**Questions**

**Q1.**Select the correct pH for each of the following solutions.

(a)  Nitric acid, HNO3, of concentration 2 mol dm−3, assuming it is fully dissociated.

**(1)**

   **A**    −0.3

   **B**    0.0

   **C**    0.3

   **D**    2.0

(b)  Sodium hydroxide, NaOH, of concentration 2 mol dm−3, using *K*w = 1.0 × 10−14 mol2 dm−6

**(1)**

   **A**    −13.7

   **B**    13.7

   **C**    14.0

   **D**    14.3

(c)  Ethanoic acid, CH3COOH, of concentration 2 mol dm−3, making the usual assumptions.



**(1)**

   **A**    2.2

   **B**    2.4

   **C**    4.5

   **D**    4.8

(d)  The mixture formed when 25 cm3 of 2 mol dm−3 sodium hydroxide solution is added to 50 cm3 of 2 mol dm−3 ethanoic acid, for which *K*a = 1.7 × 10−5 mol dm−3.

**(1)**

   **A**    2.2

   **B**    2.5

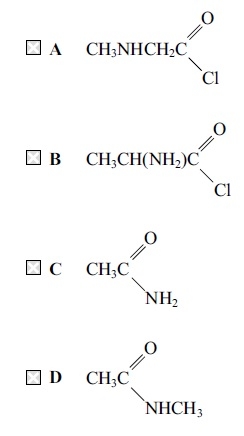
   **C**    4.5

   **D**    4.8

**(Total for Question = 4 marks)**

**Q2.**

The organic product of the reaction between ethanoyl chloride and methylamine has the formula



**(Total for question = 1 mark)**

**Q3.**A solution of 2,4-dinitrophenylhydrazine (Brady's reagent) is used as a test for organic functional groups.

(a)  The positive result of the test is the formation of

**(1)**

   **A**    a yellow solution.

   **B**    an orange precipitate.

   **C**    a red solution.

   **D**    a green precipitate.

(b)  Which of the following gives a positive result with a solution of 2,4-dinitrophenylhydrazine?

**(1)**

   **A**    Only aldehydes

   **B**    Only ketones

   **C**    Only aldehydes and ketones

   **D**    Any compound containing the CO group

(c)  The initial attack by 2,4-dinitrophenylhydrazine, when it reacts, is by

**(1)**

   **A**    a free radical.

   **B**    an electrophile.

   **C**    a nucleophile.

   **D**    a negative ion.

(d)  The product of a positive test, a 2,4-dinitrophenylhydrazone, contains which of the following bonds?

**(1)**

   **A**    NN

   **B**    CN

   **C**    CC

   **D**    CO

**(Total for Question = 4 marks)**

**Q4.**An organic compound reacts with **both** acidified potassium dichromate(VI) **and** lithium tetrahydridoaluminate (lithium aluminium hydride). The organic compound could be

   **A**    a primary alcohol.

   **B**    an aldehyde.

   **C**    a ketone.

   **D**    a carboxylic acid.

**(Total for Question = 1 mark)**

**Q5.**Ketones react with

   **A**    both 2,4-dinitrophenylhydrazine solution and Tollens' reagent.

   **B**    2,4-dinitrophenylhydrazine solution but not with Tollens' reagent.

   **C**    Tollens' reagent but not with 2,4-dinitrophenylhydrazine solution.

   **D**    neither Tollens' reagent nor 2,4-dinitrophenylhydrazine solution.

**(Total for Question = 1 mark)**

**Q6.**

Ethanoic acid, CH3COOH, can be converted into ethanoyl chloride, CH3COCl, by the action of

   **A**     phosphorus(V) chloride.

   **B**     chlorine.

   **C**     dilute hydrochloric acid.

   **D**     concentrated hydrochloric acid.

**(Total for question = 1 mark)**

**Q7.**

When the following reaction mixtures are warmed, which will contain ethanoic acid as one of the products?

   **A**     Ethyl methanoate and sodium hydroxide solution.

   **B**     Ethyl methanoate and dilute sulfuric acid.

   **C**     Methyl ethanoate and sodium hydroxide solution.

   **D**     Methyl ethanoate and dilute sulfuric acid.

**(Total for question = 1 mark)**

**Q8.**Ethanoic acid is **not** a product in the reaction of

   **A**     ethanal with lithium tetrahydridoaluminate.

   **B**     ethanoyl chloride with water.

   **C**     ethyl ethanoate with dilute sulfuric acid.

   **D**     ethanol refluxed with potassium dichromate(VI) and sulfuric acid.

**(Total for question = 1 marks)**

**Q9.**This question is about the following isomeric compounds with the molecular formula C4H8O and molar mass 72 g mol−1.

**A**    CH3CH2CH2CHO

**B**    (CH3)2CHCHO

**C**    CH3CH2COCH3

**D**    CH3CHCHCH2OH

(a)  Which compound would you expect to give a peak at *m*/*e* = 41 in its mass spectrum?

**(1)**

   **A**

   **B**

   **C**

   **D**

(b)  Which compound would NOT react with an acidified solution of potassium dichromate(VI)?

**(1)**

   **A**

   **B**

   **C**

   **D**

(c)  Which compound would give a pale yellow precipitate when reacted with iodine in alkaline solution?

**(1)**

   **A**

   **B**

   **C**

   **D**

(d)  Which compound can be reduced to give a chiral product?

**(1)**

   **A**

   **B**

   **C**

   **D**

(e)  Which compound would NOT react with hydrogen cyanide under suitable conditions to form a hydroxynitrile?

**(1)**

   **A**

   **B**

   **C**

   **D**

**(Total for Question = 5 marks)**

**Q10.**Transesterification involves the conversion of

   **A**   esters into different esters.

   **B**   esters into carboxylic acids.

   **C**   *cis* carbon-carbon double bonds to the *trans* arrangement.

   **D**   *trans* carbon-carbon double bonds to the *cis* arrangement.

**(Total for Question = 1 mark)**

**Q11.**Biodiesel is formed by transesterification. It is used as a fuel in preference to untreated vegetable oils because

   **A**   on combustion, biodiesel produces less carbon dioxide than vegetable oils.

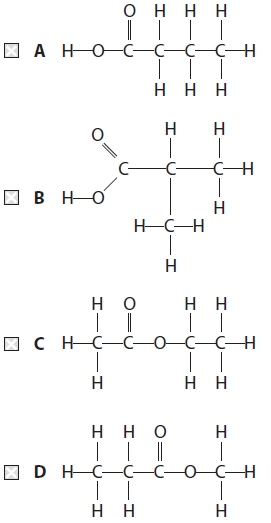
   **B**   on combustion, biodiesel produces more energy than vegetable oils.

   **C**   biodiesel vaporises more easily than vegetable oils.

   **D**   biodiesel is less volatile than vegetable oils.

**(Total for Question = 1 mark)**

**Q12.**Propanoic acid reacts with methanol to form an ester. The structure of the ester is



**(Total for Question = 1 mark)**

**Q13.**The boiling temperature of ethanoic acid is very much higher than that of butane although these molecules have similar numbers of electrons. This is because ethanoic acid has

   **A**    stronger covalent bonds.

   **B**    stronger ionic bonds.

   **C**    greater London forces.

   **D**    hydrogen bonding.

**(Total for Question = 1 mark)**

**Q14.**Ethanoic acid, CH3COOH, may be prepared from ethanenitrile, CH3CN. This reaction is best described as

   **A**    reduction.

   **B**    oxidation.

   **C**    hydrolysis.

   **D**    condensation.

**(Total for Question = 1 mark)**

**Q15.**Select the word that best describes the effect of a chiral molecule on the plane of plane-polarized light. The plane of polarization of light is

   **A**    reflected.

   **B**    refracted.

   **C**    resolved.

   **D**    rotated.

**(Total for Question = 1 mark)**

**Q16.**

Which of the following methods may be used **in a single step** to make carboxylic acids?

   **A**     Hydrolysis of an ester with an alkali.

   **B**     Reaction of acidified potassium manganate(VII) with an alkene.

   **C**     Hydrolysis of a nitrile with hydrochloric acid.

   **D**     Reaction of an acyl chloride with ammonia.

**(Total for question = 1 mark)**

**Q17.**

Which of the following compounds would react with lithium tetrahydridoaluminate  
 (lithium aluminium hydride) **and** also with phosphorus(V) chloride (phosphorus  
 pentachloride)?

   **A**     CH3CH2CH2COOH

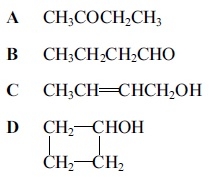
   **B**     CH3CH2COCH3

   **C**     CH3CHCHCH3

   **D**     CH2CHCH2CH2OH

**(Total for question = 1 mark)**

**Q18.**This question is about four compounds with molecular formula C4H8O.



(a) The compounds which react when heated with a mixture of potassium dichromate(VI) and sulfuric acid are                                                                                                                                                                                **(1)**

   **A**

   **B**

   **C**

   **D**

(b) The compound which produces a yellow precipitate when heated with a mixture of iodine and sodium hydroxide is                                                                                                                                                                                **(1)**

   **A**

   **B**

   **C**

   **D**

(c) There would **not** be a significant peak at mass/charge ratio of 15 in the mass spectrum of                                                                                                                                                                                **(1)**

   **A**     Titrations **A** and **B** only.

   **B**     Titrations **A**, **B** and **D** only.

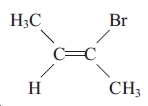
   **C**     Titration **C** only.

   **D**     Titrations **A**, **B**, **C** and **D**.

**(Total for question = 3 marks)**

**Q19.**

What is the correct name for the molecule shown below?



   **A**  *Z*-2-bromobut-2-ene

   **B**  *E*-2-bromobut-2-ene

   **C**  *E*-3-bromobut-2-ene

   **D**  *Z*-3-bromobut-2-ene

**(Total for question = 1 mark)**

**Q20.**

Which of the following compounds has both optical and *E*-*Z* isomers?

   **A**     CH3CHCHCH2CH3

   **B**     CH3CHClCHC(CH3)2

   **C**     CH3CClCClCH3

   **D**     CH3CHBrCHCHCl

**(Total for question = 1 mark)**

**Q21.**

Which of the following has both optical and E-Z isomers?

   **A**     ClCH2CHClCH==CH2

   **B**     CH2==CClCH2CH2Cl

   **C**     ClCH2CH==CHCH2Cl

   **D**     CHCl==CHCHClCH3

**(Total for question = 1 mark)**

**Q22.**

One optically active isomer of 2−chlorobutane reacts with hydroxide ions to form  
 butan−2−ol.

C2H5CHClCH3 + OH− → C2H5CH(OH)CH3 + Cl−

The organic product is a **mixture** of enantiomers because

   **A**    butan−2−ol contains a chiral carbon atom.

   **B**    the reaction is a nucleophilic substitution.

   **C**    2−chlorobutane forms a carbocation intermediate.

   **D**    2−chlorobutane forms a five-bonded transition state.

**(Total for question = 1 mark)**

**Q23.**

This question is about calcium chloride, CaCl2.

It can be formed by burning calcium in chlorine.



You must include a sign and units in your answers to the calculations in this question.

(a)  (i)  The standard molar entropy at 298 K for 1 mole of chlorine molecules, Cl2, is +165 J mol−1 K−1. Use this, and appropriate values from your Data Booklet, to calculate the standard entropy change, , for this reaction.

**(2)**

\*(ii)  Explain fully why the sign for the standard entropy change of the system,  is as you would expect.

**(2)**

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(b)  Calculate the total entropy change, , in J mol−1 K−1, for this reaction, giving your answer to three significant figures.

**(2)**

(c)  Use the standard entropy change of the surroundings, , to calculate the standard enthalpy change, , in kJ mol−1, for the reaction at 298 K.

**(2)**

(d)  0.0500 mol of calcium chloride, prepared by burning calcium in chlorine, is added to 51.8 cm3 of water.

50.0 cm3 of a 1.00 mol dm−3 solution is formed, and the temperature rise, ΔT, is 15.0°C.

(i)  Calculate the energy transferred, in joules, for this process using:

Energy transferred in joules = volume of **solution formed** × 4.2 × ΔT

**(1)**

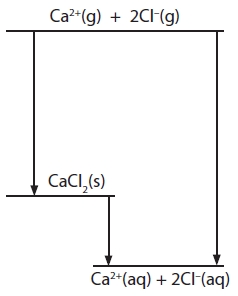
(ii)  Calculate the enthalpy change of solution, , of calcium chloride in kJ mol−1.

**(2)**

\*(iii)  The enthalpy change of hydration of Ca2+(g) is −1560 kJ mol−1.

Use this, your value from (d)(ii) and the experimental lattice energy from your Data Booklet, to calculate the standard enthalpy change of hydration of Cl−(g).

**(3)**



Answer ........................................................... kJ mol−1

(iv)  Draw diagrams to represent hydrated calcium ions and hydrated chloride ions.

**(2)**

(v)  Suggest why the addition of anhydrous calcium chloride to water results in an increase in temperature and a decrease in volume.

**(2)**

Temperature increases

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Volume decreases

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**(Total for question = 18 marks)**

**Q24.**

In the synthesis of an ester, the use of an acyl chloride and an alcohol gives a better yield than the use of a carboxylic acid and an alcohol.

This is because the reaction between

   **A**     an acyl chloride and an alcohol is an equilibrium.

   **B**     an acid and an alcohol goes to completion.

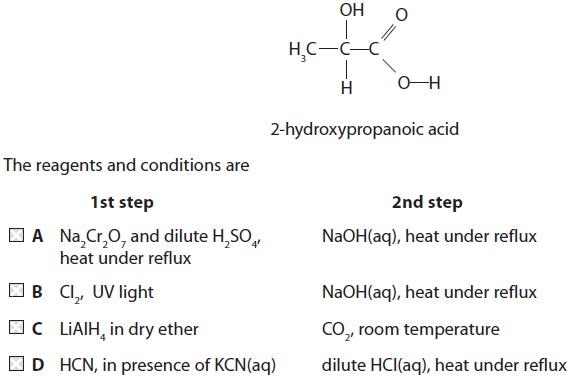
   **C**     an acid and an alcohol requires a catalyst.

   **D**     an acyl chloride and an alcohol goes to completion.

**(Total for question = 1 mark)**

**Q25.**

Ethanal, CH3CHO, can be converted by a two-step synthesis into 2-hydroxypropanoic acid.



**(Total for question = 1 mark)**

**Q26.**Which of the following statements about ethanoyl chloride is **not** correct?

   **A**     It reacts with ammonia to make an amine.

   **B**     It reacts with an amine to make an amide.

   **C**     It reacts with an alcohol to make an ester.

   **D**     It reacts with water to make an organic acid.

**(Total for question = 1 marks)**

**Q27.**

Which of the following does not have hydrogen bonding in a pure sample, but forms  
 hydrogen bonds with water when it dissolves?

   **A**    Propane

   **B**    Propanal

   **C**    Propanol

   **D**    Propanoic acid

**(Total for question = 1 mark)**

**Q28.**

Which of the following molecules is a methyl ester?

   **A**     CH3COOCH2CH3

   **B**     HCOOCH3

   **C**     CH3COCH2CH3

   **D**     CH3COCl

**(Total for question = 1 mark)**

**Q29.**

A compound, **Q**, gives an orange precipitate with 2, 4-dinitrophenylhydrazine.  
 Compound **Q** is resistant to oxidation.  
 On reduction, **Q** gives a product made up of a pair of optical isomers.  
  
 Which of the following compounds could be compound **Q**?

   **A**     CH3CH2CH2COCH3

   **B**     CH3CHCHCH(OH)CH3

   **C**     CH3CH2CH2CH2CHO

   **D**     CH3CH2COCH2CH3

**(Total for question = 1 mark)**

**Q30.**

When propanone reacts with iodine in the presence of sodium hydroxide, the crystalline solid product has the formula

   **A**     CH3I

   **B**     CHI3

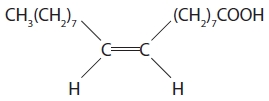
   **C**     CH3COCH2I

   **D**     CH3COCI3

**(Total for question = 1 mark)**

**Q31.**

The formula for oleic acid, which is present in fingerprints, is shown below.



(a)  The systematic name for oleic acid is

**(1)**

   **A**    *E*-octadec-9-enoic acid.

   **B**    *Z*-octadec-9-enoic acid.

   **C**    *E*-octadec-8-enoic acid.

   **D**    *Z*-octadec-8-enoic acid.

(b)  Which intermolecular forces are present between oleic acid molecules?

**(1)**

   **A**    Hydrogen bonds only.

   **B**    Hydrogen bonds and permanent dipole-dipole forces only.

   **C**    Hydrogen bonds, permanent dipole-dipole forces and London forces.

   **D**    Hydrogen bonds and London forces only.

(c)  Which of the following species is most likely to cause a peak at *m*/*e* = 45 in the mass spectrum of oleic acid?

**(1)**

   **A**    CH2CH2OH

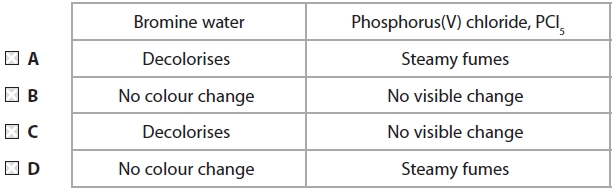
   **B**    CH2CH2OH+

   **C**    COOH

   **D**    COOH+

(d)  What would you expect to see if oleic acid is tested separately with bromine water and with phosphorus(V) chloride, PCl5?

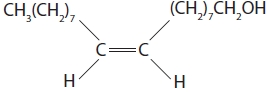
**(1)**



**(Total for question = 4 marks)**

**Q32.**

The formula for oleyl alcohol, which is present in sperm whale oil and was used as a lubricant, is shown below.



(a)  The systematic name for oleyl alcohol is

**(1)**

   **A**   *E*-octadec-9-en-1-ol.

   **B**   *Z*-octadec-9-en-1-ol.

   **C**   *E*-octadec-8-en-1-ol.

   **D**   *Z*-octadec-8-en-1-ol.

(b)  Which intermolecular forces are present between oleyl alcohol molecules?

**(1)**

   **A**   London forces only

   **B**   Hydrogen bonds and London forces only

   **C**   Hydrogen bonds and permanent dipole–dipole forces only

   **D**   Hydrogen bonds, permanent dipole–dipole and London forces

(c)  Which of the following is the most likely structure of the species to cause a peak at *m*/*e* 31 in the mass spectrum of oleyl alcohol?

**(1)**

   **A**   CH3O

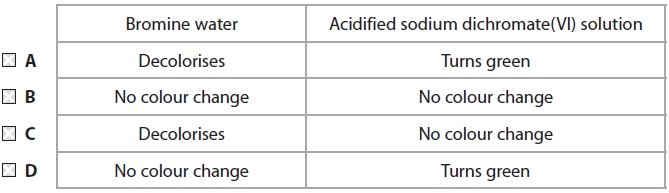
   **B**   CH2OH

   **C**   CH3O+

   **D**   CH2OH+

(d)  What would you expect to see if oleyl alcohol is tested separately with bromine water and heated with acidified sodium dichromate(VI) solution?

**(1)**



**(Total for question = 4 marks)**

**Q33.**The following tests can be carried out on organic compounds.

**A**     Warm with 2,4-dinitrophenylhydrazine.

**B**     Warm with Fehling's or Benedict's solution.

**C**     Add solid sodium carbonate.

**D**     Add phosphorus(V) chloride, PCl5.

(a) Which test would give a positive result with propanoic acid but not with propan-1-ol?                                                                                                                                                                                **(1)**

   **A**

   **B**

   **C**

   **D**

(b) Which test would give a positive result with propanoic acid **and** with propan-1-ol?                                                                                                                                                                                **(1)**

   **A**

   **B**

   **C**

   **D**

(c) Which test would give a positive result with propanal but not with propanone?                                                                                                                                                                                **(1)**

   **A**

   **B**

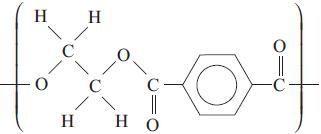
   **C**

   **D**

**(Total for question = 3 marks)**

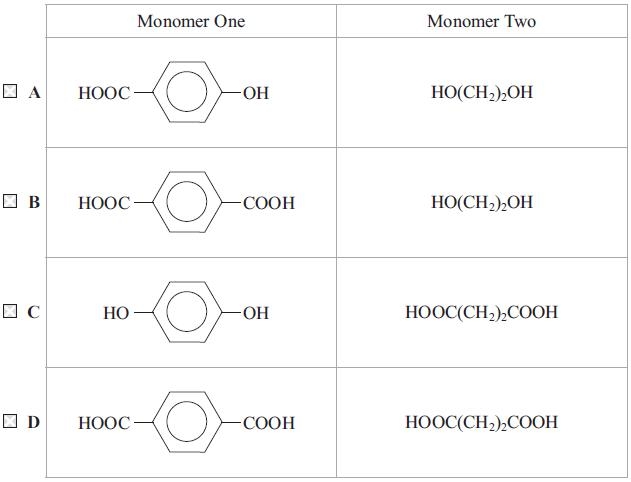
**Q34.**

 An example of a polyester is



 (a) The two monomers needed to form this polymer are

**(1)**

  
  
  
 (b) The type of reaction to form this polymer is

**(1)**

   **A**      addition.

   **B**      substitution.

   **C**      condensation.

   **D**      hydrolysis.

**(Total for question = 2 marks)**

**Q35.**

Butane-1,4-diol, HO(CH2)4OH, and benzene-1,4-dicarboxylic acid,

|  |  |  |
| --- | --- | --- |
| HOOC |  | COOH, react to form a polyester. |

(a) The repeat unit of the polyester is

**(1)**

|  |  |
| --- | --- |
| **A** |  |
| **B** |  |
| **C** |  |
| **D** |  |

(b) The type of reaction is

**(1)**

   **A**  hydrolysis.

   **B**  addition.

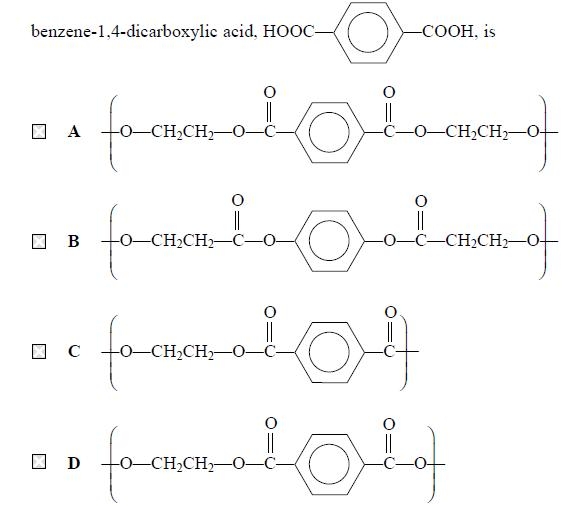
   **C**  substitution.

   **D**  condensation.

**(Total for question = 2 marks)**

**Q36.**

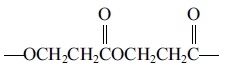
 The repeat unit of the polyester formed from ethane-1,2-diol, HOCH2CH2OH, and



**(Total for question = 1 mark)**

**Q37.**

A section of a polymer is shown below. Which of the following monomers would form  
 this polymer?



   **A**     HOCH2CH2OH and ClCOCH2CH2COCl

   **B**     HOCH2CH2OH and HOOCCH2CH2COOH

   **C**     ClCH2CH2COCl alone

   **D**     HOCH2CH2COOH alone

**(Total for question = 1 mark)**

**Q38.**

Which of the following reagents could be used to produce propanamide,  
 CH3CH2CON2?

   **A**     Ammonia and 1-chloropropane

   **B**     Ammonia and propanoyl chloride

   **C**     Methylamine and 1-chloropropane

   **D**     Methylamine and propanoyl chloride

**(Total for question = 1 mark)**

**Q39.**

In order to make CH3CH2CONHCH3, you could use

   **A**      CH3CH2COOCH3 + NH3

   **B**      CH3CH2COCl + CH3NH2

   **C**      CH3CH2COO−Na+ + CH3NH2

   **D**      CH3CH2CONH2 + CH3NH2

**(Total for question = 1 mark)**

**Q40.**

This question is about four organic compounds, each containing two carbon atoms.

**A**      CH3CH2OH

**B**      CH3CHO

**C**      CH3COOH

**D**      CH3COCl

(a)  Which is oxidized by ammoniacal silver nitrate?

**(1)**

   **A**

   **B**

   **C**

   **D**

(b)  Which has the highest boiling temperature?

**(1)**

   **A**

   **B**

   **C**

   **D**

(c)  0.01 mol of each compound is heated separately with excess acidified sodium dichromate(VI).

Which compound reduces the largest amount of sodium dichromate(VI)?

**(1)**

   **A**

   **B**

   **C**

   **D**

(d)  0.01 mol of each compound is added separately to identical volumes of water. Which solution would have the lowest pH?

**(1)**

   **A**

   **B**

   **C**

   **D**

**(Total for question = 4 marks)**

**Q41.**

Four organic compounds are:

**A**     CH3OH

**B**     HCHO

**C**     HCOOH

**D**     HCOOCH3

(a)  Which of these compounds has a fruity smell?

**(1)**

   **A**

   **B**

   **C**

   **D**

(b)  0.01 mol of each compound is added separately to identical volumes of water.   
Which solution would have the lowest pH?

**(1)**

   **A**

   **B**

   **C**

   **D**

(c)  0.01 mol of each compound is heated separately with excess acidified sodium dichromate(VI) solution. Which compound reduces the largest amount of sodium dichromate(VI)?

**(1)**

   **A**

   **B**

   **C**

   **D**

(d)  Which compound has the highest boiling temperature?

**(1)**

   **A**

   **B**

   **C**

   **D**

(e)  Which of these compounds can be oxidized by ammoniacal silver nitrate?

**(1)**

   **A**

   **B**

   **C**

   **D**

**(Total for question = 5 marks)**

**Q42.**

When one optically active isomer of 3-chloro-3-methylhexane reacts with hydroxide ions to form 3-methylhexan-3-ol, a racemic mixture forms because

   **A**    3-chloro-3-methylhexane forms a carbocation intermediate.

   **B**    the reaction is a nucleophilic substitution.

   **C**    3-chloro-3-methylhexane forms a five-bonded transition state.

   **D**    3-methylhexan-3-ol contains a chiral carbon.

**(Total for question = 1 mark)**

**Q43.**

Which of the following reacts with hydrogen cyanide, HCN, to make a racemic mixture?

   **A**     Methanal, HCHO

   **B**     Ethanal, CH3CHO

   **C**     Propanone, CH3COCH3

   **D**     Pentan-3-one, C2H5COC2H5

**(Total for question = 1 mark)**

**Q44.**

 The equation for the reaction between ethanoic acid and phosphorus(V) chloride is

   **A**      CH3COOH + PCl5 → CH3COCl + POCl3 + HCl

   **B**      CH3COOH + PCl5 → CH3COOCl + PCl3 + HCl

   **C**      CH3COOH + PCl5 → CH3COCl + PCl3 + HOCl

   **D**      2CH3COOH + PCl5 → (CH3CO)2O + PCl3 + H2O + Cl2

**(Total for question = 1 mark)**

**Q45.**

Hydrogen cyanide, HCN, reacts with propanal, CH3CH2CHO, in the presence of  
 potassium cyanide, KCN.

(a) The mechanism for this reaction is

**(1)**

   **A**    nucleophilic addition.

   **B**    nucleophilic substitution.

   **C**    electrophilic addition.

   **D**    electrophilic substitution.

(b) The first stage of the mechanism of this reaction is

**(1)**

   **A**    the lone pair of electrons on carbon in CN¯ attacking Cδ+ of propanal.

   **B**    the lone pair of electrons on nitrogen in CN¯ attacking Cδ+ of propanal.

   **C**    the lone pair of electrons on oxygen in propanal attacking Cδ+ of HCN.

   **D**    the lone pair of electrons on oxygen in propanal attacking Hδ+ in HCN.

(c) The product of the reaction is

**(1)**

   **A**    1−hydroxypropanenitrile.

   **B**    2−hydroxypropanenitrile.

   **C**    1−hydroxybutanenitrile.

   **D**    2−hydroxybutanenitrile.

**(Total for question = 3 marks)**

**Q46.**

Ketones react with hydrogen cyanide, HCN, in the presence of cyanide ions, CN&#150;.  
  
 (a) Which of these ketones does **not** form a racemic mixture in this reaction?

**(1)**

   **A**  CH3CH2CH2COCH3

   **B**  CH3CH2COCH2CH3

   **C**  CH3CH2CH2CH2COCH3

   **D**  CH3CH2CH2COCH2CH3

(b) This type of reaction is classified as

**(1)**

   **A**  nucleophilic substitution.

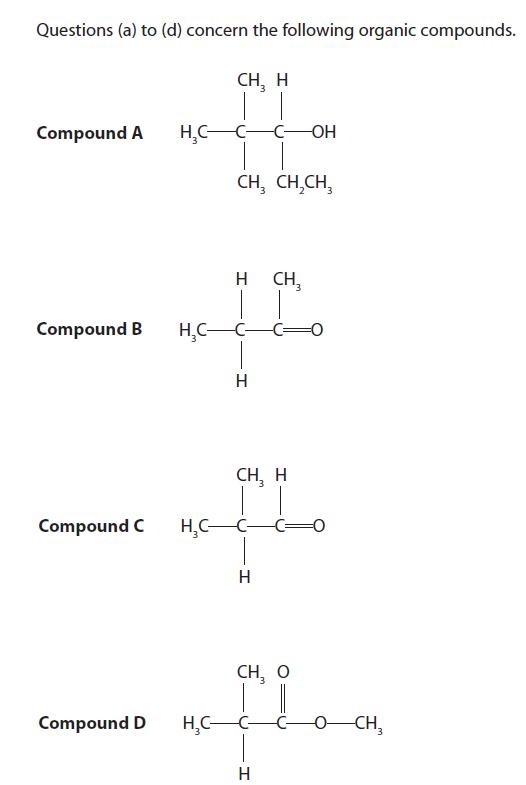
   **B**  nucleophilic addition.

   **C**  electrophilic addition.

   **D**  electrophilic substitution.

**(Total for question = 2 marks)**

**Q47.**



      Select from **A** to **D** the compound that  
  
 (a)  forms iodoform with iodine in the presence of alkali.

**(1)**

   **A**

   **B**

   **C**

   **D**

(b)  is chiral.

**(1)**

   **A**

   **B**

   **C**

   **D**

(c)  reacts with Tollens' reagent.

**(1)**

   **A**

   **B**

   **C**

   **D**

(d)  can be oxidized to form a ketone.

**(1)**

   **A**

   **B**

   **C**

   **D**

**(Total for question = 4 marks)**

**Q48.**

Which of these is **not** observed when ethanoyl chloride reacts with water?

   **A**  Misty fumes given off.

   **B**  The gas given off turns damp blue litmus paper red.

   **C**  The mixture gets hot.

   **D**  A white precipitate forms.

**(Total for question = 1 mark)**

**Q49.**

This question is about the four organic substances shown below.  
  
**A**   CH3CH2CH2CH2CHO  
  
**B**   CH3CH2CH2CH2COOH  
  
**C**   CH3COCH2CH2CH3  
  
**D**   CH3CH2CH2CH2COCl  
  
 Which substance will

(a) give a positive result with both Brady's and Tollens' reagents?

**(1)**

   **A**

   **B**

   **C**

   **D**

(b) be formed by the oxidation of a secondary alcohol?

**(1)**

   **A**

   **B**

   **C**

   **D**

(c) form the most acidic solution when equal amounts are each mixed with 100 cm3 of water?

**(1)**

   **A**

   **B**

   **C**

   **D**

(d) form steamy fumes in the reaction with PCl5?

**(1)**

   **A**

   **B**

   **C**

   **D**

**(Total for question = 4 marks)**

**Q50.**

Which of the following is a redox reaction?

   **A**     Ethanal reacting with Tollens' reagent.

   **B**     Ethanoyl chloride reacting with ammonia.

   **C**     Ethanoic acid reacting with ethanol.

   **D**     Ethanoic acid reacting with sodium hydroxide.

**(Total for question = 1 mark)**

**Q51.**

The following methods can be used to distinguish between pairs of organic compounds without further tests.

**A**     Warm each compound with Fehling's or Benedict's solution.

**B**     Add solid sodium carbonate to each compound.

**C**     Add 2,4-dinitrophenylhydrazine (Brady's reagent) to each compound.

**D**     Add water, drop by drop, to each compound.

(a)  Which test would distinguish propanone from propan-1-ol?

**(1)**

   **A**

   **B**

   **C**

   **D**

(b)  Which test would distinguish between aqueous solutions of ethanoic acid and ethanol?

**(1)**

   **A**

   **B**

   **C**

   **D**

(c)  Which test would distinguish ethanoyl chloride from ethanol?

**(1)**

   **A**

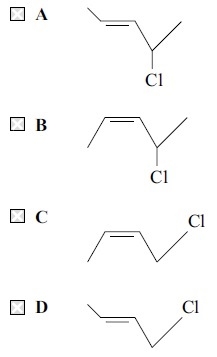
   **B**

   **C**

   **D**

**(Total for question = 3 marks)**

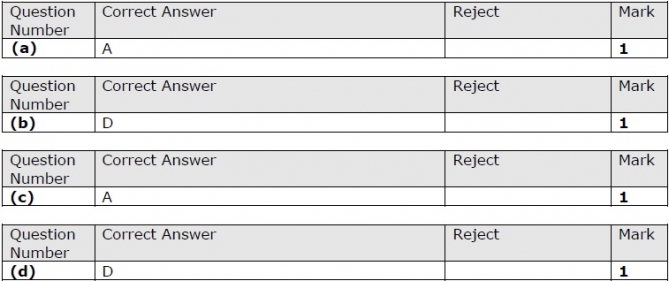
**Q52.**Which of the following compounds is a *Z* isomer **and** contains a chiral carbon atom?



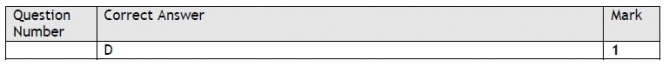
**(Total for question = 1 marks)**

**Mark Scheme**

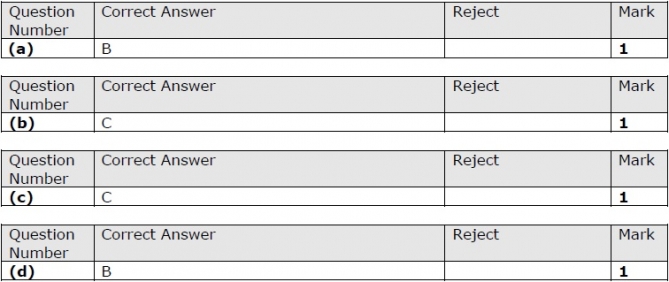
**Q1.**



**Q2.**



**Q3.**



**Q4.**



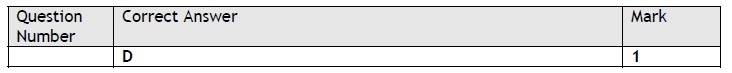
**Q5.**



**Q6.**

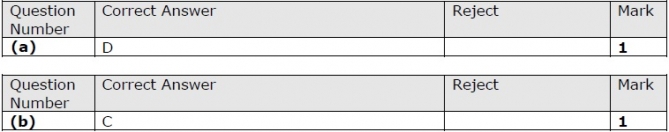


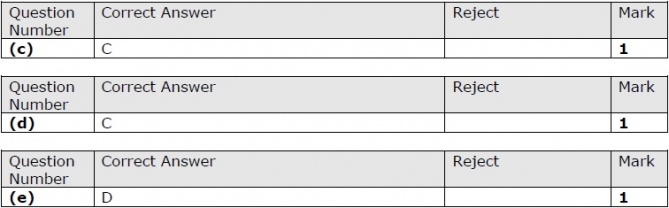
**Q7.**



Q8.  


**Q9.**





**Q10.**



**Q11.**



**Q12.**



**Q13.**



**Q14.**



**Q15.**

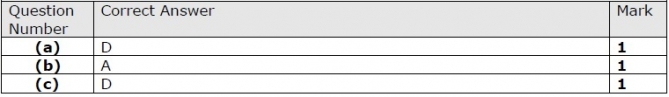


**Q16.**



**Q17.**

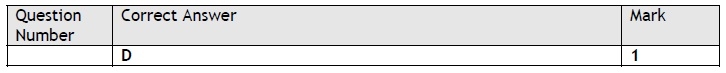


Q18.  


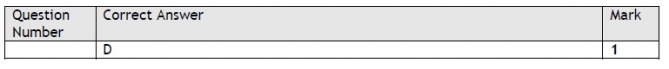
**Q19.**



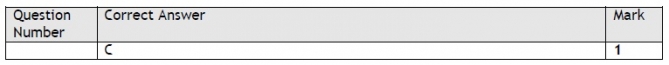
**Q20.**



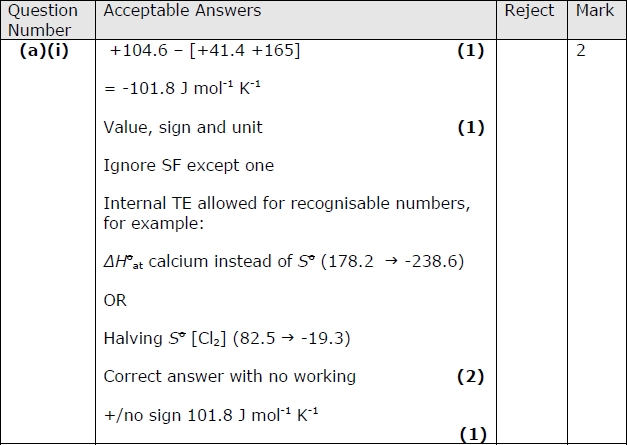
**Q21.**

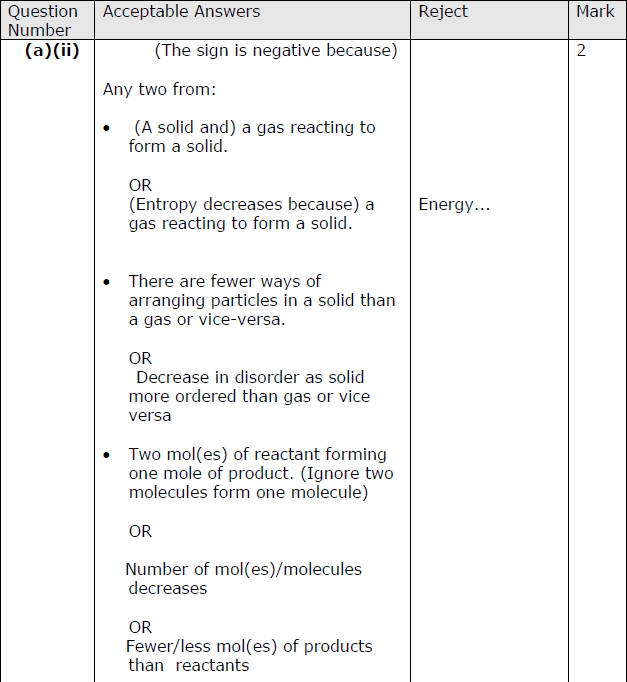


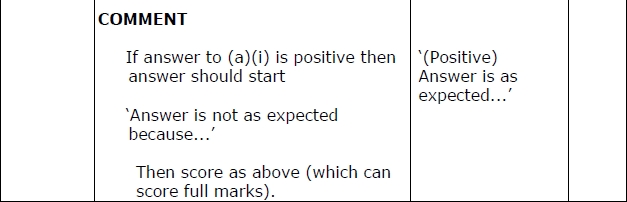
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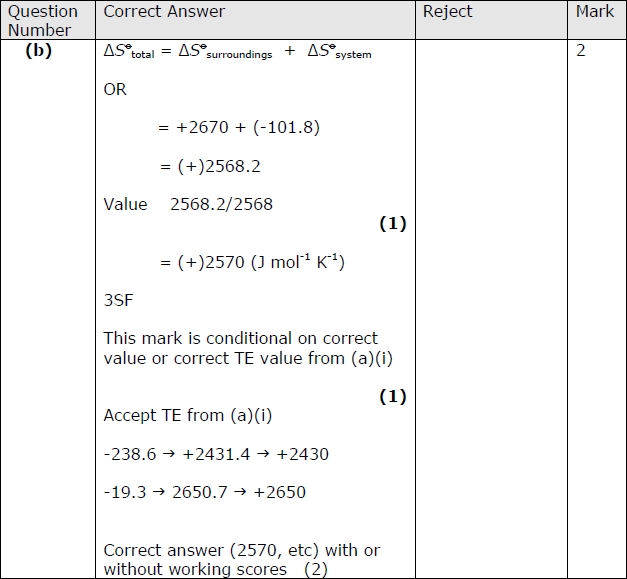


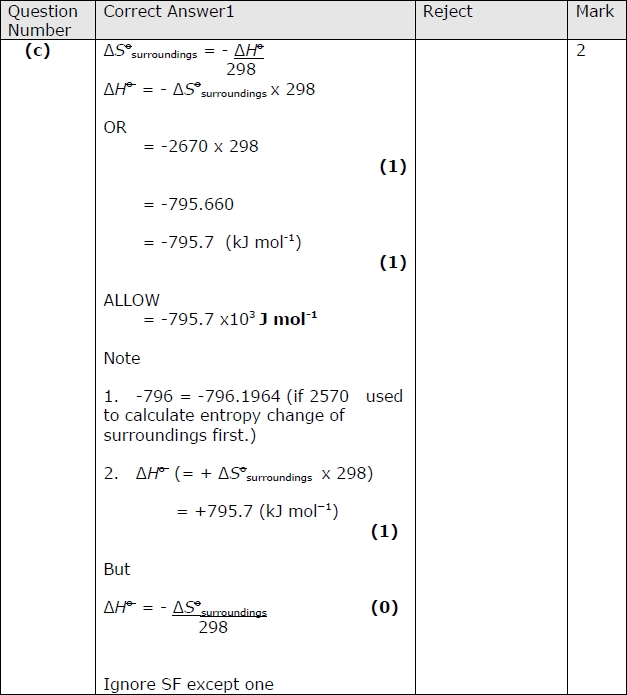
**Q23.**

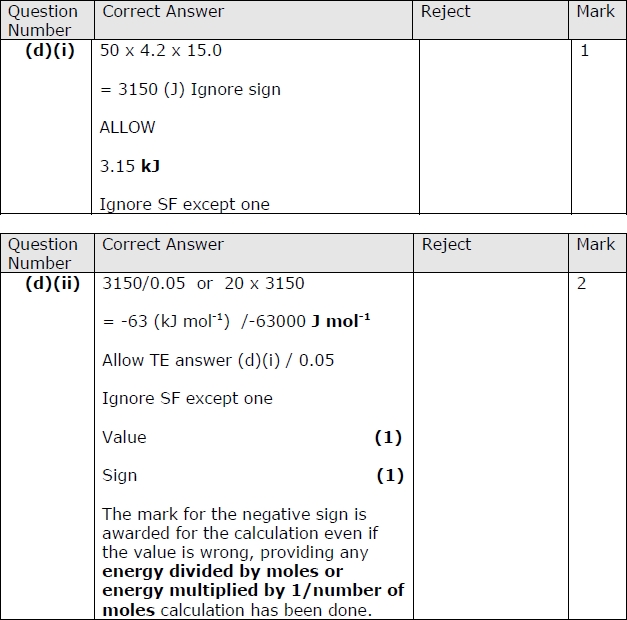


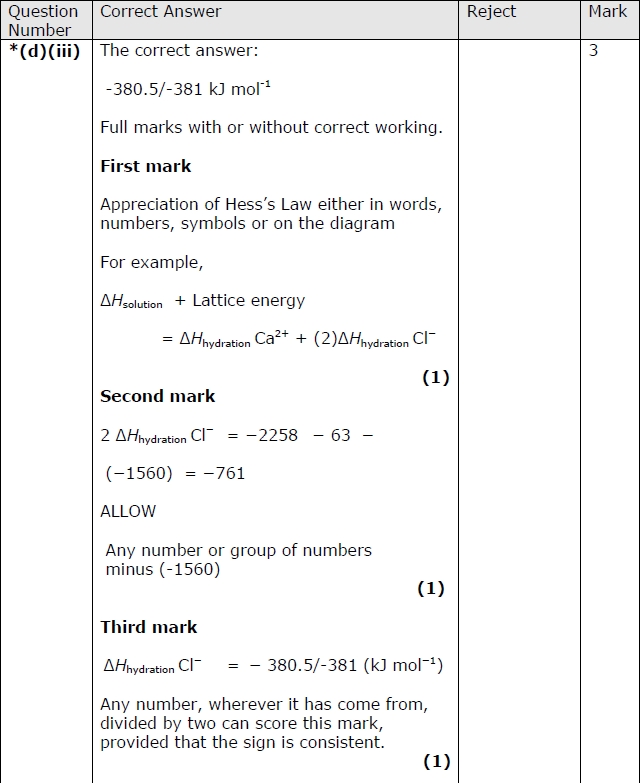


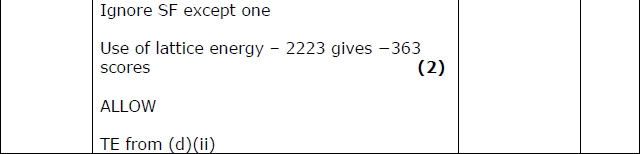


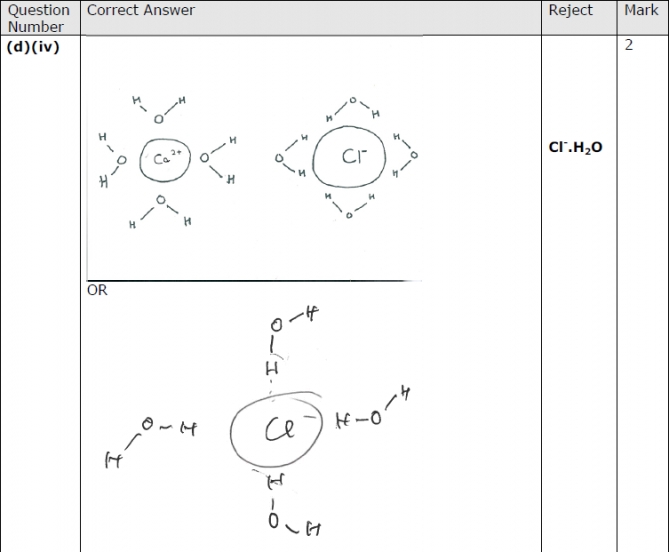


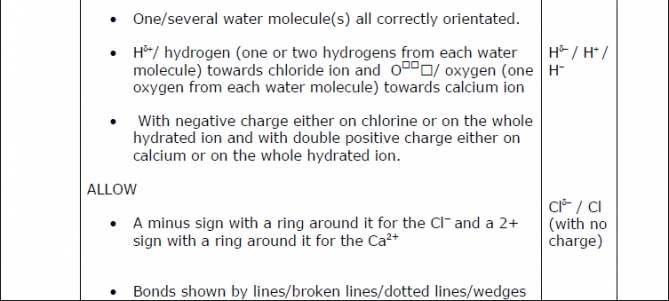


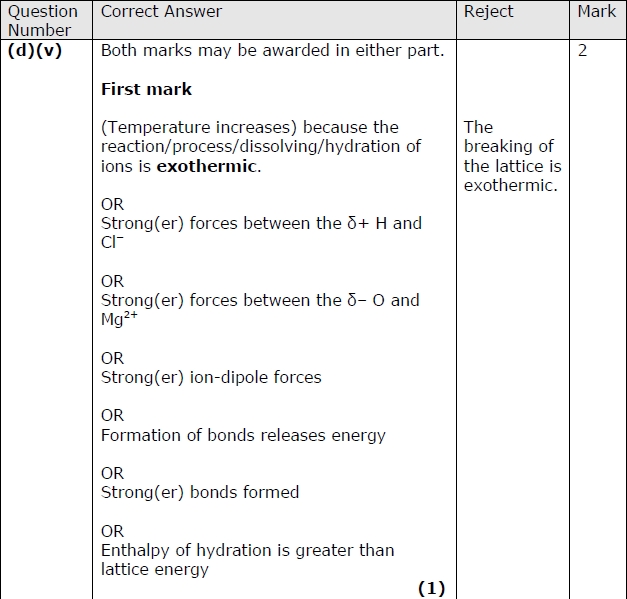


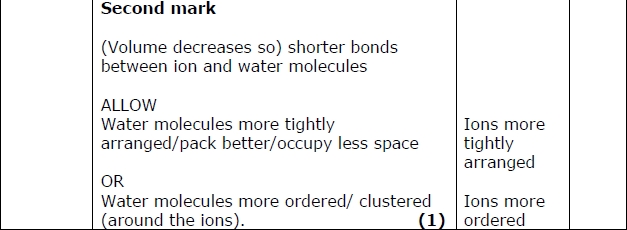




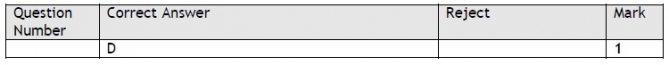








**Q24.**

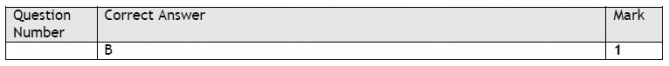


**Q25.**



Q26.  


**Q27.**



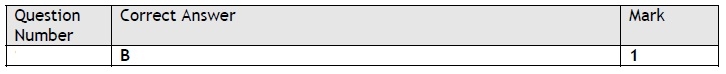
**Q28.**



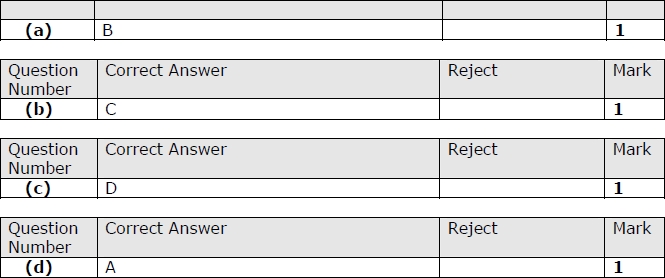
**Q29.**



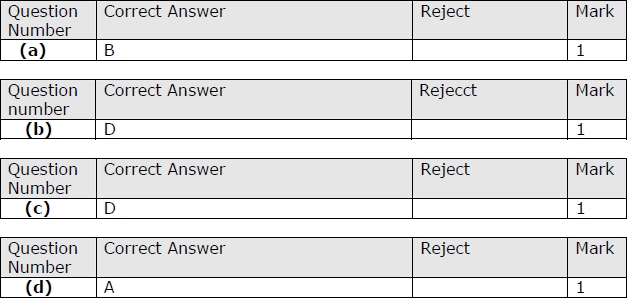
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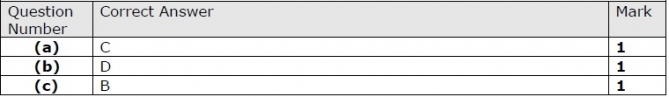


**Q31.**

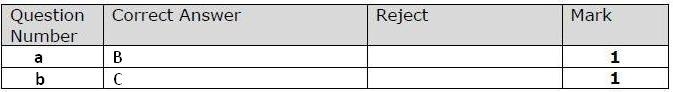


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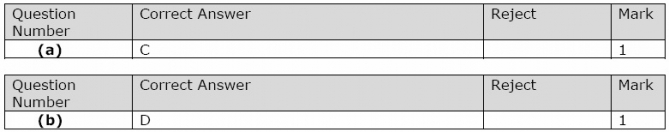


Q33.  


**Q34.**



**Q35.**



**Q36.**



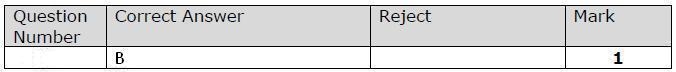
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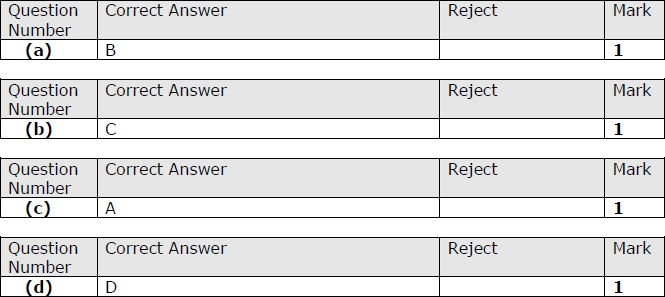
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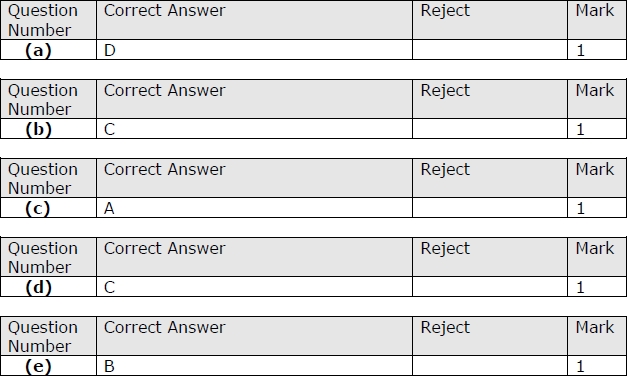
**Q39.**



**Q40.**



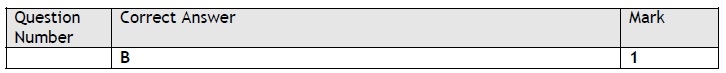
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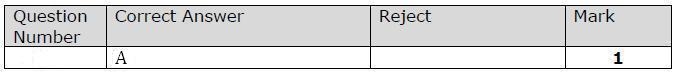
**Q42.**



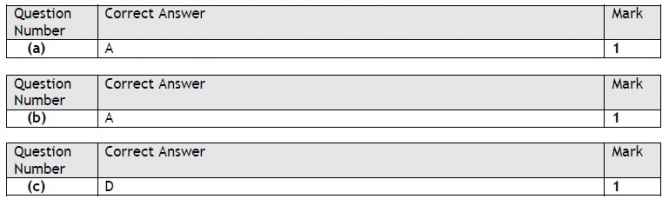
**Q43.**



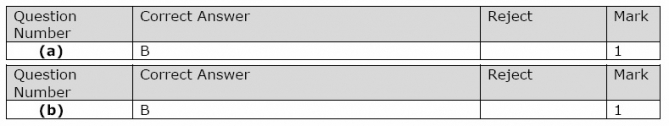
**Q44.**



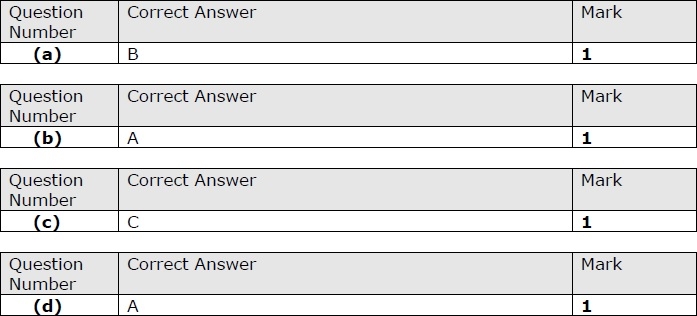
**Q45.**



**Q46.**



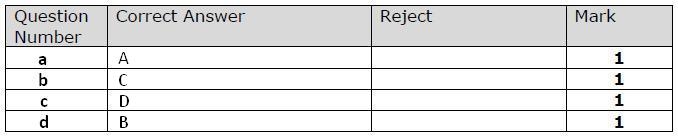
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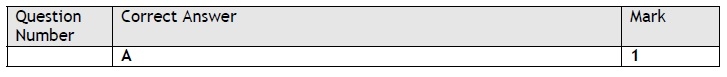
**Q48.**



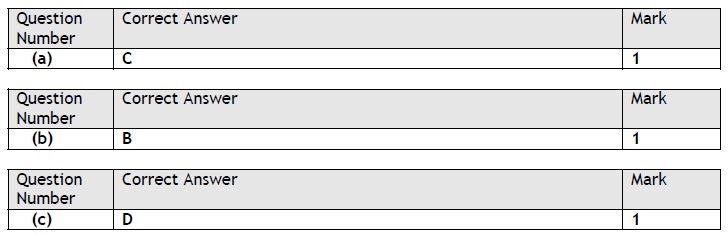
**Q49.**



**Q50.**



**Q51.**



Q52.  
