The concentration of reducing sugars biology essay

ASSIGN BUSTER

Benedict’s reagent is used to determine if a reducing sugar is present. Benedict’s reagent is used as a test for the presence of all monossacharides and generally also reducing sugars. These include glucose, galactose, mannose, lactose and maltose. Even more generally, Benedict’s test will detect the presence of aldehydes (except aromatic ones) and alpha-hydroxyl-ketones, including those that occur in certain ketoses. Benedict’s reagent contains blue copper(II) ions (Cu2+) which are reduced to copper(I) (Cu+). These are precipitated as red copper(I) oxide which is insoluble in water.

In this particular experiment, the concentrations of reducing sugars in three different types of canned soft drinks can be determined via color and mass of precipitate formed. Soft drinks with the highest concentration of reducing sugars will have intense brick-red precipitate color and greater mass of its precipitate when measured with electronic balance.

Research question:

Does the concentrations of reducing sugars in three different types of canned soft drinks available in the school canteen can be determined via time taken for color to change and the mass of precipitate formed in the presence of Benedict’s solution?

Hypothesis:

The concentrations of reducing sugars in different types of soft drinks can be determined with the presence of Benedict’s solution. Benedict’s reagent contains blue copper(II) ions which are reduced to copper(I) ions. The mass of precipitate with the highest value indicates the highest concentration of

reducing sugars among the three different canned-soft-drinks. Therefore, the higher the mass of precipitate formed, the higher the concentration of reducing sugars in the soft drink.

Variables:

Independent variable:

The different types of soft drinks

Definition:

Different types of soft drinks are used in order to vary the results of the experiment. 20 ml of 7UP, Sprite and Orange Mirinda are used for this experiment, each measured by measuring cylinder.

Dependent variable:

Concentration of glucose in the soft drinks

Definition:

The concentration of glucose is varied in each of the soft drinks. In order to test for the different concentrations, the mass of precipitate formed and time taken for the color to change are taking into account. The mass of precipitate can be obtained as follows:

[Mass of precipitate with filter paper (g) – Mass of filter paper (g)]

Once the mass is obtained, the concentration of glucose in each of the soft drinks can be calculated as follows:

[Average mass of precipitate (g)]

Volume of soft drinks (ml)

The color intensity of the precipitate on the other hand is observed via the experiment within 5 minutes duration. The more intense the color of precipitate formed, the greater the concentration of glucose in the soft drink.

Constant:

Volume of soft drinks

Definition:

The volume for each of the soft drinks is 20 ml. The volume is carefully measured by 100 ml measuring cylinder. The volume needs to be kept constant in order to ensure the accuracy of the experiment.

Duration of the experiment

Definition:

The duration for this experiment is in the range of 3-5 minutes. Stop watch is used to take the time taken for the experiment, starting from the beaker is being heated.

Uniform rate of heating

Definition:

To ensure a uniform rate of heating, the Bunsen burner is adjusted in order to obtain a gentle yellow flame. The beaker which is filled with the water bath and boiling tubes are then heated with this gentle flame. This is essential to make sure that the rate of heating can be sustained.

Apparatus and Materials:

Apparatus

Justification

Quantity

Boiling tubes

It is essential to fill in 20 ml of each of the soft drinks

3

500 ml beaker

It is essential to fill in 250 ml of water bath once it is measured by using 100 ml measuring cylinder.

1

100 ml measuring cylinder

It is used to measure the volume of the water bath and as well as the volume of soft drinks

1

Bunsen burner

This allows the heating process of the water in the beaker.

Stop watch

Stop watch is used in order to take the time taken for the duration of the experiment, approximately 5 minutes, starting from the moment the beaker is being heated.

Electronic balance

Electronic balance is used to measure the mass of the precipitate formed in each of the boiling tubes

Tripod stand

Tripod stand is essential to support the beaker during the heating process

Wire gauze

Wire gauze is placed on top of the tripod stand before the heating process begins. This helps to prevent any direct heating towards the beaker.

1

Thermometer

It is used to obtain the suitable temperature of the water bath (37°C)

1

Materials

Justification

Quantity

Canned soft drinks

Sprite, 7UP and Orange Mirinda are used for the experiment.

20 ml in each of the boiling tube

Tap water

Tap water is heated slowly to obtain a water bath of 37 °C

250 ml

Filter paper

Filter paper is used in order to filter the precipitate formed at the end of the experiment.

3

Benedict’s reagent

Benedict’s reagent acts as an indicator to test for the presence of glucose (reducing sugar). The color intensity of the precipitates formed would indicate the different concentration of the soft drinks.

Excess amount in each of boiling tube

Matches

Matches are used to light up the Bunsen burner

1 box

Aspect 2: Developing a method for collecting data

Methodology:

Prepare 3 different types of canned soft-drinks as follows:

7UP

Sprite

Orange Mirinda

Then, measure 20 ml of each of the soft drinks by using 100 ml measuring cylinder. Pour the measured volume of the soft drinks into 3 separated boiling tubes labeled A, B and C respectively. Avoid any parallax error when taking the reading of the volume. The eyes must be at the meniscus while taking the measurement.

Drop excess amount of Benedict’s reagent into boiling tubes A, B and C. This allows the sample to be fully reacted with the reagent.

Next, prepare 250 ml of water bath. The water bath is poured into a 500 ml beaker. Water bath is used in this experiment to provide the optimum temperature for the enzymatic reaction.

The apparatus for heating process is prepared. Wire gauze is placed on the tripod stand. The wire gauze is essential in preventing direct heating towards the beaker. All of the boiling tubes are placed into the beaker. Then, place the beaker on the tripod stand. The Bunsen burner is then lightened up with a gentle flame. This is to ensure the moderate heating on the sample.

Get ready with a stop watch. The time is taken when the beaker starts to be heated by the Bunsen burner.

Once the precipitates are formed at the end of the experiment, observe the color of the precipitates formed in each of the boiling tubes. The boiling tubes are left to be cooled down for a few minutes.

Weigh the mass of each of the filter papers

After that, filter the precipitate formed from each boiling tubes. Weigh the precipitates together with the filter paper using electronic balance. Do make sure that the balance is read zero before weighing so that false readings can be avoided.

Record and tabulate all the data and information.

Plot a graph of concentration of glucose versus type of soft drinks.

Table of mass of precipitate and concentration of glucose in the soft drinks:

Boiling tubes

Type of soft drinks

Volume (±0. 05ml)

Mass of precipitate (±0. 01g)

Concentration of glucose in the soft drinks

(gml-1)

M1

M2

M3

Average mass

A

7UP

20

B

Sprite

20

C

Orange Mirinda

20

Table of color intensity of precipitates after 5 minutes:

Boiling tubes

Color intensity of precipitates

A

B

C

Key point:

M1 = mass 1

M2 = mass 2

M3 = mass 3

Formula for uncertainties = Smallest Unit Measurement

2

Mass = smallest scale

= ± 0. 01 g

Volume = ±0. 10 ml

2

= ± 0. 05 ml

Graph of concentration of glucose in soft drinks versus types of soft drinks

Concentration

of glucose in

soft drinks

(gml-1)

Type of soft drinks