CATHOLIC JUNIOR COLLEGE
JC2 PRELIMINARY EXAMINATIONS
Higher 1

CHEMISTRY

8872/01

Paper 1 Multiple Choice

Wednesday 3rd September 2014
50 minutes

Additional Materials: Multiple Choice Answer Booklet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your name and HT group on all the work you hand in.
Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

WORKED SOLUTIONS

This document consists of **13** printed pages and **1** blank page.

[Turn over

Section A

For each question there are ***four*** possible answers, ***A***, ***B***, ***C*** and ***D***. Choose the one you consider to be ***correct*** and record your choice in soft pencil on the ***separate Answer Sheet*** provided.

1 Nervous disorders due to mercury poisoning occur when mercury forms a 1:1 complex with lipoyl groups, which are vital for glucose metabolism.
For a human containing 5.0 kg of body fluid, what is the mass of mercury (A_r 200) required to complex all the lipoyl groups?
[Average concentration of lipoyl groups in body fluid = 1.0×10^{-8} mol kg^{-1}]

A 4.0×10^{-7}g **B** 2.0×10^{-6}g **C** 2.5×10^{-6}g **D** 1.0×10^{-5}g

Mass of mercury required per kg = $1.0 \times 10^{-8} \times 200 = 2.0 \times 10^{-6}$
For 5.0kg, mass required = $2.0 \times 10^{-6} \times 5.0 = 1.0 \times 10^{-5}$g

2 In a titration, a sample of 0.05 mol dm^{-3} of sulfuric acid was found to require 15.00 cm^3 of 10.50 g dm^{-3} solution of potassium hydroxide for complete neutralisation.
Which of the following shows the correct volume of acid used in the titration?

A 14.1 cm^3 **B** 28.1 cm^3 **C** 42.2 cm^3 **D** 56.1 cm^3

Concentration of KOH in mol dm^{-3} = 10.50 / (39.1 + 16.0 + 1.0) = 0.187 mol dm^{-3}
Amount of KOH = conc × vol = 15 / 1000 × 0.187 = 2.81×10^{-3} mol
Amount of H_2SO_4 = 2.81×10^{-3} / 2 = 1.40×10^{-3} mol
Vol. of H_2SO_4 = no. of moles / conc = 1.40×10^{-3} / 0.05 = 28.1 cm^3

3 In an experiment, 37.50 cm^3 of 0.100 mol dm^{-3} solution of aqueous sodium sulfite reacted exactly with 25.0 cm^3 of 0.100 mol dm^{-3} of X^{n+}.

The half equation for the oxidation of the sulfite ion is shown below.

$$SO_3^{2-}(aq) + H_2O(l) \rightarrow SO_4^{2-}(aq) + 2H^+(aq) + 2e^-$$

If the new oxidation number of X is 0, what is the value of n?

A -3 **B** -2 **C** +2 **D** +3

Amount of SO_3^{2-} = 0.10 × 37.5 / 1000 = 3.75×10^{-3}

Amount of X^{n+} = 0.10 × 25.0 / 1000 = 2.5×10^{-3}

$2X^{n+} \equiv 3SO_3^{2-}$

Therefore,

$3\ SO_3^{2-}(aq) + 3\ H_2O(l) \rightarrow 3\ SO_4^{2-}(aq) + 6\ H^+(aq) + 6\ e^-$

$2\ X^{n+} + 2n\ e^- \rightarrow 2\ X$

From the half equations, 2n = 6, n= 3

4 Potassium ferricyanide, $K_3Fe(CN)x$, is commonly used in photography. Given that the 1 mole of $K_3Fe(CN)x$ has a mass of 329.3 g, calculate the percentage by mass of C in the compound.

A 47.4% **B** 23.7% **C** 21.9% **D** 14.6%

No of mole of CN present in 1 mole of compound

$$= \frac{329.3 - 39.1 \times 3 - 55.8}{12+14} = \frac{156}{126} = 6.00 \text{ (3.s.f.)}$$

Thus x = 6

% by mass of C in compound = $\frac{12 \times 6}{329.3} \times 100\% = 21.9\%$ (3.s.f.)

5 Which of the following has more neutrons than electrons and more electrons than protons?

A $^{37}Cl^-$ **B** $^{48}Ti^{4+}$ **C** $^{79}Br^+$ **D** $^{32}S^{2-}$

	$^{37}Cl^-$	$^{48}Ti^{4+}$	$^{79}Br^+$	$^{32}S^{2-}$
Proton:	17	22	35	16
Electron:	18	18	34	18
Neutron:	20	26	44	16

Note: Students should eliminate option B and C since the qns stated that there are "more electrons than protons". Thus the only options that required calculation of no. of neutrons and electrons is option A and D.

6 Which of the following statement regarding isotopes is correct?

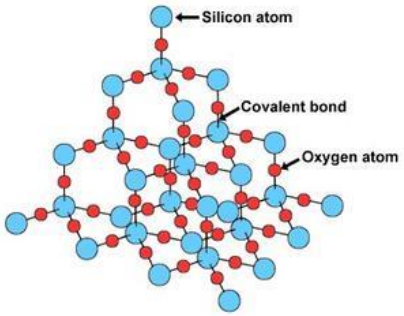
A Graphite is an isotope of diamond.
B Isotopes have the same number of neutrons.
C Isotopes have the same density.
D Isotopes have similar chemical properties.

A: Incorrect – Graphite and diamond are allotropes, not isotopes.
B: Incorrect – Isotopes have the same number of protons (since they are the same element) but different number of neutrons.
C: Incorrect – Isotopes do not have the same density as they different in mass (isotopic mass) i.e. deuterium, D (^2H) is more dense than hydrogen ^1H.
D: Correct – Chemical reactions involve valence electrons of the atom/molecules, since the number of valence electrons of isotopes are the same, thus they have the same chemical properties.

7 Which one of the following statements about the properties of silicon dioxide is correct?

A It exists as simple molecules with intermolecular van der Waals' forces of attraction.
B It is a non-conductor of electricity.
C It can dissolve in water to produce Si^{4+} and O^{2-} ions.
D Each silicon atom is bonded to oxygen atoms in a trigonal planar arrangement.

Silicon dioxide exists as a macromolecule, where each Si atom is covalently bonded to 4 other O atoms.



The shape around each Si atom is tetrahedral, with a O-Si-O bond angle of 109.5°. Because the covalent bonds are strong, and both Si and O are non-metals, SiO_2 does not dissolve in water to give ions. There are also no mobile electrons to conduct electricity.

8 Which option shows, in ascending order, the correct sequence of the magnitude of lattice energies of the following compounds?

I NaC*l*

II RbC*l*

III MgS

IV BaS

A I, II, III, IV

B II, I, IV, III

C III, IV, I, II

D IV, III, II, I

Worked solution:

According to the formula for lattice energy,

$$\Delta H_{latt} \propto \frac{q_+ q_-}{r_+ + r_-}$$

The effect of charges will be multiplied therefore the magnitude of lattice energy is higher for MgS and BaS as compared to NaCl and RbCl.

According to the formula, the bigger the size of cation, the lower the magnitude of lattice energy. Since Rb is bigger than Na, the magnitude of lattice energy of NaCl >RbCl. Similarly, Ba is bigger than Mg thus the magnitude of lattice energy of MgS> BaS.

The answer is: RbCl< NaCl< BaS < MgS (II, I, IV, III) (B)

9 From which of the following reactions can the bond energy of the Si–C*l* bond be determined by using **only** the standard enthalpy change of the reaction?

A $SiCl_4(l) \rightarrow SiCl_4(g)$

B $2Cl_2(g) + Si(s) \rightarrow SiCl_4(g)$

C $SiCl_4(g) \rightarrow Si(g) + 4Cl(g)$

D $SiCl_4(g) \rightarrow SiCl_2(g) + Cl_2(g)$

Worked solution:

A $SiCl_4(l) \rightarrow SiCl_4(g)$

This involves a change in state and the bonds that are broken are the intermolecular force of attraction. Si-Cl bonds are not broken.

B $2Cl_2(g) + Si(s) \rightarrow SiCl_4(g)$

In this reaction, 4 Si-Cl bonds are formed and Cl-Cl bonds are broken, the bond energy required to break Cl-Cl bonds is required to find out the bond energy of Si-Cl bond.

C $SiCl_4(g) \rightarrow Si(g) + 4Cl(g)$

In this reaction, 4 Si-Cl bonds are broken, therefore the enthalpy change of reaction for this step divided by 4 will give us Si-Cl bond.

D $SiCl_4(g) \rightarrow SiCl_2(g) + Cl_2(g)$

In this reaction, 4 Si-Cl bonds are broken, 2 Si-Cl bonds are formed and 1 Cl-Cl bond is formed. The bond energy given out to form Cl-Cl bond is required to find out the bond energy of Si-Cl bonds.

Answer: C

10 Which of the following statement is always true about a system in dynamic equilibrium?

A The addition of a catalyst can affect the position of the equilibrium.

B The rate of forward reaction is the same as the rate of backward reaction.

C The concentration of products is constantly changing at dynamic equilibrium.

D At dynamic equilibrium, the concentration of products is the same as that of the reactants.

Worked solution:

The addition of a catalyst can only alter the **rate at which the equilibrium is reached** but not the position of equilibrium.

Dynamic equilibrium refers to a ***reversible reaction*** in which the forward rate of reaction is ***equa***l to the reverse rate of reaction. There is ***no change*** in the concentrations of the reactants and the products, though the reaction is still ***proceeding***.

Answer B

11 A mixture was made by adding $10cm^3$ of a solution of pH 1 to $30cm^3$ of another solution of pH 5. What is the final pH of the mixture?

A 1.6 **B** 2.5 **C** 3.0 **D** 4.0

Worked solution:

$[H^+]$ in solution of pH 1 = 10^{-1}

$[H^+]$ in solution of pH 5 = 10^{-5}

$[H^+]$ in the mixture = $\frac{no.of\ moles\ of\ H^+}{total\ volume}$

$$= \frac{\frac{10}{1000}\times 10^{-1} + \frac{30}{1000}\times 10^{-5}}{\frac{40}{1000}} = 0.0250$$

pH of the mixture = -lg(0.0250) =1.6

Answer A

12 Which of the following pairs of solutions will produce an acidic buffer solution upon mixing equal volumes of each solution?

A 1.50 mol dm^{-3} of HCl and 1.00 mol dm^{-3} of NaOH

B 1.00 mol dm^{-3} of CH_3CO_2H and 2.00 mol dm^{-3} of NaOH

C 0.50 mol dm^{-3} of H_2SO_4 and 2.00 mol dm^{-3} of $NH_3(aq)$

D 1.00 mol dm^{-3} of $C_6H_5CO_2H$ and 0.50 mol dm^{-3} of KOH

Worked solution:

To produce an acidic buffer solution, there must be a weak acid and the conjugate base of the weak acid.

A 1.50 mol dm^{-3} of HCl and 1.00 mol dm^{-3} of NaOH

$HCl + NaOH \rightarrow NaCl$ and H_2O

Although there is excess acid and salt produced, no buffer solution is created since there is no weak acid nor conjugate base of the weak acid.

B 1.00 mol dm^{-3} of CH_3CO_2H and 2.00 mol dm^{-3} of NaOH

$CH_3CO_2H + NaOH \rightarrow CH_3CO_2^- Na^+$ and H_2O

Although there is a weak acid, upon reaction, there will not be any excess CH_3CO_2H left. Instead, there is excess strong base. Thus, only NaOH and $CH_3CO_2^-Na^+$ are present in the resultant solution Therefore there will not be an acidic buffer created.

C 0.50 mol dm^{-3} of H_2SO_4 and 2.00 mol dm^{-3} of $NH_3(aq)$

$H_2SO_4 + 2NH_3 \rightarrow (NH_4)_2SO_4$

The resultant solution contains unreacted NH_3 (since it is in excess) and $(NH_4)_2SO_4$ (the salt of weak base). This is the composition of a alkaline buffer, not acidic buffer.

D 1.00 mol dm^{-3} of $C_6H_5CO_2H$ and 0.50 mol dm^{-3} of KOH

$C_6H_5CO_2H + KOH \rightarrow C_6H_5CO_2^- K^+$ and H_2O

Since $C_6H_5CO_2H \equiv KOH$, there will be an excess of $C_6H_5CO_2H$ left and at the same time, there will be conjugate base of the acid formed. Therefore, an acidic buffer will be created.

13 The rate of decay of a radioactive isotope (a first order reaction) was found to decrease from 200 counts per minute to 12.5 counts per minute after 48 hours. What is the half-life of this isotope?

A 6 hours **B** 12 hours **C** 18 hours **D** 24 hours

200 —(1 half-life)→ 100 —(1 half-life)→ 50 —(1 half-life)→ 25 —(1 half-life)→ 12.5

Total number of half-lives = 4

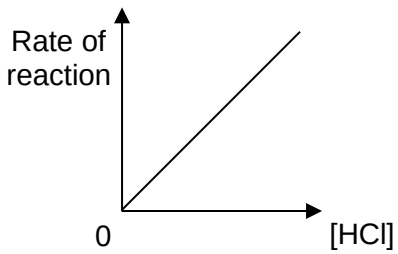
Total time taken for 4 half-lives = 48 hours

Thus, 1 half-life = 48 / 4 = 12 hours

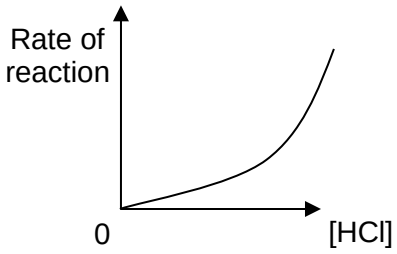
14 Methyl ethanoate, $CH_3CO_2CH_3$, undergoes hydrolysis in water in the presence of HC*l*,which catalyses the reaction.

Which of the following graphs would confirm that the rate of reaction is first order with respect to HC*l*?

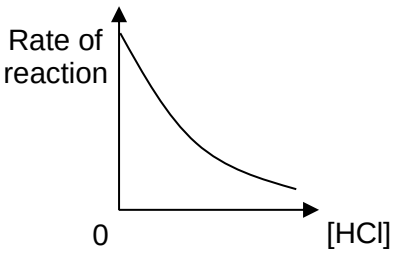
A



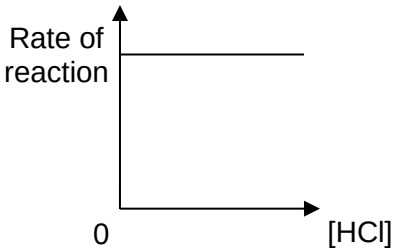
B



C



D



For a first order reaction, the rate of the reaction is directly proportional to the concentration of the reagent. Graph B represents a 2nd order of reaction with respect to HCl, as the rate of reaction increases to a greater extent than [HCl]. Graph C indicates an inverse relationship between reaction rate and [HCl] (therefore it is not directly proportional). Graph D represents a zero order of reaction with respect to HCl, as the reaction rate does not change, even when [HCl] changes.

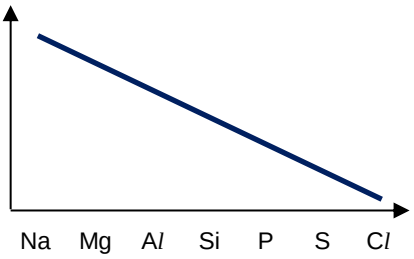
15 Element **X** has a melting point of 97.8 °C and has high electrical conductivity. Its oxide dissolves readily in water to produce a solution which turns red litmus paper blue. However, its chloride dissolves in water to give a neutral solution. Which group could element **X** belong to?

A I **B** II **C** III **D** IV

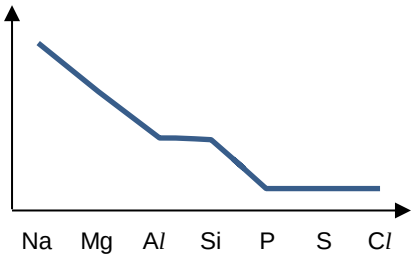
- X has high electrical conductivity → X is a metal
- X has a relatively low melting point
  → X is a Group I metal since Group I metals general have low melting and boiling point.
- Oxide of X dissolves readily in water to give basic solution
  → Group I oxides dissolves in water to give hydroxides which are basic.
  E.g. $Na_2O + H_2O \rightarrow 2NaOH$
- Chloride of X dissolved in water to give neutral solution
  → X is a Group I chloride

16 Which of the following shows the correct trend for Period 3 elements?

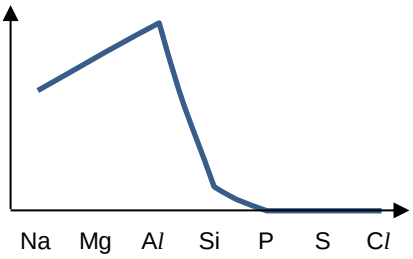
A electronegativity



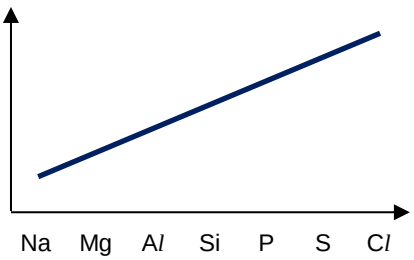
B boiling point



C electrical conductivity

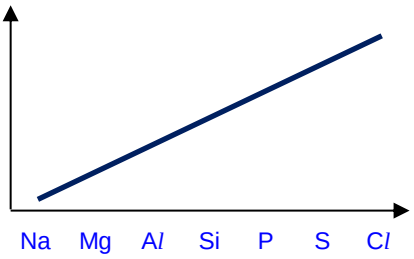


D Ionic radius

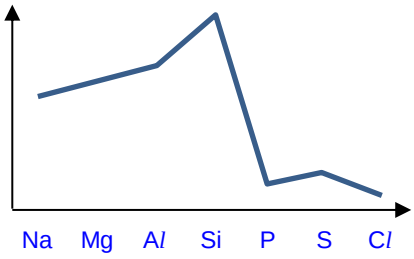


Worked solutions

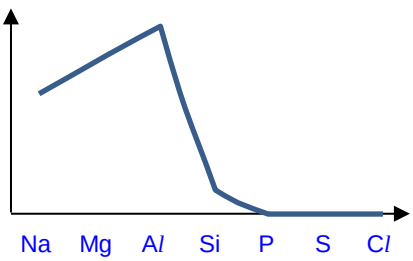
A electronegativity



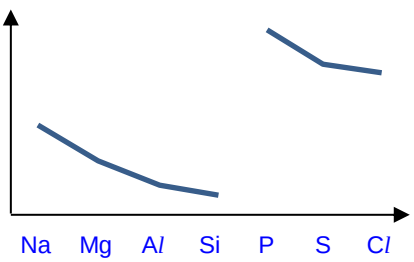
B boiling point



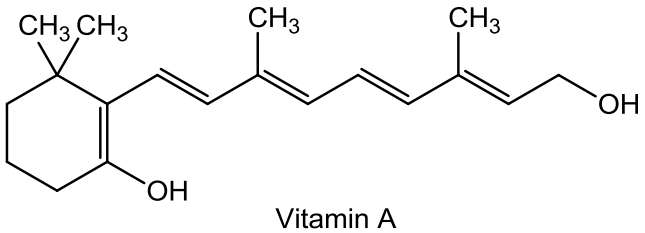
C electrical conductivity



D Ionic radius



17 Vitamin A is essential to the human body as it is needed for growth and development of the immune system. The structure of a molecule of vitamin A is shown as follows:



Vitamin A

Which of the following will **not** result in an observable change when reacted with Vitamin A?

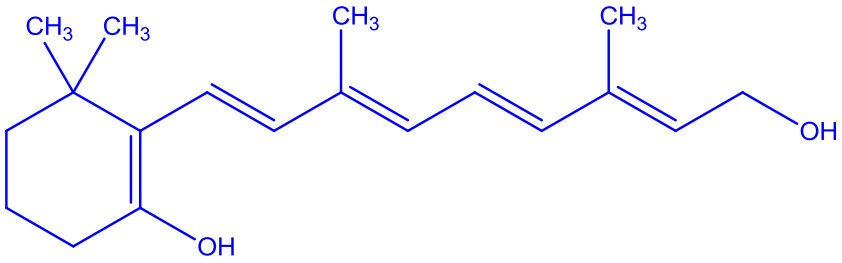
A Hot alkaline $KMnO_4$

B $SOCl_2$, heat under reflux

C $Br_2(aq)$, room temperature

D PCl_3, room temperature

Worked solution:



Vitamin A

A Since there are C=C bonds and OH group present, Vitamin A can decolorise purple $KMnO_4$ when oxidation reaction occurs.

B Subsitution can occur (due to the presence of OH groups in vitamin A) and steamy white fumes of HCl will be produced.

C Due to the presence of C=C bonds, orange $Br_2(aq)$ will decolourise.

D Although subsitution can occur (due to the presence of OH groups in vitamin A), there are no observable change when PCl_3 reacts with Vitamin A.

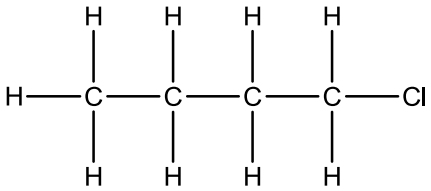
18 How many structural isomers can C_4H_9Cl form?

A 3 **B** 4 **C** 5 **D** 6

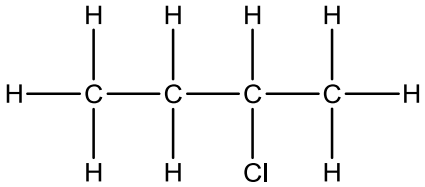
Worked solution:

In total, there are 4 structural isomers that C_4H_9Cl forms. The isomers are as follows:

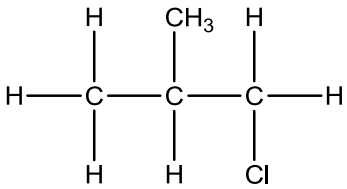
1) 1-chlorobutane



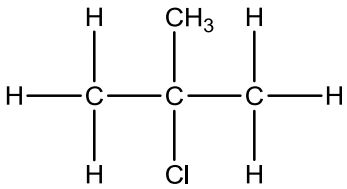
2) 2-chlorobutane



3) 1-chloro-2-methylpropane

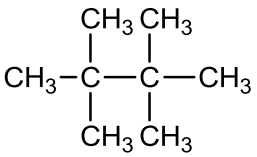


4) 2-chloro-2-methylpropane

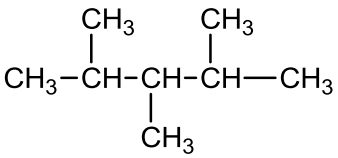


19 Hydrocarbon **X** reacts with bromine gas in the presence of UV light to form 3 mono-brominated products. Which of the following is a possible structure of **X**?

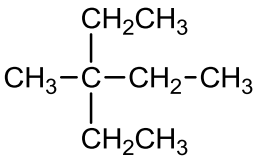
A



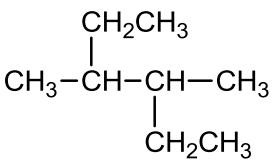
B



C



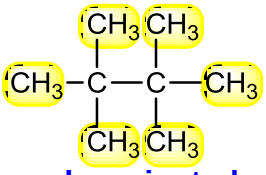
D



Worked solutions

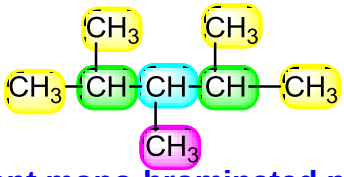
The coloured groups show the different hydrogen atoms that can be substituted to give different mono-brominated products. To solve this question, students have to identify the different types of hydrogen present, keeping in mind symmetry of the molecule. The more symmetrical the molecule is (i.e. more plane of symmetry), the fewer different mono-brominated product obtained.

A



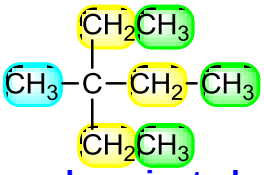
1 mono-brominated product

B



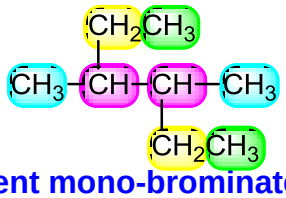
4 different mono-brominated products

C



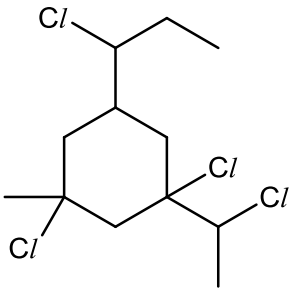
3 mono-brominated products

D



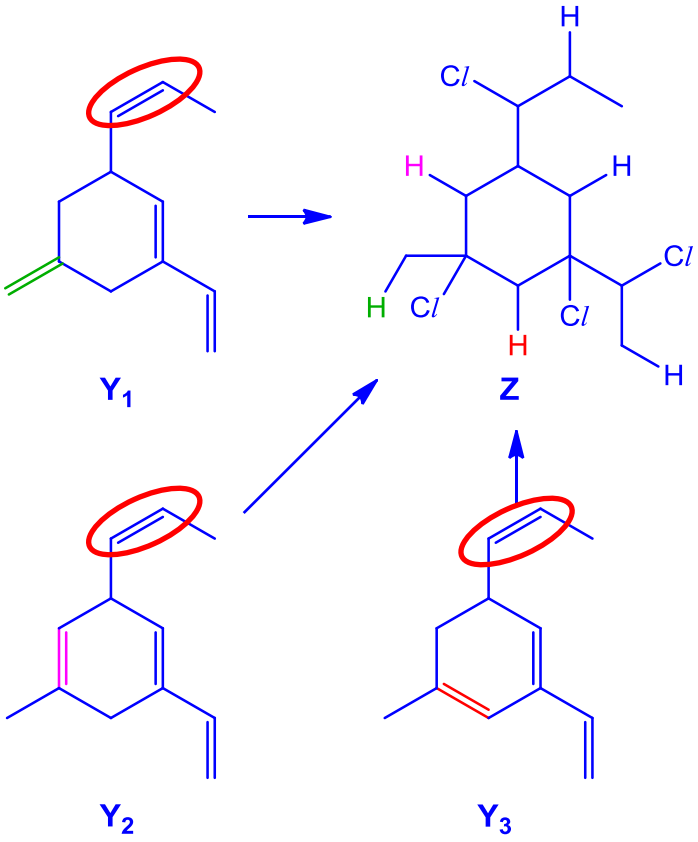
4 different mono-brominated products

20 Compound **Z**, the major product, is obtained when compound **Y** is reacted with gaseous HC*l*. How many pairs of geometric isomers does the compound **Y** have?



Z

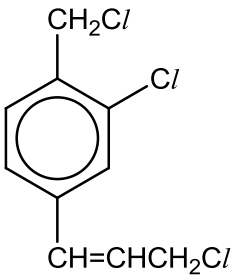
A 1 **B** 2 **C** 3 **D** 4



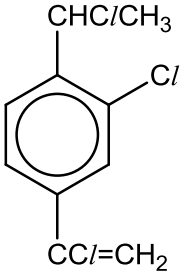
Z is a product of **Y** undergoing electrophilic addition. When looking at addition to asymmetrical alkenes, Markonikov's rule must be applied. Thus, going backward, there are 3 possible structures for **Y**. All possible structures of **Y** can only give 1 pair of geometric isomers (circled in red). The other C=C are either terminal alkenes (-C=CH_2 there are two identical H atom on one of the C involved in C=C) or C=C in a ring, thus both do not exhibit geometric isomerism.

21 0.050 mol of compound **P** is first heated with excess aqueous potassium hydroxide. Nitric acid followed by aqueous silver nitrate was then added before filtration was carried out. Given that 14.4 g of precipitate is obtained, which of the following is a possible structure of **P**?

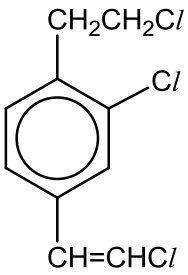
A



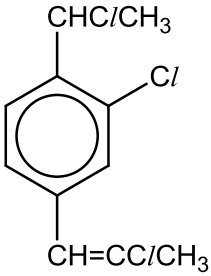
B



C

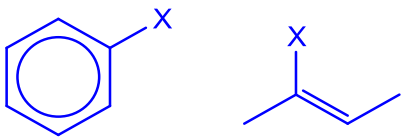


D



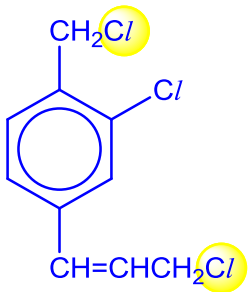
Worked solutions

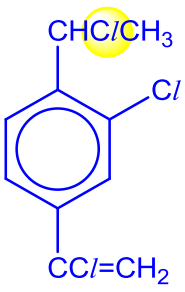
The following two types of C-X cannot be broken via hydrolysis (nucleophilic substitution).

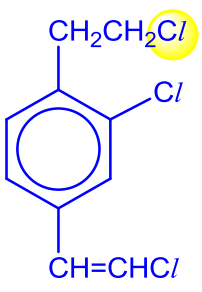


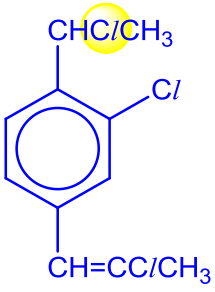
whereby the C atom of the C-X bond is either involved in a benzene ring of alkene functional group. This is due to the partial double bond character of the C-X bond, causing the bond to be stronger and less likely to break.

Thus the only C-X bond that can break in the molecules stated above are:

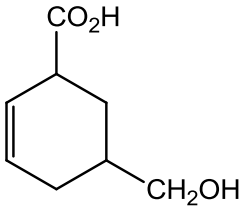






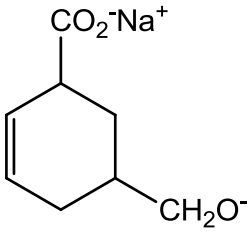


22 Excess aqueous sodium hydroxide is added to the molecule shown as follows.

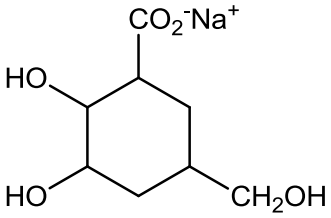


Which structure represents the organic ion produced?

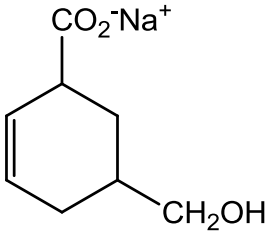
A



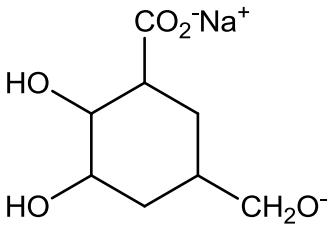
B



C



D



Worked solution:

There are 3 functional groups present in the molecule, namely, alkene (C=C), alcohol and carboxylic acid. Out of these 3, only carboxylic acid is able to react with NaOH, therefore C is the correct answer.

23 Which of the following statements is **not** true about ethanol?

A It produces yellow precipitate when reacted with NaOH(aq) and I_2

B It can react with NaBr and concentrated H_2SO_4 heated under reflux.

C It can react with KCN to produce an organic compound with 3 carbon atoms.

. **D** It produces brown precipitate when heated under reflux with alkaline $KMnO_4$

Worked solution:

A It produces a yellow ppt when reacted with NaOH(aq) and I_2.

True as ethanol contains the $-CH(OH)CH_3$ group that produces CHI_3 ppt with NaOH and I_2.

B It can react with NaBr and concentrated H_2SO_4 heated under reflux.

True as ethanol contains OH group which can react with the HBr generated in-situ from NaBr and H_2SO_4 to form bromoethane.

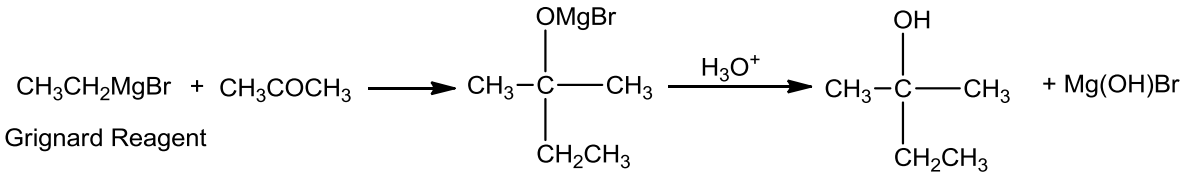
C It can react with KCN to produce a molecule with 3 carbon atoms.

Not true. Alcohols doe not react with KCN. Step up reactions are only possible using halogenoalkane/carbonyl functional groups.

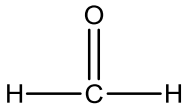
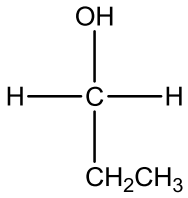
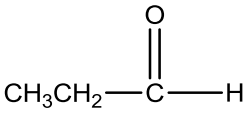
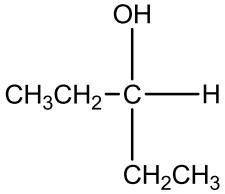
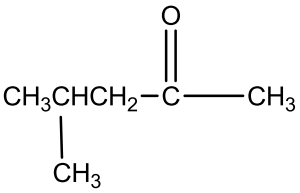
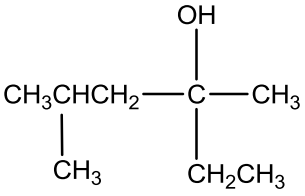
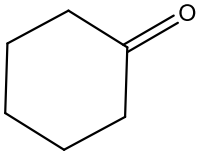
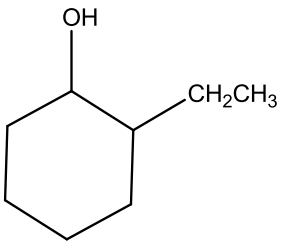
D It causes purple $KMnO_4$ to decolourise and forms a brown ppt of MnO_2 in an alkaline medium when heated under reflux.

True as ethanol can be oxidized by alkaline $KMnO_4$ to form ethanoic acid.

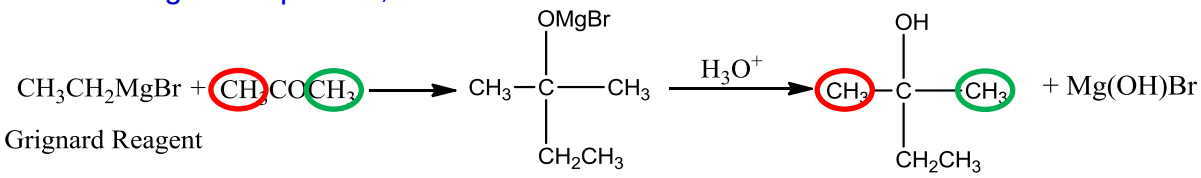
24 In a Grignard reaction, the Grignard reagent reacts with carbonyl compounds to yield alcohols. One example of such reaction is shown as follows:



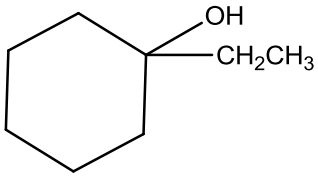
When the following carbonyl compounds are reacted with the same Grignard reagent, which of the following alcohol will **not** be produced?

	Carbonyl compound	Alcohol produced
A		
B		
C		
D		

Worked solution:
Looking at the pattern,

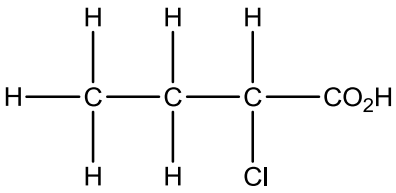


Answer is D
Upon reaction with Grignard reagent, the alcohol formed should be

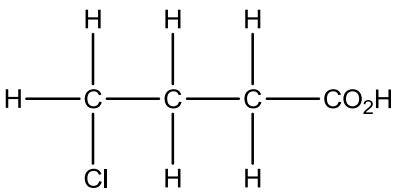


The OH and the CH_2CH_3 groups should be on the same carbon.

25 The structure of two organic acids, **X** and **Y** are shown as follows.



X



Y

Which of the following statement is true about these two acids?

A **X** has a higher pKa value than **Y**.

B Only **Y** can produce effervenscence when reacted with $NaHCO_3$.

C Only **X** can undergo elimination to form a pair of geometric isomers.

D Both acids can be reduced to form primary alcohols when reacted with $NaBH_4$ in methanol.

Worked solution:

A **Not True.**

Since the position of the electron withdrawing Cl atom is nearer to the CO2H group in acid X, thus increasing the polarisation of the O-H bond in acid X, making it a stronger acid than acid Y. Therefore X should have a lower pKa than Y. (lower pKa→ stronger acid)

B **Not True.**

Both acids will be able to produce effervenscence of CO_2 when reacted with $NaHCO_3$.

C **True.**

Although both X and Y can undergo elimination, only X can form a pair of geometric isomers. Y will form an alkene with 2 H atoms attached to one of the C across the C=C.

D **Not True.**

Both acids cannot be reduced by using $NaBH_4$. They can only be reduced using $LiAlH_4$.

Section B

For each of the questions in this section, one or more of the three numbered statements **1** to **3** may be correct.

Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements that you consider to be correct).

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

No other combination of statements is used as a correct response.

26 Which of the following compounds is able to form hydrogen bonding with water molecules?

1 $CH_3CH_2NH_2$

2 CH_3CH_2CHO

3 $CH_2CH_2CH_2Cl$

For a compound to be able to form hydrogen bonding, it must:

1. contain either F, O, or N, whereby F, O, or N is bonded to the H atom
2. have lone pair of electrons on F, O, or N

Option 1 contains H directly bonded to electronegative N so it will be able to form hydrogen bonding with water.

Although Option 2 does not contain any H directly attached to electronegative O, it is still able to form hydrogen bonding with water as there are lone pairs of electrons on O.

Option 3 is false as it does not contain electronegative F, O or N.

27 The kinetics of the reaction A + B → C + D were investigated and the results are given in the following table.

Experiment	[A]	[B]	Relative Rate
1	x	y	r
2	2x	y	2r
3	3x	3y	3r

Which of the following statements is correct?

1 The reaction is first order with respect to A.

2 The rate of reaction is independent of the concentration of B.

3 The units for the rate constant, k, is $mol^{-1}\ dm^3\ s^{-1}$.

Option 1 is correct.

Comparing experiments 1 and 2, when [A] doubles, while [B] remains the same, the rate doubles. Thus, reaction is first order with respect to A.

Comparing experiments 1 and 3, and using the equation rate = $k[A]^m[B]^n$,

$$\frac{r}{3r} = \frac{k(x)(y)^n}{k(3x)(3y)^n}$$

$$\frac{1}{3} = \frac{1}{3 \times 3^n}$$

$$n = 0$$

Option 2 is correct.

The reaction is zero order with respect to B, and the rate of reaction is independent of the concentration of B.

Option 3 is not correct.

Since the rate equation is

Rate= k[A], units for k are s^{-1}.

28 Elements diagonally adjacent to each other in the Periodic Table have similar properties. For example, beryllium has properties similar to aluminium.

Which of the following statements regarding beryllium is correct?

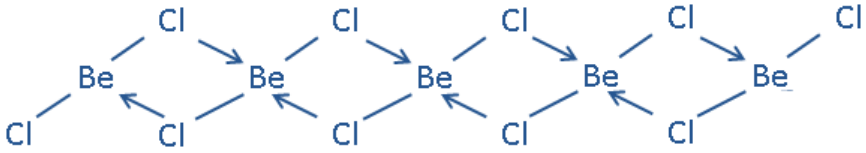
1 Beryllium oxide is amphoteric.

2 Beryllium chloride is able to polymerise due to dative covalent bond.

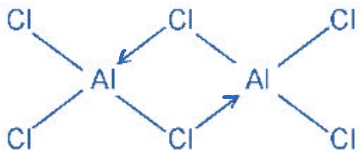
3 Beryllium oxide has high melting point.

1 True. Beryllium oxide is amphoteric.
Similar to Al_2O_3, BeO is amphoteric.

2 True . Beryllium chloride is able to polymerise due to dative bonding.



Similar to

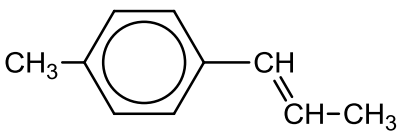


3 True. Similar to aluminium oxide, beryllium oxide has high melting point. The melting point of beryllium oxide is about 4000^{o}C.

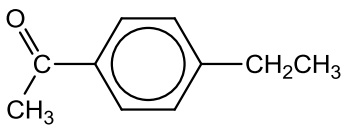
29 An organic compound, **U**, is heated under reflux with acidified $KMnO_4$ and the organic only product formed obtained is benzene-1,4-dicarboxylic acid.

Which of the following is a possible structure of compound **U**?

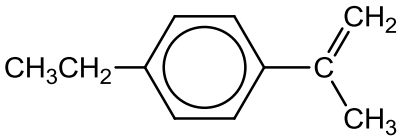
1



2

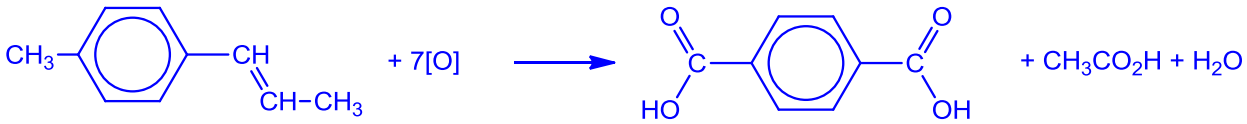


3

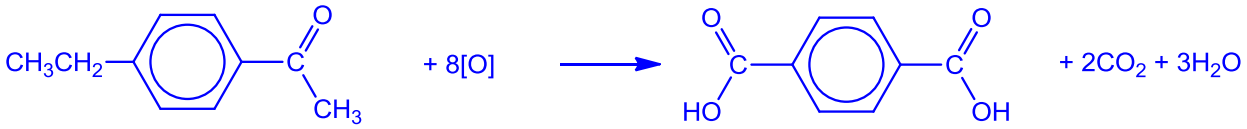


Worked solutions

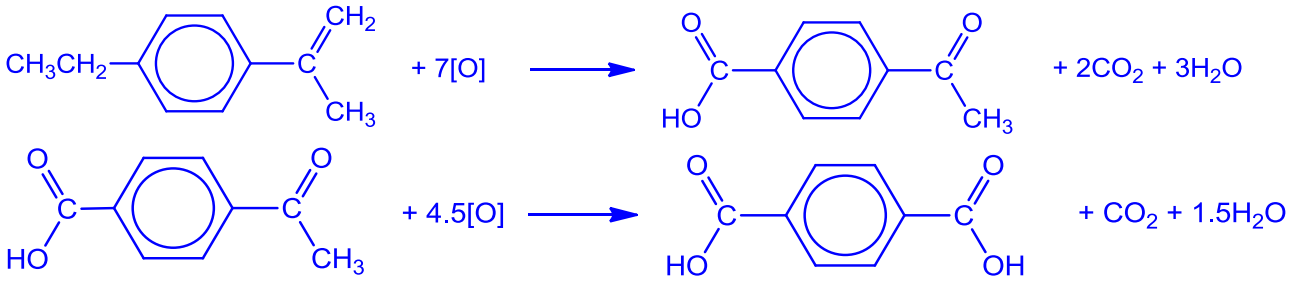
Option 1: 2 organic compounds obtained.



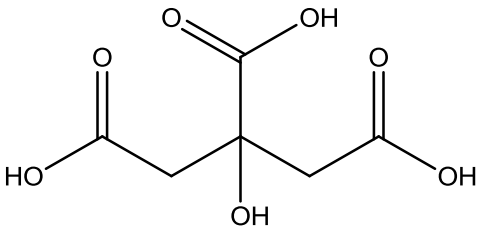
Option 2: Only 1 organic compound obtained



Option 3: The intermediate compound can undergo further oxidation to give benzene-1,4-dicarboxylic acid as the only product.



30 Citric acids which can be found in citrus fruits are usually used as a natural preservatives and food additive. A molecule of citric acid is shown as follows.



Which of the following statements is true about citrus acid?

1 One mole of citric acid can react with 4 moles of PCl_5(s) at r.t.p.

2 One mole of citric acid can react with 4 moles of NaOH(aq) at r.t.p.

3 After heating with acidified $KMnO_4$, the product formed is able to form orange crystals with 2,4-dinitrophenylhydrazine.

Worked solution:

1 Since there are 3 CO_2H groups and 1 OH group, One molecule of citric acid can react with 4 moles of PCl_5(s) at r.t.p.

2 Only the CO_2H groups are able to react with NaOH, thus One molecule of citric acid can only react with **3** moles of NaOH(aq) at r.t.p.

3 The alcohol group present in citric acid is a tertiary alcohol which cannot be oxidized further. Due to the absence of carbonyl functional group, the product is **not** able to form orange crystals with 2,4-dinitrophenylhydrazine.

Answer: D

Answers:

1	D	**11**	A	**21**	A
2	B	**12**	D	**22**	C
3	D	**13**	B	**23**	C
4	C	**14**	A	**24**	D
5	A	**15**	A	**25**	C
6	D	**16**	C	**26**	B
7	B	**17**	D	**27**	B
8	B	**18**	B	**28**	A
9	C	**19**	C	**29**	C
10	B	**20**	A	**30**	D