**A-LEVEL CHEMISTRY**

**PAPER 3**

**PRACTICE PAPER 13**

Answer all questions

Max 90 marks

1 hour 45 minutes

|  |  |  |
| --- | --- | --- |
|  | Name …………………………………………………………….. |  |
|  | Mark ……../90 ……....% Grade ……… |  |

The first 10 multiple choice questions have already been used for AS-level resources

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| **1.** |  | |
|  | (c) | |
|  |  | |
|  |  | |
|  | **(Total 18 marks)** | |
| **2.** |  | |
|  |  | |
|  |  | |
|  | **(d)** | **(Total 6 marks)** |
| **3.** |  | |
|  |  | |
|  |  | |
|  | **(c)** |  |
|  | **(d)** |  |
|  | **(e)** |  |
|  |  | |
|  | **(f)** |  |
|  | **(g)** | **(Total 13 marks)** |
| **4.** |  | |
|  |  | |
|  | **(Total 5 marks)** | |

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| **5.** | ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  ………………………………………………………………………………………………………………………………………………………………………………..  **(Total 15 marks)** |

**6.** (a)     Some metal ions are toxic to humans. A substance that can be used to treat such poisoning contains the ion EDTA4–.   
EDTA4– forms very stable complexes with metal ions. These complexes are **not** toxic.

(i)      Write an equation for the reaction of EDTA4– with aqueous copper(II) ions, [Cu(H2O)6]2+.

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**(1)**

(ii)     A solution containing EDTA4– can also be used in a titration to determine the concentration of metal ions in solution.   
A river was polluted with copper(II) ions. When a 25.0 cm3 sample of the river water was titrated with a 0.0150 mol dm–3 solution of EDTA4–, 6.45 cm3 were required for complete reaction.   
Calculate the concentration, in mol dm–3, of copper(II) ions in the river water.   
Show your working.

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**(2)**

(b)     The determination of the concentration of copper(II) ions in a single sample of river water gives an unreliable value for the copper(II) ion pollution in the river.   
Give one reason why this value is unreliable.

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**(1)**

(c)     Silver complexes can be used to identify a particular organic functional group.   
Give **one** example of a silver complex that can be used in this way and state the organic functional group it identifies.

Silver complex ...............................................................................................

Organic functional group ...............................................................................

**(2)**

**(Total 6 marks)**

**7.** Which atom has an incomplete sub-shell?

**A**       Be

**B**       Ca

**C**       Ge

**D**       Zn

**(Total 1 mark)**

**8.** When TiCI4 is reduced with hydrogen under certain conditions, a new compound is produced which contains 68.9% chlorine by mass. Which one of the following could be the formula of the new compound?

**A**       TiH2Cl2

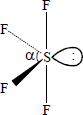
**B**       TiCl

**C**       TiCl2

**D**       TiCl3

**(Total 1 mark)**

**9.** Which one of the following is the most likely value for the bond angle α shown in the diagram of SF4 below?



**A**       118°

**B**       101°

**C**       90°

**D**       88°

**(Total 1 mark)**

**10.** In which one of the following reactions is the standard enthalpy change equal to the standard enthalpy of formation of lithium fluoride?

**A**       Li(g) + F(g) → LiF(s)

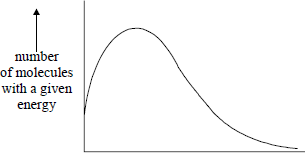
**B**       Li+(g) + F−(g) → LiF(s)

**C**       Li+(aq) + F−(g) → LiF(s)

**D**       Li(s) + F2(g) → LiF(s)

**(Total 1 mark)**

**11.**

  
  
                                             energy

The total area under the distribution curve represents

**A**       total energy.

**B**       activation energy.

**C**       total number of reacting molecules.

**D**       total number of molecules present.

**(Total 1 mark)**

**12.** A sample of chlorine gas was sealed in a tube, heated and an equilibrium was established.

Cl2(g) **⇌** 2Cl(g)

Which one of the following is **not** true?

**A**       The concentration of chlorine atoms remains the same when a catalyst is added to the tube.

**B**       Increase in temperature causes an increase in the concentration of chlorine atoms.

**C**       Increase in pressure causes an increase in the concentration of chlorine atoms relative to chlorine molecules.

**D**       Addition of more chlorine gas to the tube causes an increase in the concentration of chlorine atoms.

**(Total 1 mark)**

**13.** Which of these species is the best reducing agent?

|  |  |  |  |
| --- | --- | --- | --- |
|  | **A** | Cl2 |  |
|  | **B** | Cl− |  |
|  | **C** | I2 |  |
|  | **D** | I− |  |

**(Total 1 mark)**

**14.** The number of structural isomers of C3H2Cl6 is

**A**       2

**B**       3

**C**       4

**D**       5

**(Total 1 mark)**

**15.** Which of these substances does **not** contribute to the greenhouse effect?

|  |  |  |  |
| --- | --- | --- | --- |
|  | **A** | Unburned hydrocarbons. |  |
|  | **B** | Carbon dioxide. |  |
|  | **C** | Water vapour. |  |
|  | **D** | Nitrogen. |  |

**(Total 1 mark)**

|  |  |  |
| --- | --- | --- |
| **16.** | The amount of CH3CH2OH at equilibrium cannot be increased by: | |
|  | A | adding more water |
|  | B | raising the temperature |
|  | C | adding some dilute aqueous sodium hydroxide |
|  | D | adding a catalyst  **(Total 1 mark)** |
| **17.** | Which statement is correct? | |
|  | A | the overall order of reaction is 2 |
|  | B | the reaction is first order with respect to nitrogen monoxide |
|  | C | the reaction is second order with respect to hydrogen |
|  | D | the overall order of reaction is 3  **(Total 1 mark)** |
| **18.** | Which of the following processes is not accompanied by an increase in entropy? | |
|  | A | decomposing ammonia gas into hydrogen and nitrogen |
|  | B | melting ice |
|  | C | dissolving magnesium sulphate in water |
|  | D | converting sulphur dioxide gas into sulphur trioxide in the Contact Process  **(Total 1 mark)** |
| **19.** | Which of the following reactions is feasible at 2000 K? | |
|  | A | reduction of zinc oxide by magnesium |
|  | B | reduction of zinc oxide by nickel |
|  | C | oxidation of nickel by magnesium oxide |
|  | D | oxidation of nickel by zinc oxide  **(Total 1 mark)** |
| **20.** | Cyanide ions will react with: | |
|  | A | C2H6 and C6H6 |
|  | B | CH3CH2Br and CH3COCH3 |
|  | C | C2H6 and CH3CH2Br |
|  | D | C6H6 and CH3COCH3  **(Total 1 mark)** |
| **21.** |  | |
|  | A | and |
|  | B | and |
|  | C | and |
|  | D | and  **(Total 1 mark)** |

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| **22.** | In water, hydrogen cyanide is a weak acid with a pKa of 9.4. Which of the following is not true concerning 500 cm of aqueous HCN that has a concentration of 0.10 moldm-3? | |
|  | A | It will react completely with 2.5 g of sodium hydroxide |
|  | B | The pH of the solution is 5.2 |
|  | C | it can be formed by dissolving 1.35 g of HCN in water and making up to 500 cm3 of solution |
|  | D | the amount of HCN in the solution can be determined accurately by titration of a 25.0 cm3 sample with a 0.1 moldm-3 solution of NaOH using methyl orange as indicator  **(Total 1 mark)** |
| **23.** |  | |
|  | A | 10H+ + SO42- + 8I- 🡪 H2S + I2 + 4H2O |
|  | B |  |
|  | C |  |
|  | D | **(Total 1 mark)** |
| **24.** | Which of the following is true concerning the CH3- ion? | |
|  | A | it has bond angles of 120o |
|  | B | it is an electrophile |
|  | C | it has two lone pairs of electrons |
|  | D | It is a base  **(Total 1 mark)** |
| **25.** | In this reaction, which of the following is not true? | |
|  | A | the solvent H2O is acting as a base by accepting a proton |
|  | B | the pH of the solution will be lower if the value of n is 3 rather than 2 |
|  | C | the equilibrium position lies more to the right if the value of n is 3 rather than 2 |
|  | D | the oxidation state of the central metal cation has decreased from n to n-1 |

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| **26.** | Which of the following involves the reduction of a transition metal? | |
|  | A |  |
|  | B |  |
|  | C |  |
|  | D | **(Total 1 mark)** |
| **27.** | Which of the following statements is true? | |
|  | A | 6.6 g of ethanol were used in the reaction |
|  | B | both ethanol and ethanal have three different proton environments |
|  | C | the theoretical yield of ethanal is 6.6 g |
|  | D | Tollen’s reagent will oxidise both ethanol and ethanal to ethanoic acid  **(Total 1 mark)** |
| **28.** | Which of the following statements is untrue? | |
|  | A | The colour changes from colourless to purple at the equivalence point |
|  | B | Dilute H2SO4 is a suitable acid for use in this titration |
|  | C | Each mole of H2O2 accepts one mole of electrons |
|  | D | [Mn(H2O)6]2+ is formed in the reaction  **(Total 1 mark)** |

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| **29.** | Which of the following conversions is a reduction? | |
|  | A |  |
|  | B |  |
|  | C |  |
|  | D | **(Total 1 mark)** |
| **30.** | An inorganic species does not act as the nucleophile in the reaction between: | |
|  | A |  |
|  | B |  |
|  | C |  |
|  | D | **(Total 1 mark)** |
| **31.** |  | |
|  | A | an electron pair acceptor and a catalyst |
|  | B | an electron pair acceptor and oxidising agent |
|  | C | an oxidising agent and a base |
|  | D | an electron pair acceptor and a base  **(Total 1 mark)** |

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| **32.** | Which of the following statements correctly describe which molecules are capable of forming hydrogen bonds? | |
|  | A | but not |
|  | B | but not |
|  | C | and |
|  | D | and |
| **33.** | Which of the following statements about xylocaine is incorrect? | |
|  | A | it is soluble in dilute hydrochloric acid |
|  | B | it can form a quaternary ammonium salt |
|  | C | it contains a chiral centre |
|  | D | it can undergo Friedel-Crafts reactions |