**A-LEVEL CHEMISTRY**

**PAPER 1**

**PRACTICE PAPER 11**

Answer all questions

Max 105 marks

2 hours

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|  | Name …………………………………………………………….. |  |
|  | Mark ……../105 ……....% Grade ……… |  |

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| **1.** | …………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………… |
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| **2.** | ………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………**(Total 6 marks)** |
| **3.** |  |
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|  | **(Total 9 marks)** |
| **4.** |  |
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|  |  **(Total 15 marks)** |

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| **5.** |  |
|  |  |
|  | **(Total 11 marks)** |
| **6.** | **(Total 2 marks)** |

**7.**          The value of the acid dissociation constant, *K*a, for ethanoic acid is 1.74 × 10–5 mol dm–3 at 298 K.

(a)     (i)      Write an expression for *K*a for ethanoic acid.

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(ii)     Calculate the pH at 298 K of a 0.220 mol dm–3 solution of ethanoic acid.

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**(5)**

(b)     A sample of the 0.220 mol dm–3 solution of ethanoic acid was titrated against sodium hydroxide solution.

(i)      Calculate the volume of a 0.150 mol dm–3 solution of sodium hydroxide required to neutralise 25.0 cm3 of the ethanoic acid solution.

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(ii)     From the list below, select the best indicator for this titration and explain your choice.

**Name of indicator       pH range**

bromophenol blue         3.0 – 4.6

methyl red                     4.2 – 6.3

bromothymol blue         6.0 – 7.6

thymol blue                    8.0 – 9.6

*Indicator* ..............................................................................................

*Explanation* .........................................................................................

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**(5)**

(c)     A buffer solution is formed when 2.00 g of sodium hydroxide are added to 1.00 dm3 of a 0.220 mol dm–3 solution of ethanoic acid.

Calculate the pH at 298 K of this buffer solution.

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**(6)**

**(Total 16 marks)**

**8.** Copper, in the form of nanoparticles of copper(II) hexacyanoferrate(II), has recently been investigated as an efficient method of storing electrical energy in a rechargeable cell.

(a)     Solar cells generate an electric current from sunlight. These cells are often used to provide electrical energy for illuminated road signs.

Explain why rechargeable cells are connected to these solar cells.

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**(2)**

(b)     Suggest **one** reason why many waste disposal centres contain a separate section for cells and batteries.

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**(1)**

**(Total 3 marks)**

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| **9.** |  |
|  | **(Total 13 marks)** |

**10.**       (a)     State what is meant by the term *homogeneous* as applied to a catalyst.

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**(1)**

(b)     (i)      State what is meant by the term *autocatalysis*.

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(ii)     Identify the species which acts as an autocatalyst in the reaction between ethanedioate ions and manganate(VII) ions in acidic solution.

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**(2)**

(c)     When petrol is burned in a car engine, carbon monoxide, carbon dioxide, oxides of nitrogen and water are produced. Catalytic converters are used as part of car exhaust systems so that the emission of toxic gases is greatly reduced.

(i)      Write an equation for a reaction which occurs in a catalytic converter between two of the toxic gases. Identify the reducing agent in this reaction.

*Equation* ..............................................................................................

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*Reducing agent* ...................................................................................

(ii)     Identify a transition metal used in catalytic converters and state how the converter is constructed to maximise the effect of the catalyst.

*Transition metal* ...................................................................................

*How effect is maximised* ......................................................................

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**(5)
(Total 8 marks)**

**11.** A student carried out an experiment to find the mass of FeSO4.7H2O in an impure sample, **X**.
The student recorded the mass of **X**. This sample was dissolved in water and made up to 250 cm3 of solution.
The student found that, after an excess of acid had been added, 25.0 cm3 of this solution reacted with 21.3 cm3 of a 0.0150 mol dm–3 solution of K2Cr2O7

(a)    Use this information to calculate a value for the mass of FeSO4.7H2O in the sample of **X**.

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**(5)**

(b)    The student found that the calculated mass of FeSO4.7H2O was greater than the actual mass of the sample that had been weighed out. The student realised that this could be due to the nature of the impurity.

Suggest **one** property of an impurity that would cause the calculated mass of FeSO4.7H2O in **X** to be greater than the actual mass of **X**.
Explain your answer.

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**(2)**

**(Total 7 marks)**