOO⁻Na⁺) and glycerol (alcohol).

32. The -CO₂CH₃ shows an ester group. Being an alkene at the same time, it undergoes addition polymerisation.

Questions are not shown in Preview



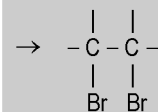
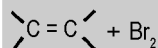
- What was the purpose of the condenser?
- A to make sure the blue red went with ethanol
 B to stop ethanol acid changing back to ethanol
 C to stop ethanol being converted into ethene
 D to stop ethanol vapour escaping

14. A Since both compounds contain only C and H, they are hydrocarbons.

B: The second compound is unsaturated since it contains a C = C double bond.
 C: The first compound is an alkane while the second compound is an alkene.

D: The 2 compounds have different formulae (C₄H₁₀ and C₄H₈). They are not isomers (isomers have the same molecular formula).

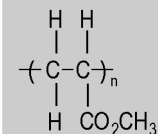
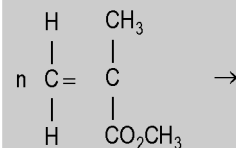
15. D When a compound is unsaturated of C=C double bond, it decolourises Br₂.



A compound with more C = C double bonds and hence more unsaturated causes a greater degree of decolourisation of Br₂.

16. C The animal fat (an ester) is hydrolysed when heated with aqueous NaOH to form a soap (RCOO⁻Na⁺) and glycerol (alcohol).

17. B The -CO₂CH₃ shows an ester group. Being an alkene at the same time, it undergoes addition polymerisation.

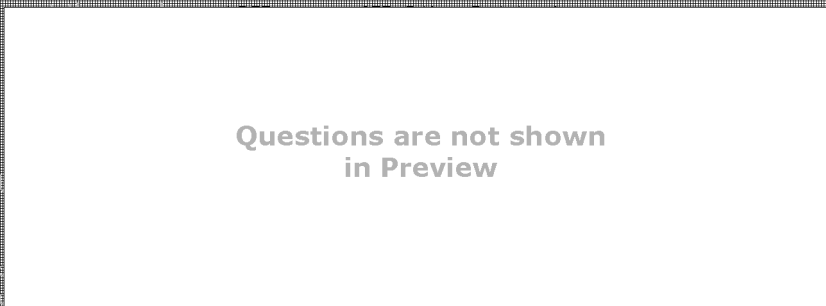


Topic 9 Electricity and Chemistry

THEORY Section

Question 1

The diagram shows a circuit used to purify copper. The electrodes are connected to a 6V d.c. power supply.

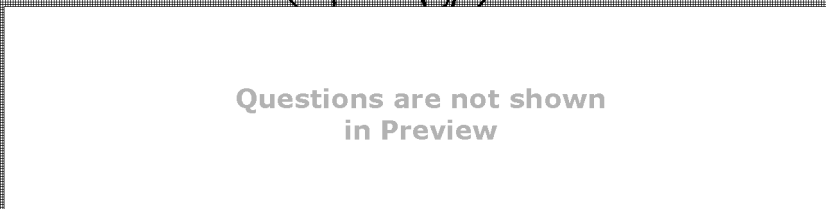
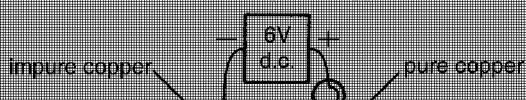


Solution

- (a) (i) For every 4 moles of electrons, 1 mole of O_2 and 2 moles of H_2 are evolved as seen from the equations. Hence, the volumes of H_2 and O_2 are in a ratio of 2 : 1.
- (ii) SO_4^{2-} .
- (b) Anode : O_2 Cathode : H_2
- (c) (i) Aluminium is manufactured by electrolysis of molten Al_2O_3 using graphite electrodes.
- At the cathode, $Al^{3+} + 3e^- \rightarrow Al$
- The Al formed is then drained off.
- (ii) In making cooking utensils eg saucepan.
- (d) 'Amphoteric' means that the oxide shows both acid and basic properties i.e. an amphoteric oxide reacts both with an acid and a base to form a salt.

Question 2

The diagram shows a circuit used to purify copper. The electrodes are connected to a 6V d.c. power supply.



The diagram shows a circuit used to purify copper. The electrodes are connected to a 6V d.c. power supply.

The diagram shows a circuit used to purify copper. The electrodes are connected to a 6V d.c. power supply.

Solution

- (a) 1. The impure copper should be the positive electrode while the pure copper should be the negative electrode.
2. The electrolyte should be CuSO_4 .
- (b) $\text{Cu(s)} \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{e}^-$.

Question 3

Aluminium is manufactured from aluminium oxide. Aluminium oxide is dissolved in molten cryolite and the solution is electrolyzed. (a) Write the ion formed at the anode and describe a test to identify the gas. (2)

(b) Write equations for the reactions at the:

(i) cathode. (1) (ii) anode. (2)

(c) The table shows how much aluminium is made in a factory.

temperature of electrolyte/ $^{\circ}\text{C}$	current used / kA	time / days	mass of aluminium made / tonnes
1000	60	1	1
1000	180	2	6

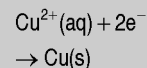
Questions are not shown
in Preview

Solution

- (a) Oxygen.
Insert a glowing splint into the gas and it will be rekindled.
- (b) (i) $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$ (ii) $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$
- (c) (i) Temperature
(ii) When the current used in 180kA, the mass of Al obtained will be 3 times that at 60kA. When the time duration is 2 days, the mass of Al obtained will be 2 times that at 1 day. Hence, mass of Al obtained = $3 \times 2 \times 1 = 6$ times.
- (d) (i) Haematite is reduced by heating with coke to form iron.
 $2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$
- (ii) Aluminium is more reactive than iron and its oxide may not be reduced by chemical reduction. Hence, an electrolytic means is used.
- (ii) lead(II) bromide or lead(II) chloride
- (iii) Pb^{2+} .
- (iv) In solid X, the opposite charged ions are held in fixed positions in a regular arrangement by strong ionic bonds. When molten, free and mobile ions are available to conduct electricity.

COMMENT on ANSWER

“(a) 1. At the negative electrode (cathode), Cu^{2+} ions migrate there and are discharged.



Hence, pure Cu should be made the cathode.

On the other hand, the impure Cu at the positive electrode (anode) dissolves. In this way, Cu is transferred from the anode to the cathode.
2. In order for Cu^{2+} ions to be discharged at the cathode, the electrolyte must contain Cu^{2+} ions.”

COMMENT on ANSWER

“(a) In the electrolysis of molten Al_2O_3 (purified bauxite), cryolite (Na_3AlF_6) is added to lower the melting point of Al_2O_3 . Thus, electrolysis can be carried out at a lower temperature.

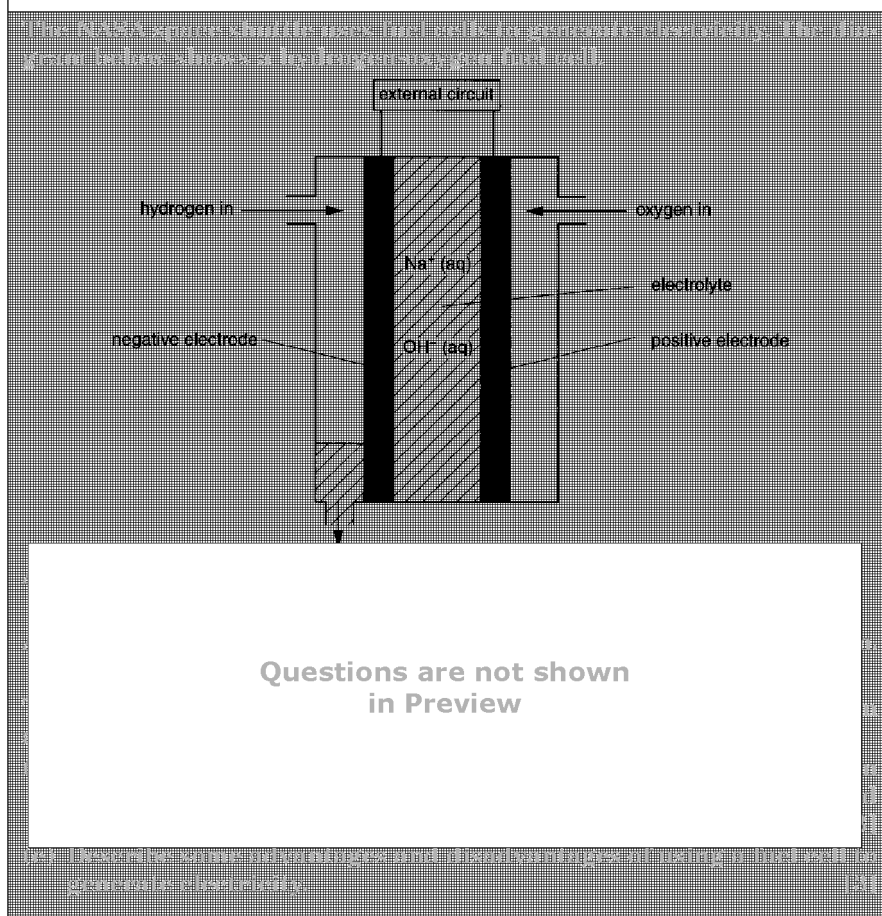
- (b) The amount of product formed (n) depends on the amount of charge (Q) passed through. i.e.

$n \propto Q$. However,
 $Q = It$ where
I = current (A)
t = time (s)
 $Q = \text{charge (c)}$

and $n = \frac{m}{M}$ where

M = molar mass
m = mass of product

Hence, $\frac{m}{M} \propto It$
 $\Rightarrow m \propto MIt$ ”

Question 5**Solution**

- (a) Source of hydrogen: Catalytic cracking of petroleum fractions.
Source of oxygen: Fractional distillation of liquid air.
- (b) sodium hydroxide
- (c) Reduction reaction. Oxygen and water gain electrons to form hydroxide ions.
Cathode: $O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$
- (d) Volume of $O_2 = 120 \text{ dm}^3$
From the equations given, 2 mol of H_2 is required to react with 1 mol of O_2 , to produce 4 mol of OH^- ions, therefore, 240 dm^3 of H_2 will react completely with 120 dm^3 of O_2 .
Using overall equation: $2H_2 + O_2 \rightarrow 2H_2O$
- No. of mol of hydrogen = $\frac{240}{24} = 10$
- No. of mol of water formed = 10
Mass of water formed = $10 \times 18 = 180 \text{ g}$
- (e) *Advantage:* A fuel cell is a renewable energy source and it does not produce any pollutants as products.
Disadvantage: Effective and safe storage of hydrogen and oxygen gases is still a major problem.

COMMENT on ANSWER

“(b) Aqueous sodium chloride electrolyte consists of $Na^+(aq)$, $Cl^-(aq)$, $H^+(aq)$ and $OH^-(aq)$ ions.

(c) The oxidation number of oxygen decreased from 0 in oxygen gas to -2 in hydroxide ion.”