Quantitative glucose test essay sample

Science, Chemistry

AIM: To determine the amount of glucose in three unknown samples namely A, B and C INTRODUCTION:

Biological molecules are held together by covalent bonds, hydrogen bonds among others bonds in various ways to produce large molecules called macromolecules. Simple organic compounds and macromolecules molecules vary in structure and can be distinguished by their functional groups. Molecules of a certain class have similar chemical properties because they have the same functional group. A chemical test that is sensitive to that group can be used to identify molecules that are in that class. There are also tests which measure the quantity of the particular biological molecule present in the substance. This was done so that one can be mindful of the quantities of certain biological molecules entering the body. This awareness can prevent and control diseases such as diabetes mellitus which is a condition where blood sugar level is not controlled correctly and affected people take insulin to help to control their glucose levels and test their blood to determine the level of glucose in it.

There are a variety of different ways in which blood glucose level can be measured. It is often important to measure the concentration of glucose in a solution. In this experiment a variety of solutions will be tested for the glucose concentration of known value and a graph, drawn to show the results. This type of graph is known as a Standard Curve. This graph will then be used to estimate the glucose concentration in an unknown solution. This is the method which was used in hospital labs to measure the glucose level in blood samples. Glucose ($C_6H_{12}O_6$) is a monosaccharide reducing sugar. In this reaction the glucose readily donates electrons which are accepted by

the permanganate causing it to change colour. The time taken for the pink colour of the potassium permanganate to disappear once the glucose solution has been added will be measured. MATERIALS/APPRATUS:

MATERIALS: six (6) controlled solutions containing 90%, 80%, 70%, 60%, 50%, 40% glucose, three (3) samples A, B and C, sulphuric acid, potassium permanganate, water, APPARATUS: six (6) boiling tubes, boiling tube stand, stop watch, nine (9) beakers, measuring cylinder, 5cm syringe, 1cm syringe, two (2) glass rods, tape, white paper PROCEDURE:

Firstly six controlled samples were tested by pouring 10cm3 (ten centimeters cubed) of the 90% glucose into the measuring cylinder then placing it into the boiling tube, next 5cm3 (five centimeters cubed) of the sulphuric acid was measured with the syringe and added to the control of 90% glucose in the boiling tube the timer was then set and 1cm3 (one centimeter cubed) of potassium permanganate was measured and was simultaneously added while the timer was started. The mixture was then stirred with a glass rod until it was colourless to verify this; a piece of white paper was placed behind the boiling tube to confirm the transparency the time the mixture took to become transparent was then recorded. This procedure was repeated for the rest of control samples that is 80%, 70%, 60%, 50%, and 40% and was done twice for accuracy the both times recorded were then averaged. Finally when all of the results of the controls were recorded the test was repeated on the samples A, B and C and compared to that of the controls to obtain how much sugar was present within the samples. RESULTS:

TABLE 2. 0: TABLE SHOWING THE TIMES RECORDED DURING THE CONTROL TESTS AND THE AVERAGE OF THE TWO TIMES RECORDED GLUCOSE CONTROL PERCENTTEST1 (seconds)TEST2 (seconds)CALCULATIONSAVERAGE

90%194 198(194+198)/2196

80%245249(245+249)/2247

70%270270(270+270)/2270

60%290288(290+288)/2289

50%310312(310+312)/2311

40%342344(342+344)/2343

TABLE 2. 1: TABLE SHOWING THE TIMES RECORDED DURING THE SAMPLE TESTS AT A PARTICULAR LEVEL OF CONCENTRATION SAMPLETIME (SECONDS)

RATIOS (SAMPLE : WATER)

5: 53: 71: 9

A1. 5615

B2720

C1510

DISCUSSION:

In this experiment sulphuric acid and potassium permanganate were added to glucose solutions, the time it took for the purple pink colour of the potassium permanganate to decolourise showed how long it took for a certain percent of glucose to decolourise thus allowing a time limit in second to be put to a quantity of glucose. SULFURIC ACID WAS USE TO BREAK DOWN….

In the results we can see that the purple pink solution of potassium permanganate (MnO4-) was reduced to a colourless solution of manganese ions (Mn2+). MnO4- + 8H+ + 5e- ☾ Mn2+ + 4H2O
From purple pink, to a colourless solution.

As a result of this reaction the glucose is oxidised. Potassium permanganate is used as a qualitative test for the presence of double or triple bonds in a molecule, since the reaction decolourises the permanganate solution. Glucose (C6H12O6) is a monosaccharide reducing sugar. In this reaction the glucose readily donates electrons which are accepted by the permanganate causing it to change colour. The time taken for the loss of colour from a standardised solution of permanganate is directly related to the concentration of glucose present in solution. In order for the experiment to be balanced there were three types of variables that need to be taken into consideration. These are the independent variables, dependant variables and the fixed variables. Independent variables such as the reducing sugars used were measured accurately and the same amount of each were put into each boiling tube also the measuring cylinder was washed thoroughly to prevent the concentration controls from mixing because that could cause the chemical reaction to be sped up or slowed down giving the incorrect time reading. Due to the fact that these variables such as the reducing sugars the measurements of the sugars are being controlled they have to be accurate. Another area of the experiment where inaccuracy can occur is dependant variables.

The dependant variables in this experiment are the time it takes the solution to decolourise. In order for the experiment to be precise the point of decolourisation has to be defined. This was done by using a white piece of paper and putting it behind the test tube and comparing the solution to the paper. Fixed variables such as; temperature, volumes of sulphuric acid, volume of potassium permanganate, the glucose and water were taken into consideration. The volumes of the sulphuric acid and potassium permanganate were measured precisely. The timing of the stopwatch also has to be accurate and thus was done simultaneously with the adding of the potassium permanganate. When the unknown sample were tested first the reaction took place to quickly for the change to be recorded with the available technology in addition to the samples limitations such as; the samples containing other ingredients such as sucrose colouring and additives which would have sped up the chemical reaction thus the sample was diluted (with water) first at a ratio of five centimeters cubed (5cm3) sample to five centimeters cubed (5cm3) water, 5: 5 , then three centimeters cubed (3cm3) sample to seven centimeters cubed (7cm3) water, 3: 7 and finally one centimeter cubed (1cm3) sample to nine centimeters cubed (9cm3) water, 1: 9 The main observation in this experiment was the colour changes from purple to clear. This was done with the naked eye and it is in this area where faults in accuracy occurred.

To stop inaccuracy the introduction of white paper behind the test tubes helped determine when the solution has decolourised. The measurements of the results were changed from the numerical numbers received on the stopwatch to seconds. This was done for both the control and samples. To

make the results more accurate a colourimeter could have been used. A colourimeter is a machine that is used to see how much light can pass through a liquid. It shows how much light is being transmitted through a sample of liquid. As the number of cells gets higher, less light will be transmitted through the sample. Special thin walled test tubes are used in the colourimeter so that they do not affect the amount of light passing through the sample.

This could have both positive and negative effects on the experiment if the use of the colourimeter were to occur then every solution would have to be carried out in the cuvetts. This would be difficult as they are very small and all the amounts of various sugars and chemicals would have to be changed to fit into the cuvetts. Another area in which faults might occur is the readings of the meter. If there are scratches on the cuvetts it can change the reading on the colourimeter. In addition a major precaution hat should have been taken into consideration are the additives, sucrose, colouring and other chemicals that were present in the sample which sped up the chemical reaction disabling us to accurately determine the amount of glucose present in the sample. CONCLUSION:

It can be concluded that glucose was present in the samples however a substantial conclusion cannot be made because the aim of the experiment was to determine how much glucose was present in three samples via comparing it to the controls in the experiment, due to the precautions that were not taken the samples cannot be compared to the controls thus the hypothesis was unsuccessfully tested.