**Friday Worksheet** **Name: …….**

**Revision Unit 3 and 4 worksheet 1**

1) Iron is an essential element and has many functions throughout the body. Many factors can deplete the body of iron. Factors such as bleeding or poor diet. A certain brand of iron supplement contains soluble iron(II) salts that replenish $Fe^{2+}$ in the body in case of deficiency. Iron supplements usually contain about 25 mg per tablet of iron(II). The permanganate ion ($MnO_4^-$) is converted to $Mn^{2+}$ in the presence of $Fe^{2+}$, while the Fe(II) is converted to Fe(III).


Potassium permanganate ($KMnO_4$), has a molar mass of 158.0 atomic mass units and is a good primary standard, To confirm the amount, in grams, of $Fe^{2+}$ ions in each tablet a student followed the experimental procedure outlined below.

i. Weigh a tablet in a beaker and record its mass
ii. Add 100 ml of deionised water and heat until the tablet is dissolved.
iii. Allow the solution to cool and transfer it to a 250 ml volumetric flask and make up to the mark with deionised water.
iv. Prepare a standard $KMnO_4$ solution by accurately weighing out approximately 1.58 grams of potassium permanganate and adding it to approximately 100 mL of 2.00 M $H_2SO_4$. This is then transferred to a 1000 ml volumetric flask and made up to the mark with deionised water.
v. Using a 20 mL pipette transfer 20.0 mL from the 1000 mL volumetric flask into another 1000 mL volumetric flask and fill up to the mark with deionised water . Label it "Solution2"
vi. Pipette a 25.0 ml aliquot of the standard $KMnO_4$ solution from the volumetric flask labelled "Solution 2" into a conical flask.
vii. Fill a burette with the unknown iron(II) solution from the 250 mL volumetric flask. Recording the starting volume of the burette.
viii. Add the unknown Fe(II) solution from the burette into the conical flask containing the 25.0 mL standard $KMnO_4$ until the purple colour of the $KMnO_4$ solution disappears. Record the final reading from the burette.

Results from a typical experiment are shown below:

- Mass of potassium permanganate used: 1.63 g
- Titration results:

| titre | initial/ml ± 0.05 | final/ml ± 0.05 | volume/ml ± 0.1 |
|---|---|---|---|
| 1 | 0.00 | 17.86 | 17.86 |

a) What makes potassium permanganate a good primary standard?

b) Calculate the concentration of the standard $KMnO_4$ solution in the flask labelled "Solution 2"

c) Circle the type of reaction that takes place between the $MnO_4^-$ and the Fe(II) and justify your answer.

- Acid/base

- Redox

- Esterification.

d) Write the overall reaction that occurs and calculate the mol of $MnO_4^-$ present in the conical flask

e) Calculate the amount of Fe(II), in grams, in the 17.86 mL titre.

f) Calculate the mass of iron in one capsule.

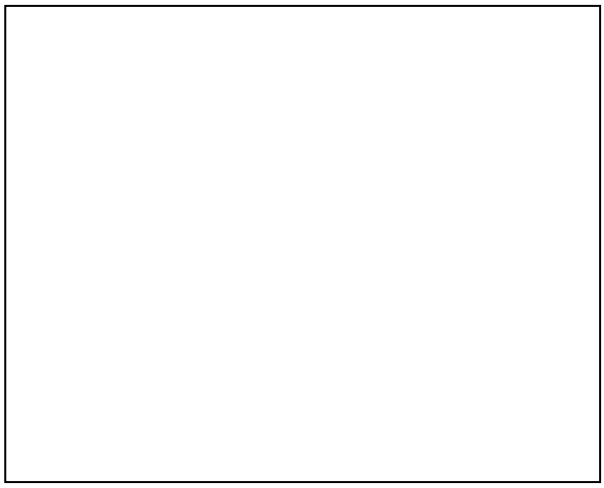
g) What are some improvements that the student can make to their investigation procedure?

h) Another student conducted the same investigation and the titration results are shown below. Complete the table and give the average titre.

| titre | initial/ml ± 0.05 | final/ml ± 0.05 | volume/ml ± 0.1 |
|---|---|---|---|
| 1 | 1.00 | 19.20 | |
| 2 | 19.20 | 37.38 | |
| 3 | 1.35 | 19.55 | |
| 4 | 19.55 | 38.20 | |
| 5 | 4.42 | 23.62 | |

2) Sodium is produced from the electrolysis of sodium salts. Which of the following would be the best choice for the electrolyte and the anode in a commercial cell? Explain
   a) 0.1M NaCl solution, using iron electrodes
   b) Molten NaCl using zinc electrodes
   c) 1.0 M NaCl solution using carbon electrodes
   d) Molten NaCl using carbon electrodes

3) A classroom experiment was set up to simulate the industrial extraction of zinc metal from an aqueous solution of zinc ions by electrolysis. In this experiment 200 mL of 1.50 M $ZnSO_4$ solution was electrolysed at 25°C using inert carbon electrodes.
   a) Draw a diagram of the electrolytic cell. Label the following.
      i. direction of electron flow
      ii. cathode
      iii. anode
      iv. polarity of each electrode
      v. oxidation half-equation
      vi. reduction half-equation
      vii. material that each electrode is made from



**b)** A mass of 1.900 g of zinc is produced in 65.0 minutes. Calculate the electric current, in Amps, supplied to the cell during the electrolysis. Express your answer to an appropriate number of significant figures.

4) What is the pH of a 252 mL sample of a 0.230 M Propanoic acid, solution?