**Form 1**

**Mandatory Science experiments**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Class: \_\_\_\_\_\_\_

**Do not take this booklet home with you**

**It is to be kept in the science lab at all times**

**Biology**

|  |  |  |
| --- | --- | --- |
| Page | **First Year** |  |
| 2 | Qualitative food tests for starch, reducing sugar, protein and fat.  |  |
| 4 | Investigate the conversion of chemical energy in food to heat energy. |  |
| 5 | Investigate the action of amylase on starch; identify the substrate, product and enzyme. |  |
| 6 | Investigate the variety of living things by direct observation of animals and plants in their environment; classify living organisms as plants or animals, and animals as vertebrates or invertebrates. |  |
| 7 | Prepare a slide from plant tissue and sketch the cells under magnification. |  |

**Chemistry**

|  |  |  |
| --- | --- | --- |
|  | **First Year** |  |
| 8 | Separate mixtures using a variety of techniques: filtration, evaporation, distillation and paper chromatography.  |  |
| 12 | Grow crystals using alum or copper sulphate. |  |
| 13 | Investigate the pH of a variety of materials using the pH scale |  |
| 14 | Show that approximately one fifth of the air is oxygen;Show that there is CO2 and water vapour in air.  |  |
| 16 | Prepare a sample of oxygen by decomposing H2O2 using MnO2  as a catalyst.  |  |

**Physics**

|  |  |  |
| --- | --- | --- |
|  | **First Year** |  |
| 17 | Measure the mass and volume of a variety of solids and liquids |  |
| 19 | Show that light travels in straight lines.  |  |
| 20 | Investigate the reflection of light by plane mirrors, and illustrate this using ray diagrams; demonstrate and explain the operation of a simple periscope.  |  |
| 22 | Plot the magnetic field of a bar magnet.  |  |
| 23 | Identify different forms of energy and carry out simple experiments to show the following energy conversions: (a) chemical to electrical to heat energy (b) electrical to magnetic to kinetic energy (c) light to electric to kinetic energy.  |  |

**OP 3: Qualitative food tests for starch, reducing sugar, protein and fat.**

**Date:**

**Lab partners:**

**To test for fat**

**Procedure**

* We got a product which we knew contained fat.

**Diagram**

* We rubbed the food onto a piece of brown paper.
* If the paper turns translucent (some light can pass through it), then that indicates that fat is present.

**Result**: See the table at the end.

**Questions**

1. What food(s) did you test?
2. How could you show that all food types don’t make brown paper translucent – even if they don’t have fat?

**To test for starch**

**Procedure**

* We placed the food which we were testing in a dish.

**Diagram**

* We added a couple of drops of iodine (which is yellowish in colour).
* If the food turns deep blue, then that indicates that starch is present.

**Result**: See the table at the end

**Questions**

1. What food(s) did you test?
2. How could you show that iodine doesn’t turn all foods deep blue – even if they don’t have starch?

**To test for reducing sugar**

**Procedure**

**Diagram**

* We poured some glucose solution (which is a reducing sugar) into a test tube.
* We added a couple of drops of Benedict’s solution (which is blue in colour) to the test tube.
* We heated the test tube in a water bath for a couple of minutes.
* If reducing sugar is present. then the solution will turn deep red, otherwise nothing will happen.

**Result**: See the table at the end

**Questions**

1. If the food which you want to test is a solid (like a cream cracker) how will you change it into liquid form before testing?
2. Use of a control: How could you show that Benedict’s solution doesn’t turn all foods deep red – even if they don’t have sugar?

**To test for protein**

**Procedure**

* We placed the food which we were testing in a test tube containing sodium hydroxide and we gently shook it.

**Diagram**

* We next added 3 drops of copper sulphate.
* If the solution changes colour from blue to purple, then that indicates that protein is present.

**Results**: See the table at the end

**Questions**

1. What food(s) did you test?
2. How could you show that a food type that doesn’t have protein *won’t* turn purple when sodium hydroxide and copper sulphate are added?

**Results**

***Place a tick for a positive result and an X for a negative result.***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Food to be tested | **Fat** | **Starch** | **Reducing sugar** | **Protein** |
| Milk |  |  |  |  |
| Sugar |  |  |  |  |
| Cornflakes |  |  |  |  |
| Glucose solution |  |  |  |  |
| Butter |  |  |  |  |
| Bread |  |  |  |  |
| Lucozade |  |  |  |  |
|  |  |  |  |  |

**OB 5: To investigate the conversion of chemical energy in food to heat energy**

**Date:**

**Lab partners:**

**Diagram**

**Procedure**

* We put a little water into a test tube.
* We placed a thermometer into this test tube and noted the temperature of the water.
* We held a burning cream cracker/peanut under the test tube of water and recorded the rise in temperature.

**Result**:

Food used:

Initial temperature of water:

Final temperature of water:

**Conclusion**

The food contained (chemical) energy and this was converted to heat energy when we burned it which raised the temperature of the water.

**Questions**

1. Where did the food get its energy?
2. Where did the energy come from before that?
3. Does the water keep the energy – if not where does it go?

Can you think of any other questions to ask about this experiment?

**OB8: Investigate the action of amylase on starch; identify the substrate, product and enzyme.**

**Date:**

**Lab Partners:**

* A ***catalyst*** is something which speeds up a chemical reaction.
* An ***enzyme*** is a biological enzyme (it is made in the human body).
* ***Amylase*** is an enzyme.



**Procedure**:

* We made up a solution of starch and a solution of amylase.
* We poured some of the amylase solution into the test tube containing starch.
* We heated this in a water bath at roughly 37 0C for about 10 minutes.
* The starch should now be converted to a simple sugar product called maltose so we need to test for this.

**Tests**

1. We needed to confirm that the solution we had at the beginning was indeed starch.

Test for starch: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Result: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. We need to confirm that the solution we had at the end was indeed a reducing sugar.

Test for reducing sugar:

Add some Benedict’s solution and place in boiling water for a few minutes.

Result: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Questions**:

1. What is meant by the phrase “we made up a solution of starch”?
2. Instead of using amylase powder you could have used your own saliva (spit) instead – why?
3. Why was the water bath heated to 37 0C – what is so special about this number?
4. What do you think might be the function of the fourth test tube in the diagram above?

**OB 39: Investigate the variety of living things by direct observation of animals and plants in their environment;**

**Classify living organisms as plants or animals, and animals as vertebrates or invertebrates.**

**Date:**

**Lab Partners:**

**Procedure:**

* We went out into the field outside our classroom and looked at as many different things as we could find.
* We used a chart which contained keys to help us identify the different life-forms.
* We used this to fill in our table of results below.

**Diagram**

**Results**:

|  |  |
| --- | --- |
| **Plants** | **Animals** |
|  | **Vertebrates** | **Invertebrates** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Can you think of any other questions to ask about this experiment?

**OB 44: Prepare a slide from plant tissue and sketch the cells under magnification.**

**Date:**

**Lab Partners:**

**To prepare plant cells for viewing under a microscope**

1. We placed a drop of iodine onto a clean glass slide (iodine is used to stain (‘dye’) a cell and make it easier to see).
2. We cut an onion and removed a thin layer of inner cells.
3. We placed it on the slide and placed a cover slip on top.

**To examine a plant cell**

1. We put a piece of tissue on the slide and covered it with a glass slip.
2. We placed the glass slide on the stage and secured it with clips.
3. We watched from the side and turned the coarse focus wheel so that the objective lens was as close to the stage as possible.
4. We put our eye to the eyepiece and gently turned the fine focus wheel the opposite way to sharpen the image.

**Result**

Draw a diagram of what you saw in the microscope – label the various parts if you can.

**Diagram**

**Questions**

1. Why is an onion tissue ideal for this investigation?

**Microscope**

1. Label parts A, B and C in the diagram – give the function of each part.

A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

B \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

C \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. In the instructions above you were told to “*Watch from the side and turn the coarse focus wheel so that the objective lens is as close to the stage as possible*”. Why do you need to watch from the side?

Can you think of any other questions to ask about this experiment?

**OC2A: Separate mixtures using filtration**

**Date**:

**Lab Partners:**

If two substances are just mingled together then it is usually straightforward to separate them.

**An *insoluble* solid** is a solid which doesn’t dissolve in a liquid, e.g. a soil in water

**Filtration is a way of separating an insoluble solid from a liquid**

**Equipment** (What did you use?):

**Diagram**

**Procedure** (what did you do?):

**Result**

The water flows slowly through, leaving just the soil behind.

**Questions**

* What could you do to make this experiment work better?

Can you think of any other questions to ask about this experiment?

**OC2B: Separate mixtures using evaporation**

**A *soluble* solid** is a solid which dissolves in a liquid, e.g. sugar in water

**Evaporation is used to separate a soluble solid and a liquid**

The problem is that you lose the liquid.

**Diagram**

**Procedure**:

We heated the mixture (e .g. water and salt) using a hot plate.

**Result**:

The water evaported, leaving just the salt behind.

**Questions**:

What is the disadvantage of this technique?

**OC2C: Separate mixtures using distillation to purify salt-water**

**Distillation can be used to separate a soluble solid and a liquid (and you get to keep both)**

****

**Equipment – label each of the following:**

A:

B:

C:

D:

E:

F:

**Procedure**

* We poured some salt-water into the round-bottom flask.
* We connected point D up to a water tap, and connected a second pipe to go from point B to the sink.

**Result**

Pure water dripped into the beaker at the other end

**Questions**

1. What happens in the condenser?
2. What appears in the beaker at the other end?
3. Why don’t you just use a normal tube to connect the round-bottom flask to the beaker?

**OC2D: Chromatography**

**Procedure**

**Diagram**

* We put a number of ink spots on a piece of chromatography paper and allowed the paper to dip into a gas jar as shown.
* The ink dots lay just above the water line.

**Result**

Water rises up through the chromatography paper and takes the various colours which were in the ink spot to different heights.

**Question**

1. What would happen if the ink dots were below the water line?
2. What would happen if you used ordinary paper?
3. Why does this technique work?
4. What does this tell us about what the ink spot is make from?
5. This technique doesn’t seem to work for all types of ink – why not?

**Paste in your paper here:**

**OC 17: To grow crystals using copper sulphate**

**Date:**

**Lab Partners:**

**Procedure:**

**Diagram**

* We kept adding copper-sulphate powder to a small amount (about 50 ml) of hot water until no more would dissolve – we then had a saturated solution.
* We filtered the mixture (see the filtration experiment) and poured the liquid into an evaporating dish.
* We put the evaporating dish on a shelf where it was allowed to cool slowly.

**Result:**

Crystals begin to grow

**Questions**:

1. Why did you filter the solution?
2. Most students place the evaporation dish beside the window – can you think of anywhere else to put the dish which might result in bigger crystals?

Why?

1. Why do you think the crystals were supposed to cool slowly?

**Tape one of your crystals onto the paper here:**

Can you think of any other questions to ask about this experiment?

**OC 19: Investigate the pH of a variety of materials using the pH scale**

**Date:**

**Diagram**

**Lab Partners:**

**Apparatus**:

* Universal Indicator
* Rack of test tubes, everyday acids and bases.
* Acids: citric acid (e.g. lemon juice, orange juice) apples, sour milk, vinegar, fizzy drinks and tea.
* Bases: tooth paste, lime water, bread soda, toothpaste, window cleaner and caustic soda.

**Procedure**:

* If the substances were not in liquid form then we had to dissolve them in water first.
* We put different substances into the different test tubes.
* We poured a few drops of universal indicator into each substance and shook the test tube well.
* The colour changed according to how acidic or basic the substance was.
* We compared the colour obtained to a pH chart which told us what pH each colour represented.
* We filled in our answers to the table of results below.

**Results**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Material | Apple juice | Sour milk | Coke | Vinegar | Bread soda | Tooth paste | Tea | Window cleaner |
| Colour (after adding indicator) |  |  |  |  |  |  |  |  |
| pH |  |  |  |  |  |  |  |  |
| Acid/Base |  |  |  |  |  |  |  |  |

**Questions**:

1. What else could you have used to measure the pH of the materials?
2. Try to use at least one other method on one of the materials to see if you get the same answer.

What material did you try and what other method did you use?

1. What result did you get?

**OC22: Show that approximately one fifth of the air is oxygen**

**Show that there is CO2 and water vapour in air.**

**Date:**

**Lab Partners:**

**To show that approximately one fifth of the air is oxygen**

**Method One**

**Diagram**

* We gently placed a burning night-light candle floating on a basin of water.
* We then carefully lowered a large graduated cylinder (or gas jar) into the water over the candle.

**Result (what happened?):**

**Questions**

1. What did you notice happening to the candle?
2. What made the water rise up inside the gas jar?

**Method Two**

* We used the apparatus shown below and used a bunsen burner as the heat source.
* We noted the total volume of air in both syringes.
* We gently pushed the air over and back in the syringes until all the copper powder has become oxidised.
* We noted the new total volume of air.

****

**Sample set of results**

Volume of air before heating = 100 cm3

Volume of air after heating the copper = 79 cm3

Volume of oxygen present in 100 cm3 = 21 cm3

Percentage of air = ($\frac{21}{100}×\frac{100}{1}$) = 21 %

**Note**

This method works because oxygen atoms in the air bond with the copper when heated (the technical term is that the copper gets ‘oxidised’).

As a result the oxygen atoms change state and become a solid and as a result take up only a tiny amount of space compared with when they were in gas form.

**To show that there is carbon dioxide in air**

*Remember the test for carbon dioxide – carbon dioxide turns limewater milky!!*

**Diagram**

**Procedure**:

We used a ball pump (a bicycle pump would do also) to pump air through a beaker of limewater.

**Result**:

**Conclusion:**

**Questions**

Why is it a good idea to only use a small amount of limewater?

**To show that there is water vapour in air**

*Remember the test for water – water turns blue cobalt chloride paper pink!!*

Diagram

**Procedure**:

* We filled a test-tube with ice and water and left it for a few minutes – a liquid began to form drops on the outside of the test-tube.
* We tested the liquid using blue cobalt-chloride paper.

**Result**:

**Conclusion:**

**Questions**:

1. Sometimes when you get the blue cobalt chloride paper it is already a little bit pink to begin with – why might this be?
2. How could you make the paper go back to being blue?

**OC 24: Prepare a sample of oxygen by decomposing H2O2 using MnO2 as a catalyst**

**Date:**

**Lab Partners:**

**Preparation of oxygen**

Hydrogen peroxide → oxygen + water

H2O2 → O2 + H2O

Manganese dioxide (MnO2) is added in as a catalyst (to speed up the reaction)

****

**Procedure**

1. We set up the equipment as shown.
2. **X** in the diagram is hydrogen peroxide and **Y** is manganese dioxide.
3. We slowly released the hydrogen peroxide into the flask underneath using a syringe.

**Result**

The water which was in the gas jar gets displaced by the gas coming from the conical flask.

**Test for oxygen**

We dipped a glowing splint into the jar of gas

**Result**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Conclusion**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Questions**:

1. It is advised when doing this experiment not to have the tube under the gas jar from the beginning. Instead the first bit of gas coming out should just go into the air because it’s probably not oxygen. Why is this?

Can you think of any other questions to ask about this experiment?

**OP2: Measure the mass and volume of a variety of solids and liquids**

1. To measure the mass and volume of a regularly-shaped block
2. To measure the mass and volume of an irregularly-shaped small stone
3. To measure the mass and volume of an irregularly-shaped large stone
4. To measure the mass and volume of a liquid

**To measure the mass and volume** **of *a regularly-shaped block***

*To find the mass*:

We weighed it on an electronic balance.

*To find the volume*:

To find the volume we multiplied length × width × height

For example in the picture on the right the volume of the stone would 5 × 2 × 1 = 10 cm3.

****

**Result:**

Put your numbers on the diagram of the block on the right.

Mass = \_\_\_\_\_\_\_\_\_\_ grams

Volume **= \_\_**\_\_\_ cm × \_\_\_\_\_ cm × \_\_\_\_\_ cm = \_\_\_\_\_\_\_ cm3

****

**To measure the mass and volume of an *irregularly-shaped small stone***

*To find the mass*:

We weighed it on an electronic balance.

*To find the volume*:

* We poured some water into a graduated cylinder and noted the volume.
* We dropped a stone into the graduated cylinder and noted the new volume.
* To get the volume of the stone we simply subtracted the two readings.

For example in the picture on the right the volume of the stone would be 90 cm3 – 75 cm3 = 15 cm3.

**Result:**

Mass = \_\_\_\_\_\_\_\_\_\_ grams

Initial volume of water (before dropping in the stone): \_\_\_\_\_\_\_\_\_\_ cm3

Final volume of water (after dropping in the stone): \_\_\_\_\_\_\_\_\_\_ cm3

Volume **= \_\_**\_\_\_ cm3 - \_\_\_\_\_ cm3 = \_\_\_\_\_\_\_ cm3

**To measure the mass and volume of an *irregularly-shaped large stone***

*To find the mass*:

We weighed it on an electronic balance.

*To find the volume:*

We filled an overflow can up to the top and placed an empty graduated cylinder under the spout.

We carefully dropped the stone in (using a string so there is no splash).

We noted the level of water in the overflow can.

For example in the picture on the right the volume of the stone would be 125 cm3.

**Result**:

Mass = \_\_\_\_\_\_\_\_\_\_ grams

Volume **=** \_\_\_\_\_\_\_\_\_ cm3

****

**To measure the mass and volume of *a liquid***

*To find the mass:*

We weighed an empty graduated cylinder, and then weighed the graduated cylinder after pouring water into it.

Then we subtracted the two readings.

*To find the volume:*

We simply noted the level of water in the graduated cylinder.

**Result**:

Mass of empty graduated cylinder = \_\_\_\_\_\_\_\_\_\_\_ grams

Mass of graduated cylinder plus water = \_\_\_\_\_\_\_\_\_\_ grams

Mass of water = \_\_\_\_\_\_\_\_\_\_ grams

Volume **=** \_\_\_\_\_\_\_\_\_ cm3

**OP 34: To show that light travels in straight lines.**

**Date:**

**Lab Partners:**

Diagram

**Procedure**

* We got 3 cards, each of which had a hole in the centre.
* We put a piece of string through all of the holes and pulled it tight so that all the holes were now in a straight line.
* We placed a candle at one end of the cards and looked through the holes from the other end.

**Result**

We could only see the candle when the holes were lined up; if we moved any of the cards just a little bit we could no longer see the candle.

**Questions**

1. What does this tell us about us the way that light travels?
2. Why do you need three cards – why not just use one? Or two?
3. The textbooks often suggest that you need to use a candle or a light-bulb that is shining for this experiment. Why do you need an object that is giving out its own light (or would the experiment still work if you used a candle that wasn’t lighting?)

Can you think of any other questions to ask about this experiment?

**OP 38: Investigate the reflection of light by plane mirrors, and illustrate this using ray diagrams;**

**Demonstrate and explain the operation of a simple periscope.**

**Date**:

**Lab Partners:**

**To investigate the reflection of light by a plane mirror**

**Procedure**

**Diagram**

* We used a ray box to shine a ray of light off a mirror.
* We noticed that it reflects back out at the same angle as it goes in.

**Questions:**

Often in Physics important discoveries are made by a scientist who looks very closely at an experiment and notices something unusual. Are you a physicist? Find out by trying the following questions:

1. The mirror is actually made up of two different materials – glass in front and metal at the back.

Can you figure out if the ray of light reflects off the front or the back of the mirror?

1. If it reflects off the metal then why do you need glass in front?

**Diagram**

1. If you look closely you might notice that the light doesn’t even seem to go straight through the glass – can you draw an accurate diagram of what actually happens to the light in the box provided?
2. The explanation for this involves something called ‘refraction’ – what is refraction?

**Demonstrate and explain the operation of a simple periscope.**

**Procedure:**

**Diagram**

* We got two mirrors and put each of them in a retort stand.
* We angled the mirrors in such a way that when we looked into the bottom mirror we could see the images of objects from the top mirrors. This meant that we could use it to see over our bench while sitting underneath it.

**How the periscope works**

Some of the light coming from the object hits the first mirror, then gets reflected from this onto the second mirror where it gets reflected again and travels out to the eye of the observer.

**Questions**

1. Can you think of any situation where periscopes are useful?
2. In an earlier experiment we showed that light travelled in straight lines, but here it changes direction a number of times – which experiment is correct?

**OP46: To Plot the magnetic field of a bar magnet**

**Date:**

**Lab Partners:**

**Materials used:**

Magnet, sheet of paper, compasses

**Procedure**:

* ****We placed the plotting compass beside the magnet and marked the position of the north end with a dot.
* We moved the back of the plotting compass so that it was over this dot and marked the position of the north end again.
* We kept repeating until we had a series of dots.
* We repeated this two or three times on both sides of the magnet.
* We joined the dots to get a curved line.

**Result**:

A pattern is formed on the paper representing the magnetic field of the magnet.

**Place magnet here**

**Be careful!**

Don’t begin with the plotting compasses too near the poles – if you do then the magnetic field line will go off almost in a straight line (and go off the page).

**Questions**

1. The lines seem to be closest together near the poles – what do you think this tells us?
2. Given only a bar-magnet and another similar-looking non magnetic metal, how could you tell which one was magnetic?
3. Did you remember to take a photo on your phone of the pattern?

**OP 20: Identify different forms of energy and carry out simple experiments to show the following energy conversions:**

1. **chemical to electrical to heat energy**
2. **electrical to magnetic to kinetic energy**
3. **light to electric to kinetic energy**

**Date:**

**Lab Partners:**

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

1. **Chemical energy to electrical energy to heat energy**

**Procedure**

* We set up an electric circuit consisting of a battery connected to a light-bulb.
* We switched on the circuit and noted the temperature rising using a thermometer.

**Results**

**Diagram**

Initial temperature:

Final temperature:

**Questions**

1. Draw a diagram of the equipment that you used and show how it was all connected together.
2. Indicate on the diagram where the various energy conversions take place.
3. After turning off the switch the light-bulb cooled down – where did its energy go?
4. Why doesn’t the light-bulb keep getting hotter and hotter and hotter?

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

1. **Electrical energy to magnetic energy to kinetic energy**

**Procedure**

* We made an electromagnet by winding a coil of copper wire around a couple of nails, then connected this to a battery.
* We used the electromagnet to pick up some nails.

**Questions**

1. Draw a diagram of the equipment that you used and show how it was all connected together.
2. Indicate on the diagram where the various energy conversions take place.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

1. **Light energy to electrical energy to kinetic energy**

**Procedure**

* We shone a light on a solar panel.
* The solar panel was connected to an electric motor which turned when the light was on.

**Questions**

1. Draw a diagram of the equipment that you used and show how it was all connected together.
2. Indicate on the diagram where the various energy conversions take place.
3. When the light was turned off the motor stopped – where did the energy that *it* had go?

Can you think of any other questions to ask about this experiment?