Analytical chemistry year 12

Name _____

- 1) Which one of the following equations represents a redox reaction?
 - a) $4Fe(s) + 3O_2(g) =>2 Fe_2O_3(s)$
 - b) $AgNO_3(aq) + KI(aq) => AgI(s) + KNO_3(aq)$
 - c) $HCl(aq) + H_2O(l) => H_3O^+(aq) + Cl^-(aq)$
 - d) $CO_2(aq) + H_2O(I) => H_2CO_3(aq)$
- 2) Give a reason for your choice in question 1) above.

2 marks

2 marks

1 mark

 Describe the difference in the ¹H NMR spectrum of CICH₂CH₂Cl and BrCH₂CH₂Cl

4) A compound has the following percentage composition, by mass. And its ¹H NMR is shown on the right 66.67%C, 11.11%H, 22.22%O a) Calculate the empirical formula.



b) Draw a possible structure for this molecule.

2+2 = 4 marks

5) A hydrocarbon, with empirical formula C₅H₁₁ was analysed in a mass spectrometer. Its mass spectrum is shown below.



¹⁺¹⁺¹⁼¹⁼⁴ marks

- 6) Jonathon analysed a sample of vinegar for its acetic acid content. Using a 25mL pipette he took a 25.00 mL sample of vinegar stock solution and placed it in a 250 mL volumetric flask. Distilled water was then added to the mark. A 20.00 mL sample was taken from the volumetric flask and placed in a 100mL conical flask. The sample in the conical was titrated against a 0.100 M NaOH solution. A titre of 17.85 mL was needed to reach the end point.
 - a) Stephen also conducted the same investigation. However he rinsed his conical flask with distilled water. Would his result be higher, lower or the same as Jonathon's? Explain

2 marks

b) Stephen conducted the investigation for a second time. This time he rinsed his burette with distilled water. Would his result be higher, lower or the same as Jonathon's? Explain

- c) Acetic acid is a monoprotic acid (CH₃COOH). Write a balanced chemical equation for the reaction between acetic acid and NaOH.
- d) Calculate the mol of acetic acid present in the 20.00mL sample placed in the conical flask.
- 2 marks e) Calculate the concentration of acetic acid in the volumetric flask in mol/L.
- f) Calculate the concentration of acetic acid, in mol/L, found in the stock solution, to the right number of significant figures.
- g) Explain the difference between equivalence point and end point.



2 marks

2 marks

2 marks

2 marks

- i) Two indicators are provided for students to use. Phenolphthalein and methyl orange. Which indicator should be used and why?
- j) Explain why the equivalence point, shown on the pH curve above is not at pH of 7?

1 mark

2 marks

- 7) Strontium concentration of a polluted water-way was measured by atomic absorption. The calibration curve shown below was produced.
 - a) A 20.00 mL sample was analysed and found to have an absorbance of 0.4. Calculate the
 i) mass of strontium in the 20.00 mL sample in grams.
 - in grams.

0.8

2+2=4 marks

b) What one other analytical technique could be used to analyse the concentration of strontium by first producing a calibration curve?

1 mark

c) What is the purpose of a calibration curve?

1 mark



- d) Name two analytical techniques which require the use of a reference cell?
- e) Why is a reference cell used in UV-visible spectrometry?

2 marks

- f) An ester used as a strawberry flavour in ice-creams can best be isolated and identified using which of the techniques below?
 - a) IR spectroscopy and NMR spectroscopy
 - b) Thin-layer chromatography and UV-visible spectroscopy
 - c) Gas chromatography and NMR spectroscopy
 - d) HPLC and UV-visible spectroscopy.
- g) Explain your answer to f) above.

2 marks

1 mark

h) How can UV-visible spectroscopy be used to identify metal ions which are not coloured.

1 mark

- 8) A 4.50 gram sample of baby food was analysed for sodium content. It is assumed all the sodium in the food originated from NaCl. The sample was dissolved in 100.00 mL of distilled water and filtered. The filtrate was diluted to 200.00mL by the addition of distilled water. A 20.0 mL sample of the diluted filtrate was reacted with excess silver nitrate solution and 0.150 grams of silver chloride was formed.
 - a) Calculate the amount of chloride ions present in mol in the baby food.

2 marks

b) Calculate the percentage by mass of sodium in the food.

2 marks

2 marks