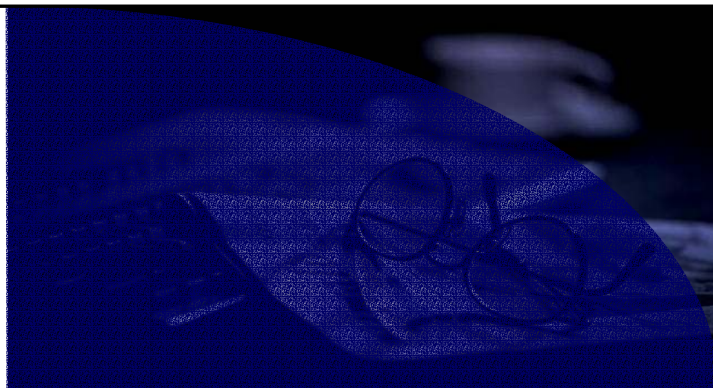


GCSE Science Coursework



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GCSE Science coursework...Year 11 Coursework:

GCSE Coursework...Year 11: Double Science: 2006.

Notes:

All Double Award students will complete the following in year 11.

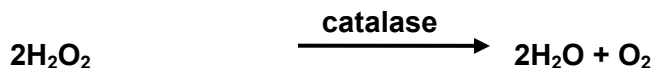
One second full investigation from the following choices:

- 1: "What affects the speed of an enzyme reaction"**
- 2: "Does ice melt more quickly if you add more rock salt" (Chem [SC03])**
- 3: "How does the load carried affect the time taken for a helicopter to fall?" (Phy [SC04])**
- 4: "How does the steepness of a hill affect the time taken to stop a vehicle?" (Phy [SC04])**
- 5: 'Partial' Investigation "How does light intensity affect the rate of photosynthesis" will be available for any pupil who still requires 'pieces' of coursework. This investigation is computer generated and can be used for one-off pieces of work for either planning, observation, analysis or evaluation work – or a combination of these skills can be examined.**
- 6: An analysis and evaluation exercise "What affects the action of rennet on milk" is also available for Year 11.**

Teacher Information Sheet

Year 11 Coursework...“What affects the speed of an enzyme reaction”

The experiment is based on the effect of the enzyme catalase on Hydrogen Peroxide.



Catalase is provided by potato. [Do not use liver as this reaction is too fast for pupils to measure and gets very messy]. Measurements are made of quantity of oxygen produced in the reaction over time.

Only one variable should be investigated by each pupil. The variables to choose from are: Size of potato (mass or length), surface area of potato (large or small pieces), concentration of H_2O_2 or temperature of H_2O_2

Pupils should be reminded of different methods of collecting gas:

- a) apparatus connected to a gas syringe
- b) apparatus connected through a delivery tube to a measuring cylinder
- c) potato/ H_2O_2 in a test tube with 3 drops of washing up liquid added. Gas is contained in bubbles of washing up liquid, and the amount of gas produced can be measured using a ruler.

Pupils should choose which method to use according to their ability. It is important that all pupils are allowed to choose their method and order the equipment required. You may wish to have a lesson prior to the Coursework so pupils can familiarise themselves with the different methods of gas collection, and ensure that pupils choose a method for their coursework with which they are confident of success.

Pupil Sheet

Year 11 Coursework...“What affects the speed of an enzyme reaction ?”

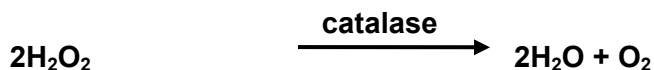
This is a biology topic – based on enzymes and their substrates specificity and factors that affect how quickly they are able to catalyse a reaction.

Research your notes, textbooks or the internet for information about enzymes, catalase and rates of reaction.

FACTS YOU NEED TO KNOW:

- catalase causes the breakdown of hydrogen peroxide:
- the enzyme is found inside the potato
- The rate of reaction can be measure by measuring the rate over time of oxygen production.
- Enzymes are pH and heat sensitive.

The experiment is based on the effect of the enzyme catalase on Hydrogen Peroxide.



Catalase is provided by potato. Measurements are made of quantity of oxygen produced in the reaction over time.

Only one variable should be investigated by each pupil. The variables to choose from are:

- Size of potato (mass or length),
- Surface area of potato (large or small pieces),
- Concentration of H_2O_2
- Temperature of H_2O_2

Pupils are reminded of different methods of collecting gas:

- apparatus connected to a gas syringe
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- potato/ H_2O_2 in a test tube with 3 drops of washing up liquid added. Gas is contained in bubbles of washing up liquid, and the amount of gas produced can be measured using a ruler.

Pupils should choose which method to use according to their choice. It is important that all pupils choose their method and order the equipment required. You will have a lesson prior to the Coursework so that pupils can familiarise themselves with the different methods of gas collection, and ensure that pupils choose a method for their coursework with which they are confident of success.

Do some preliminary work and find out over what time the reaction takes, any problems or improvements you need to make. Don't forget to write about the preliminary work that you do.

Use the coursework prompt sheets.

Enzymes speed up the breakdown and digestion of food. Without enzymes we could not survive. They are found inside the digestive tract as well as inside cells. Plant like potatoes also have enzymes. You need to decide one factor that affects the speed or rate of a reaction between catalase and hydrogen peroxide. Remember only choose one.

Research your notes, textbooks or the internet for information about indigestion, stomach acid or neutralisation.

Planning:

The technician will supply all the equipment you need or have ordered including potato and the equipment needed to measure the amount of oxygen produced over time.

Your task is to investigate how one of these factors affects the speed of reaction. You will do this by determining the rate of oxygen production by the enzyme catalase which is found in the potato.

You will need to carefully plan your experiment and repeat at least three times for each tablet. You also need to make a list of all equipment that you use including all measuring equipment and a full method that anyone could follow.

You also need to consider in your planning the following:

Planning:

PLANNING	
P2A	Outline a simple procedure.
P4A	Plan to collect evidence which will be valid.
P4B	Plan the use of suitable equipment or sources of evidence.
P6A	Use scientific knowledge and understanding to plan and communicate a procedure, to identify key factors to vary, control or take into account, and to make a prediction where appropriate.
P6B	Decide a suitable extent and range of evidence to be collected.
P8A	Use detailed scientific knowledge and understanding to plan and communicate an appropriate strategy, taking into account the need to produce precise and reliable evidence, and to justify a prediction, when one has been made.
P8B	Use relevant information from preliminary work, where appropriate, to inform the plan.

Obtaining:

You need to place all your results data and averages in a well presented results table making sure all the correct units are there.

You also need to consider the following:

OBTAINING	
O2A	Collect some evidence using a simple and safe procedure.
O4A	Collect appropriate evidence which is adequate for the activity.
O4B	Record the evidence
O6A	Collect sufficient systematic and accurate evidence and repeat or check where appropriate
O6B	Record clearly and accurately the evidence collected.
O8A	Use a procedure with precision and skill to obtain and record an appropriate range of reliable evidence.

Analysis:

You need to draw graphs with labelled axis and units and title. You also need to draw in any lines of best fit. In your analysis you need to consider what has happened and any trends and patterns in the data.

You also need to consider the following:

ANAYSIS	
A2A	State simply what is shown by the evidence
A4A	Use simple diagram, charts or graphs as a basis for explaining the evidence.
A4B	Identify trends and patterns in the evidence.
A6A	Construct and use suitable diagrams, charts, graphs (with lines of best fit, where appropriate), or use numerical methods to process evidence for a conclusion.
A6B	Draw a conclusion consistent with the evidence and explain it using scientific knowledge and understanding.
A8A	Use detailed scientific knowledge and understanding to explain a valid conclusion drawn from processed evidence.
A8B	Explain the extent to which to which the conclusion supports the prediction, if one has been made.

Evaluating:

Remember it helps you to evaluate your experiment if you write down all the problems which occur whilst you are doing your experiment: e.g: Some of the oxygen was lost or not all potato may contain equal amounts of catalase enzyme.

You also need to consider the following:

EVALUATION	
E2A	Make a relevant comment about the procedure used or the evidence obtained.
E4A	Comment on the quality of the evidence, identifying any anomalies.
E4B	Comment on the suitability of the procedure and where appropriate, suggest

	changes to improve it.
E6A	Consider critically the reliability of the evidence and whether it is sufficient to support the conclusion, accounting for any anomalies
E6B	Describe, in detail, further work to provide additional relevant evidence

Remember – all GCSE Coursework must be your own.

You need to complete all coursework and hand in to your teacher. Without coursework you cannot pass your science. You will also not be entered for your final exams. We do not waste money on exams entries for pupils with no coursework.

You will also get your coursework back to improve it only once: These corrections have to be made within 10 days.

“What affects the action of Rennet on milk” (A & E only)

Introduction:

A pupil planned an investigation to investigate the action of rennet on milk.

The following predictions were made by the pupil;

1: As you increased the concentration of the enzyme rennet, the time taken for the milk to coagulate would decrease.

2: That this decrease in time would be proportional to the enzyme concentration.

Rennet is an enzyme, which coagulates milk. The factors that may play a role in affecting the time taken for the milk to coagulate are:

- **Temperature of the reaction mixture.**
- **Enzyme Concentration.**
- **Reactant Concentration.**
- **PH of the reaction mixture.**

These are the same variables that affects the rate of most enzyme catalysed reactions, however, pH is not a suitable variable to study or investigate, because as the milk becomes more acid the milk coagulates naturally.

The investigation that was done was to investigate since as the milk becomes more acidic the milk coagulates naturally. The investigation that we are going to do will investigate the effect of changing the concentration of rennet on the time for the milk to coagulate.

Apparatus

- **Syringes 1 cm**
- **5 cm**
- **Whole milk**
- **Rennet solution made up into the following concentrations**
- **100%, 90%, 80%, 70%, 60%, 50%, 40%, 30%, 20%, 10%,**
- **Stop clock.**
- **Test tubes.**

Method

- 1. Measure out 1 cm of 100% rennet using a syringe**
- 2. Using a 5cm syringe measure out 5cm of milk**
- 3. Put the rennet and the milk into the test tube, and at the same time start the stop clock.**
- 4. Observe the milk as it coagulates and stop the stop clock as soon as the milk has coagulated**
- 5. Note the time taken for the milk to coagulate in the table.**
- 6. Repeat the experimental procedure with each concentration three times each recording the results each time.**

FAIR TEST

Make sure all experiments are done at room temperature, so that the reaction time is not increased or decreased in the temperature.

Keep the volume of the milk the same so that the rennet has the same amount of milk to coagulate.
 Make sure the volume of the rennet is kept the same
 Keep the pH of the solutions the so that enzyme action is not effected by the pH of the solution.
 Make sure the coagulation point is always the same, so that the enzyme has the same amount of work to do.
 Make sure the milk that is used is the same age because milk coagulates slowly with age.

Results

Time taken for the milk to coagulate in seconds

Concentration of enzyme	1 st result (s)	2 nd result (s)	3 rd result (s)	Average (s)
100%	79	75	70	74.6
90%	110	95	80	95.0
80%	120	100	110	110.0
70%	111	109	110	110.0
60%	134	130	137	133.6
50%	141	137	138	138.7
40%	200	130	130	153.3
30%	250	270	230	250.0
20%	400	490	520	470.0
10%	900	800	905	868.3

Pupil work...analysis

Look at the average the results for the 3 experiments.

Draw and plot a graph of the results including the correct units for the X and Y axis and a title. Put results on the same piece of graph paper.

Draw on lines of best fit for each set of results.

Explain what the results tell you and identify any trends and patterns in the observations or measurements.

Explain how the concentration of the enzyme affected the time taken for the milk to coagulate.

Include in your explanation equations and diagrams to help explain how changing the concentration of the enzymes affects the rate of reaction between the milk and the enzyme.

Use the text book information provided.

Draw a valid conclusion consistent with the results that you have been given and also use scientific ideas and understanding of the role of enzymes and the factors that affect them.

Explain how the results support or contradict the original prediction. Were a suitable number and range of observations made during the investigation.

TOP TIPS – use these questions to check your working - these things decide how many marks you should get.

Analysis

To get 4 marks

- Have you drawn a graph of the results? A4a
- Have you got units on the graph axes? A4a
- Do both axes have a scale that represents the range of your results? A4a
- Have you WRITTEN down a description of how the concentration of rennet effects the time it takes for the milk to turn solid? A4b

To get 6 marks

- Is the graph a smooth line that shows the change in time as the rennet gets more concentrated? A6a
- Which variable do you decide on – the time or the concentration of the rennet? This is the independent variable (because you choose which values to use). This makes the x-axis scale. A6a
- Which variable do you have to measure as the outcome of the experiment – time or concentration of rennet? This will make the y-axis scale of your graph. A6a
- Have you written about the reaction that makes the milk set? A6b
- Have you drawn a simple diagram to show what happens in the reaction?
- Have you mentioned the words coagulate, enzyme and catalyst and explained what they mean? A6b
- Have you explained simply why the reaction is faster with different concentrations of rennet? A6b

To get 8 marks

- Have you written about the science explanation behind the reaction that makes milk coagulate? Use a science text book to find an explanation then write it using your own words and use your own pictures. A8a
- Have you drawn diagrams of what is happening to the molecules in the milk when they come into contact with the rennet? Can you write an equation for this – even a word equation in this case? A8a
- Have you drawn a series of diagrams showing what happens if there are more and more molecules of the rennet present in the milk? A8a
- Have you written an explanation about how more and more molecules of rennet effects the rate at which the milk coagulates? A8a

Evaluation:

You need to make a comment on the procedure or method used or the results obtained. For example were enough repeats done or could you have studied the effect of perhaps temperature as well.

Comment on the overall accuracy of the results and point out any errors or points that are above or below lines of best fit.

Suggest some improvements to the method or investigation. Say how these might improve the reliability of the results.

Say whether you think that the results are sufficient to support the original hypothesis or your conclusion, how certain are you.

Propose improvements to the experiment to provide additional results and how would you extend this investigation.

Evaluation...mark scheme

To get 2 marks

- **Have you written about how the experiment was done – for example how do you think it is easy to decide if the milk has set or not? E2a**

To get 3 marks

- **Did you say were all the points on the graph on a smooth line? Write mentioning any that were off the smooth line. If ALL the points were on the smooth line, write about if you feel this is evidence that your experiment gave a correct set of results.E4a**

To get 4 marks

- **Did you write about if you think the method used was an accurate way of finding the effect of different strengths of rennet on setting milk. Explain why you think it was a good or bad method. Mention specific things about the method. E4b**

To get 5 marks

- **Look at the repeats of the results for each concentration. Write about if the individual readings are close together or far apart. Write if this makes you think the results are good evidence or poor evidence for the pattern you found. E6a**

To get 6 marks

- **Describe how you could do the same investigation using a different and much improved method. Explain in detail how you would take the readings and why this method would give better, more accurate or more reliable results. E6b**

You also need to read this mark scheme:

ANAYSIS	
A2A	State simply what is shown by the evidence
A4A	Use simple diagram, charts or graphs as a basis for explaining the evidence.
A4B	Identify trends and patterns in the evidence.
A6A	Construct and use suitable diagrams, charts, graphs (with lines of best fit, where appropriate), or use numerical methods to process evidence for a conclusion.
A6B	Draw a conclusion consistent with the evidence and explain it using scientific knowledge and understanding.
A8A	Use detailed scientific knowledge and understanding to explain a valid conclusion drawn from processed evidence.
A8B	Explain the extent to which to which the conclusion supports the prediction, if one has been made.

Evaluating:

Remember it helps you to evaluate your experiment if you write down all the problems which occur whilst you are doing your experiment: e.g: Some powder left in mortar after crushing or Difficulty in adding powder to acid and starting stopwatch at the same time.

You also need to consider the following:

EVALUATION	
E2A	Make a relevant comment about the procedure used or the evidence obtained.
E4A	Comment on the quality of the evidence, identifying any anomalies.
E4B	Comment on the suitability of the procedure and where appropriate, suggest changes to improve it.
E6A	Consider critically the reliability of the evidence an whether it is sufficient to support the conclusion, accounting for any anomalies
E6B	Describe, in detail, further work to provide additional relevant evidence

Other resources:

Pupil Sheet

Year 11 Coursework....“Does ice melt more quickly if you add more rock salt?”

Council grit lorries spread rock salt on icy roads in the winter to prevent accidents. The rock salt melts the ice. This investigation is about melting and boiling.

Research your notes, textbooks or the internet for information about melting and boiling, rock salt and its uses.

FACTS YOU NEED TO KNOW:

There are three states of matter – solid, liquid and gas. Water is a very special substance because it can be found in all three states

Liquid = water

Solid = ice

Gas = steam (water vapour)

Pure water will boil at 100°C and turn into water vapour (steam). The boiling point of water is 100°C.

Pure water will melt at 0°C and turn from ice to water – so the melting point of water is 0°C.

Pure water has a melting-boiling range of
0°C → 100°C

Impure water (water with additives – such as salt or other minerals) will affect the boiling and melting points of water. The range of the boiling point and melting point temperatures is decreased.

e.g. Salty water will not boil at 100°C but will boil at lower temperatures between 80°C and 90°C. Salty water will melt ice from a solid to a liquid at lower temperatures, about -10°C.

Impure water has a melting/boiling range of
-10°C → 90°C

Your task is to investigate the difference between the amount of rock salt added to ice and the amount of water produced by melting.

You will be provided with up to 15 plastic dishes filled with ice. (Range of 5, repeats of 3 !)

You will need to carefully plan your experiment.

Do some preliminary work on one of the ice dishes to ensure that you are happy with your plan. Don't forget to write about the preliminary work that you do.

Remember it helps you to evaluate your experiment if you write down all the problems which occur whilst you are doing your experiment.

Use the coursework prompt sheets. Remember – all GCSE Coursework must be your own

Teachers Notes

Year 11 coursework...“Does ice melt more quickly if you add more rock salt?”

Your technician can supply Petri dishes filled with ice. If rock salt is sprinkled onto the ice and a set time (e.g. 2 mins) given – then the amount of water produced from the melted ice can be poured into a measuring cylinder.

Preliminary work should be encouraged so pupils can ensure a fair and sensible investigation. Encourage pupils to make a note of all ideas and decisions made during preliminary work. Pupils should be encouraged to write about this in detail.

There are a number of in-built inconsistencies in this experiment which allows plenty of scope for evaluation.

Teachers Notes

“How does the load carried affect the time taken for a helicopter to fall?”

This is a very simple experiment – using a paper helicopter design and adding paperclips or blue tack. There are no worksheets written for this experiment – teacher explanation is all that is require, together with use of the Departmental GCSE Prompt Sheets

Teachers Notes

“How does the steepness of a hill affect the time taken to stop a vehicle?”

Using toy cars and a ramp fixed at different angles – this investigation enables pupils to use potential energy, forces, gravity, speed and friction ideas. Again a very simple investigation – teacher explanation only needed no worksheet needed. There are a number of variables to choose from so ensure only one variable is changed.

Teachers Notes

“How does light intensity affect the rate of photosynthesis?”

There is a computer program available “WEED”.

There are three worksheets available for use with this program which are attached to this document.

Alternatively – NewMedia CD has a photosynthesis section which could be used.