## **Stage 2 Chemistry**

## **Birdwood**

HIGH SCHOOL **Topic 1: Monitoring the Environment**

**Chemists Calculating and Volumetric Analysis**

**Review Paper 7**

**DUE DATE:**

**Question 1**

Three students A, B and C, made three weighings of the same sodium hydroxide sample using three different balances. The correct mass of the sodium hydroxide sample was known to be 22.70 grams.

The student results are shown in the table below:

**Mass of sodium hydroxide (g)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Weighing** | **Student A** | **Student B** | **Student C** |
| 1 | 26.1 | 22.70 | 25.30 |
| 2 | 23.2 | 22.75 | 25.35 |
| 3 | 24.7 | 22.75 | 25.30 |

i Define the term *precision*.

ii Compare the *accuracy* of students A and B.

iii State and explain which student’s results (**A**, **B** or **C**) may be affected by a systematic error.

(5 marks)

**Question 2**

The pipette used in a volumetric analysis experiment was prepared carefully, to ensure that the results were

accurate.

State two steps that should be followed in *the delivery of the solution from the pipette*, and state why each step

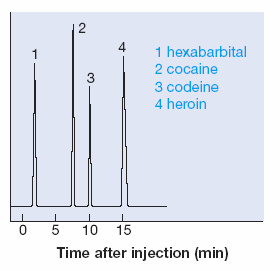
is necessary to ensure accuracy.

(4 marks)

**Question 3**

A blood sample taken from a truck-driver was analysed using thin layer chromatography.

The sample produced the retention time graph shown below. A non-polar stationary phase was used.



i Estimate the retention time of cocaine

to 1 significant figure.

ii State the polarity of the mobile phase used.

iii How many drugs were identified in

the drivers blood sample?

iv Use the graph to state which drug codeine

or heroin is more polar.

v Explain how this retention time graph indicates that

hexabarbital is more polar than cocaine.

(6 marks)

**Question 4**

*Credit will be given for the correct use of significant figures in calculations in answers to this question*. (1 mark)

The iron content of a steel razor blade was analysed as follows:

**Step 1**: The razor blade, weighing 2.857 g, was dissolved in dilute sulfuric acid in a beaker to produce a solution of iron (II) ions, (Fe2+).

**Step 2**: The entire iron (II) solution was transferred to a volumetric flask and made up to 200.0 mL.

**Step 3**: 20.00 mL samples of the iron (II) solution were transferred to conical flasks and titrated with permanganate solution with a concentration of 0.0500 mol L-1.

i Write an *ionic equation* for the reaction between the iron and the acid in Step 1 to produce the Fe2+ ions.

[The *other product* is hydrogen.]

ii State how the chemist would ensure the transfer of all of the iron (II) solution into the volumetric flask in

Step 2.

iii State the name of the best piece of apparatus used to transfer the 20.00 mL samples of the iron (II)

solution to the conical flasks.

iv Mark on a diagram *similar to the one below*, to show the liquid level at the calibration mark of the

volumetric flask,

if it was filled correctly.

v The results of the titration are shown in the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Titration No. | 1 | 2 | 3 | 4 |
| **Final** V mL | 18.10 | 35.75 | 18.35 | 36.25 |
| **Initial** V mL | 0 | 17.90 | 0.450 | 18.35 |
| **Titre value mL** |  |  |  |  |

1. Use the table to calculate the average titre. [*Show your working*.]
2. Hence find the number of moles of permanganate used in the titration.

vi The equation for the reaction between permanganate ions and iron (II) ions is:

MnO4- + 8H+ + 5Fe2+ Mn2+ + 4H2O + 5Fe3+

Use the equation to determine the number of moles of iron (II) present in each 20.00 mL sample.

vii The 20.00 mL samples were obtained from the 200.0 mL solution prepared in **Step 2**.

Hence, determine the number of moles of iron present in the original razor blade.

viii Convert this number of moles of iron to a mass and hence determine the percentage of iron in the

original razor blade.

(17 marks)

**TOTAL MARK = 33**