**Questions**

**Q1.**

Alkanes are now being used as aerosol propellants as an alternative to CFCs.   
Although they have no effect on the ozone layer, they have the disadvantage of

   **A**    having high reactivity.

   **B**    being hard to evaporate.

   **C**    being greenhouse gases.

   **D**    having an unpleasant smell.

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

**Q2.**Which type of radiation is absorbed by molecules and results in the greenhouse effect?

   **A**    Infrared

   **B**    Microwave

   **C**    Ultraviolet

   **D**    X-ray

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

**Q3.**

Which of the following is a greenhouse gas?

   **A**      Argon

   **B**      Nitrogen

   **C**      Oxygen

   **D**      Water vapour

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

**Q4.**Which of the following is **not** a greenhouse gas?

   **A**    H2O

   **B**    NO

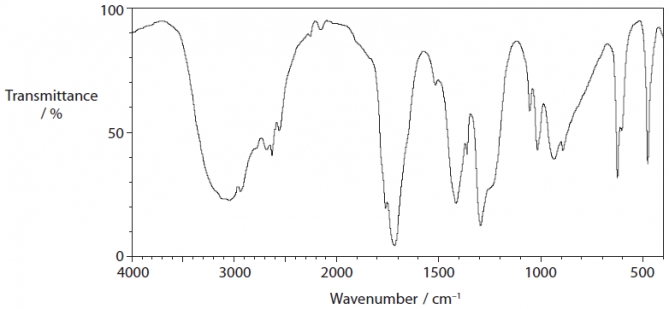
   **C**    CH4

   **D**    O2

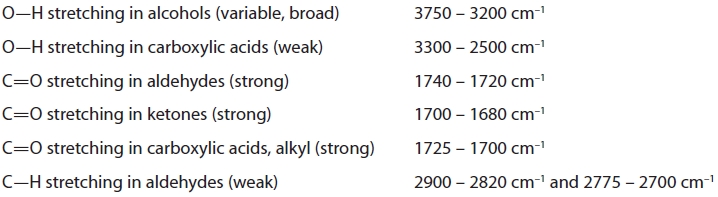
**(Total for Question = 1 mark)**

**Q5.**

Consider the infrared spectrum shown below.



The IR absorption ranges associated with some organic functional groups are given below.



Which of the following could have produced the above spectrum?

   **A**    An aldehyde

   **B**    An alcohol

   **C**    A carboxylic acid

   **D**    A ketone

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

**Q6.**

What effect does infrared radiation have on the covalent bonds in water molecules in the atmosphere?

   **A**    They are broken to form free radicals.

   **B**    They are broken into ions.

   **C**    The bonds vibrate more vigorously.

   **D**    There is no effect on the bonds.

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

**Q7.**

How many of the following molecules will absorb IR radiation?



   **A**     Two

   **B**     Three

   **C**     Four

   **D**     Five

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

**Q8.**

Molecules absorb IR radiation because

   **A**     they change their polarity when they vibrate.

   **B**     they change their velocity when they vibrate.

   **C**     they change their magnetic field when they vibrate.

   **D**     they change their direction of rotation when they vibrate.

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

**Q9.**

These questions concern the use of infrared (IR) spectra to identify organic compounds. The IR absorption ranges associated with some organic functional groups are given below.

   **A**       O—H stretching in alcohols at 3750 − 3200 cm−1

   **B**       CO stretching in aldehydes at 1740 − 1720 cm−1

   **C**       CO stretching in ketones at 1700 − 1680 cm−1

   **D**       CO stretching in carboxylic acids at 1725 − 1700 cm−1

      (a) When propan−2−ol is refluxed with potassium dichromate(VI) and sulfuric acid, the **product** will show a peak due to

**(1)**

   **A**

   **B**

   **C**

   **D**

      (b) When propan−1−ol is heated with potassium dichromate(VI) and sulfuric acid, the **product**, that is distilled off as it is formed, will show a peak due to

**(1)**

   **A**

   **B**

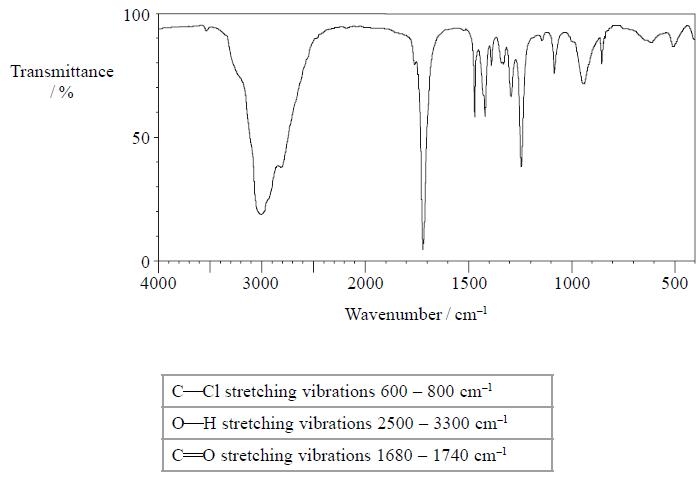
   **C**

   **D**

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

**Q10.**

The infrared spectrum below is most likely to be that of a member of which homologous  
 series?



   **A**     Alcohol

   **B**     Chloroalkane

   **C**     Aldehyde

   **D**     Carboxylic acid

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

**Q11.**

Infrared (IR) spectra can be used to follow the progress of reactions involving  
 propan-1-ol and propan-2-ol.  Some absorption ranges by chemical bonds in the IR  
 spectrum are given below.

**1**     O—H stretching in alcohols at 3750 − 3200 cm−1

**2**     CO stretching in aldehydes at 1740 − 1720 cm−1

**3**     CO stretching in ketones at 1700 − 1680 cm−1

**4**     CO stretching in carboxylic acids at 1725 − 1700 cm−1

(a) To identify the formation of the product when propan-1-ol has been partially  
      oxidized, you can look for absorptions in the IR spectrum at absorption range

**(1)**

   **A**     1

   **B**     2

   **C**     3

   **D**     4

(b) To monitor whether all of the sample of propan-2-ol has been oxidized, you can  
       look for

**(1)**

   **A**     a lack of absorptions in the IR spectrum at 1.

   **B**     a lack of absorptions in the IR spectrum at 2.

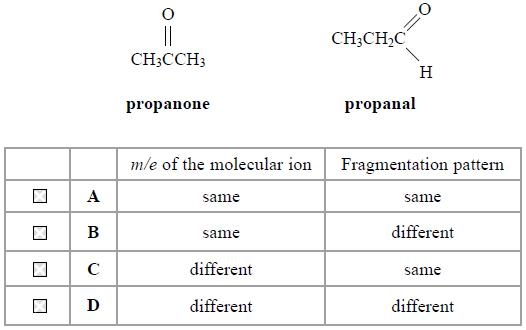
   **C**     absorptions in the IR spectrum at 3.

   **D**     absorptions in the IR spectrum at 4.

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

**Q12.**

Which of the following features is shown by the mass spectra of propanone and propanal?



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

**Q13.**

There would be a major peak in the mass spectrum for butan-1-ol, CH3CH2CH2CH2OH, but not for butan-2-ol, CH3CH2CH(OH)CH3, at *m/e* value

   **A**    15

   **B**    17

   **C**    29

   **D**    43

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

**Q14.**

Which of the following values for the mass/charge ratio for singly charged ions would  
 be present in the mass spectrum of propanal, CH3CH2CHO, but not of propanone,  
 CH3COCH3?

   **A**     15

   **B**     29

   **C**     43

   **D**     58

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

**Q15.**A compound which has major peaks with mass / charge ratio at 29, 57 and 58 in the mass spectrum could be

   **A**    propanal, CH3CH2CHO.

   **B**    propanone, CH3COCH3.

   **C**    propan-1-ol, CH3CH2CH2OH.

   **D**    propan-2-ol, CH3CH(OH)CH3.

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

**Q16.**The molecular (parent) ion in the mass spectrum of a hydrocarbon containing 12C and 1H only

   **A**    is the peak with highest relative abundance.

   **B**    is the peak with highest charge.

   **C**    is the peak produced by the most stable fragment.

   **D**    is the peak with highest mass to charge ratio.

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

**Q17.**

Methanol dissolves in water mainly due to the formation of new

   **A**    hydrogen bonds.

   **B**    dipole-dipole forces.

   **C**    London forces.

   **D**    covalent bonds.

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

**Q18.**

Consider the following organic liquids:

**A**  ethanal

**B**  ethanol

**C**  tetrachloromethane

**D**  trichloromethane

(a) Each liquid is run from a burette. Which liquid would not be deflected significantly by a charged rod?

**(1)**

   **A**

   **B**

   **C**

   **D**

(b) Which liquid would react with phosphorus(V) chloride to give a gas which fumes in moist air?

**(1)**

   **A**

   **B**

   **C**

   **D**

(c) Which liquid would you expect to have the peak at the greatest mass/charge ratio in its mass spectrum?

**(1)**

   **A**

   **B**

   **C**

   **D**

(d) Which liquid has an infrared spectrum with a broad absorption due to hydrogen bonding?

**(1)**

   **A**

   **B**

   **C**

   **D**

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

**Q19.**

When propanal, CH3CH2CHO, and propanone, CH3COCH3, are compared using  
 physical methods of analysis, which of the following is **not** correct?

   **A**  The carbonyl groups absorb at very similar frequencies of the IR spectrum.

   **B**  The compounds will have different patterns in the fingerprint region of the IR spectrum.

   **C**  The compounds will form different fragmentation patterns in a mass spectrum.

   **D**  The compounds will have molecular ion peaks at different mass to charge ratios in a mass spectrum.

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

**Q20.**

In a mass spectrum of butane, C4H10, where would a peak be seen for the molecular ion if it had a charge of 2+?

   **A**    29

   **B**    56

   **C**    58

   **D**    60

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

**Q21.**

The enthalpy change of neutralization of an acid by an alkali is measured by adding 10.0 cm3 of hydrochloric acid to 10.0 cm3 of sodium hydroxide. 10.0 cm3 pipettes with an accuracy of ±0.04 cm3 are used to measure out both solutions.

The overall percentage error in measuring the total volume of the reaction mixture is

   **A**    ±0.04%

   **B**    ±0.08%

   **C**    ±0.4%

   **D**    ±4.0%

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

**Mark Scheme**

**Q1.**



**Q2.**



**Q3.**



**Q4.**



**Q5.**



**Q6.**



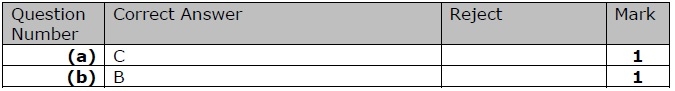
**Q7.**



**Q8.**



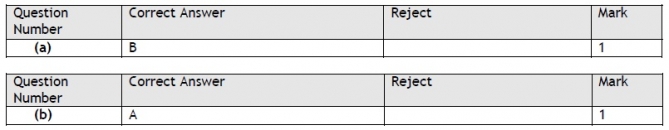
**Q9.**



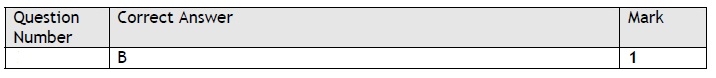
**Q10.**



**Q11.**



**Q12.**



**Q13.**



**Q14.**



**Q15.**



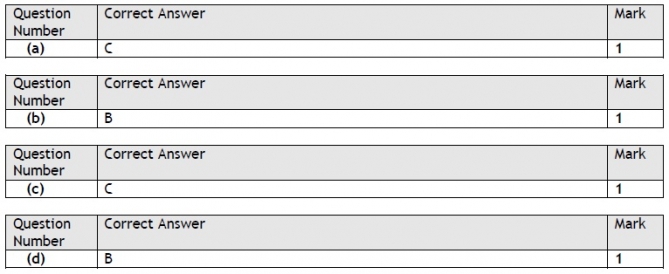
**Q16.**



**Q17.**



**Q18.**



**Q19.**



**Q20.**



**Q21.**

