



# Coimisiún na Scrúduithe Stáit State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2006

SCIENCE – HIGHER LEVEL  
(N.B. Not for Science – Local Studies Candidates)

THURSDAY, 15 JUNE - MORNING, 9.30 to 12.00

**Section A** is on a separate sheet, which provides spaces for your answers.  
The completed sheet should be enclosed in your answer-book.

## SECTIONS B, C, D, E

These sections should be answered in your answer-book.

Answer **ONE** question from each of the Sections **B, C and D**.

All questions carry equal marks.

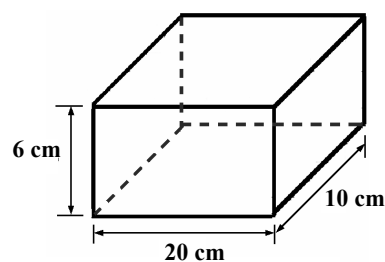
Answer **TWO** questions from **Section E**. All questions carry equal marks.

## SECTION B - PHYSICS (48 marks)

Answer **either** question 4 **or** question 5.

4. (a) The rectangular block shown in the diagram has mass 2.5 kg.

Calculate the *pressure* that the block exerts on the ground supporting it in the orientation shown. Give units with your answer. (12)

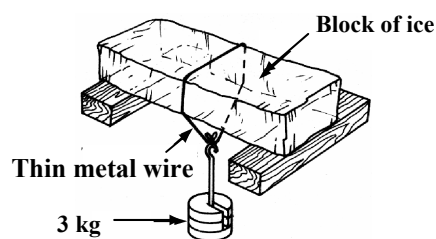


Which of the sides would you stand the block on so as to exert the *greatest pressure* on the ground? (3)

The experiment shown in the diagram was set up and observed for some time.

The thin metal wire moved slowly through the block of ice leaving the block intact i.e. *not cut* into two pieces.

Why does this happen?



(9)

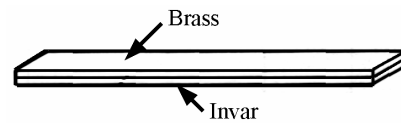
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- (b) Describe a simple experiment to show that *water expands at low temperatures* (below 4 °C). (9)

A *bimetallic strip* consists of two different metals joined to form a single piece as in the diagram. Invar is a type of steel.

When heated the brass expands more than the invar causing the strip to bend.

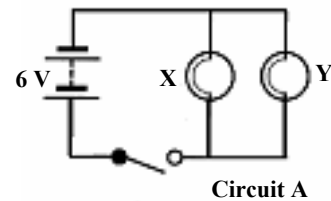
The strip straightens again when it cools.



Draw a diagram showing a bimetallic strip in a circuit for *either* a fire alarm *or* a thermostat. (9)

What are *tog values*? (6)

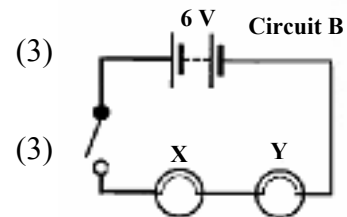
5. (a) Circuits **A** and **B** both contain one switch and two bulbs; however, the parts of the circuits are connected together differently. The bulbs in both circuits are identical, and the single switch controls both bulbs in each circuit.



- (i) Which circuit **A** or **B** has the bulbs connected in *series*? (3)

When the switches are closed,

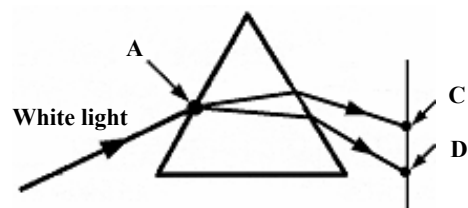
- (ii) which circuit has the *brighter* bulbs? (3)  
 (iii) what happens to bulb **Y**, in circuit **B**, if bulb **X** fails (blows)? Explain your answer. (6)



- (iv) Calculate the *resistance* of a filament of a bulb when 6 volts causes a current of 0.03 amperes to flow through it. (6)

- (v) Batteries supply d.c. while the electricity mains supply a.c. Clearly distinguish between d.c. and a.c. (6)

- (b) A pupil did an experiment using a triangular glass prism. The results of the experiment are summarised in the diagram.



- (i) In the experiment the ray of light changed direction at point **A**. What is this '*bending*' of light called? (3)

- (ii) In the experiment white light was passed through the prism and it separated into a band of coloured lights. What is this *separation* called? What does this experiment tell us about the *nature* of white light? **C** and **D** are the colours at the ends of the visible spectrum. Name the *colours* at points **C** and **D**. (12)

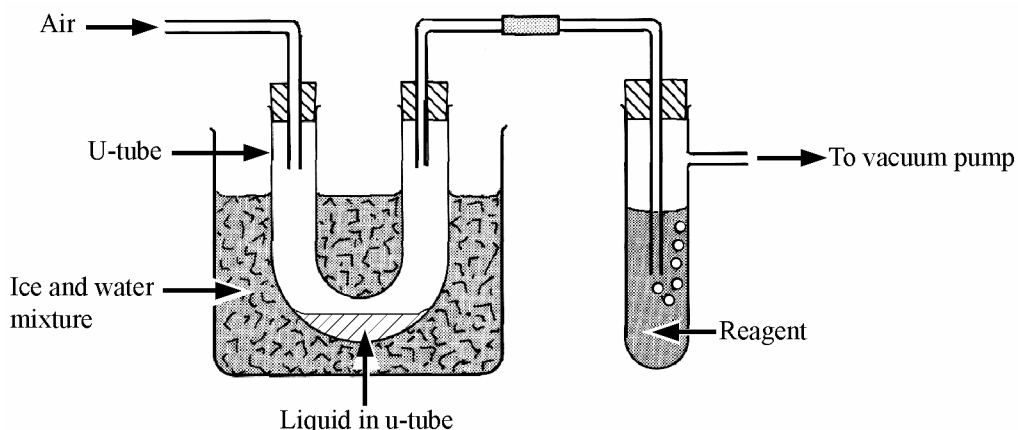
- (c) Describe, using a labelled diagram, an experiment to show that sound cannot travel through a vacuum. (9)

**SECTION C - CHEMISTRY (48 marks)**

Answer **either** question 6 **or** question 7.

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6. (a) A pupil set up the apparatus shown in the diagram to show the presence of two substances in air.

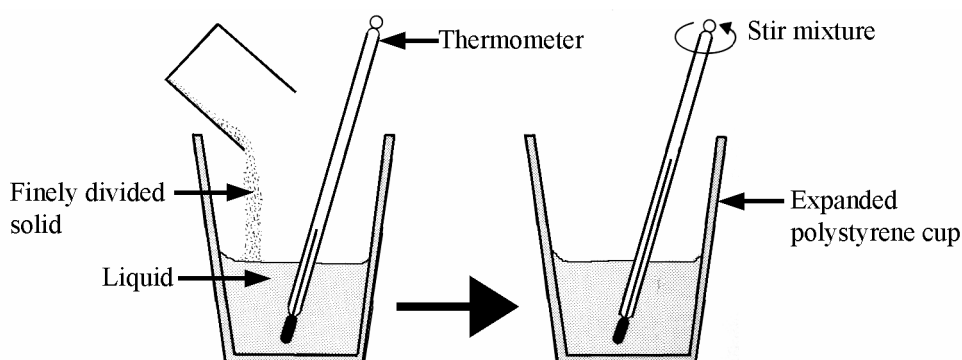


Air was drawn through the apparatus by a vacuum pump. A colourless liquid condensed in the u-tube. The reagent through which the air bubbled turned from colourless and clear to a cloudy white.

- (i) Name the *liquid* in the u-tube and give a test to confirm your answer. (12)
- (ii) Name the *reagent* through which the air was bubbled. What *constituent* of air caused the reagent to change appearance? (6)
- (iii) Oxygen makes up about 21% by volume of air. Magnesium burns in oxygen with a brilliant white flame. Name the *compound* produced by this reaction and give the *result* of testing this compound with moist litmus or pH indicator. (6)
- (b) *Water* for domestic use undergoes the following *treatments*: settling, filtration, chlorination and fluoridation.
- Select **any two** treatments from the list; *describe the treatments* and say *why* the treatments are carried out. (12)
- Describe how to *test* a water sample for hardness. (6)
- Name a substance that causes permanent hardness in water. (6)

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7. (a) A pupil did a number of experiments to investigate *heat changes in chemical reactions*. The equipment used was simple; see the diagram.



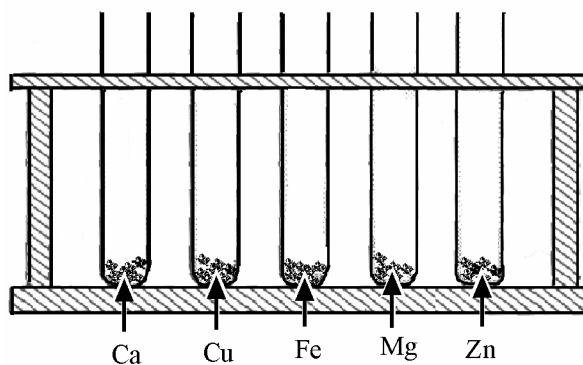
In the experiment illustrated heat was *released*. Note the *rise* in temperature shown by the thermometer.

- (i) What word describes chemical reactions that *release* heat energy? (3)
  - (ii) Give an example of a chemical reaction that *releases* heat energy. (6)
  - (iii) Give an example of a chemical reaction that *absorbs* heat energy. (6)
- (b) An experiment was set up to find out how *different metals react with acids*. The metals used in the experiment can be identified by their atomic symbols shown in the diagram.

Name a *suitable acid* for this experiment. (3)

If bubbles are seen, what *gas* is being released? (3)

List the metals, with the *most reactive first*, in order of reactivity. (6)



- (c) A magnesium *atom* has an *atomic number* of 12 and a *mass number* of 24.

- (i) What is an *atom*? (3)
- (ii) Define *atomic number*. (3)
- (iii) Define *mass number*. (6)
- (iv) Draw a diagram, of a magnesium atom, showing the *electronic structure* and *nuclear composition*. (9)

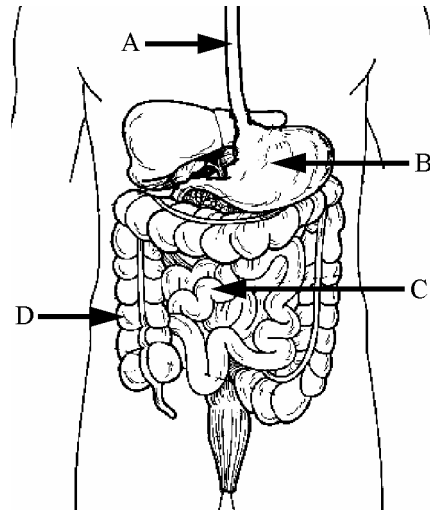
**SECTION D - BIOLOGY (48 marks)**

Answer **either** question 8 **or** question 9.

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8. (a) The diagram shows part of the human digestive system.

- (i) Name the parts labelled **A**, and **C**. (6)
- (ii) What *happens to food* in part **B**? (6)
- (iii) Where is the digested food *absorbed* into the blood stream? (3)
- (iv) What is meant by '*assimilation*' when applied to nutrition? (6)
- (v) Give a *function* of part **D**. (3)

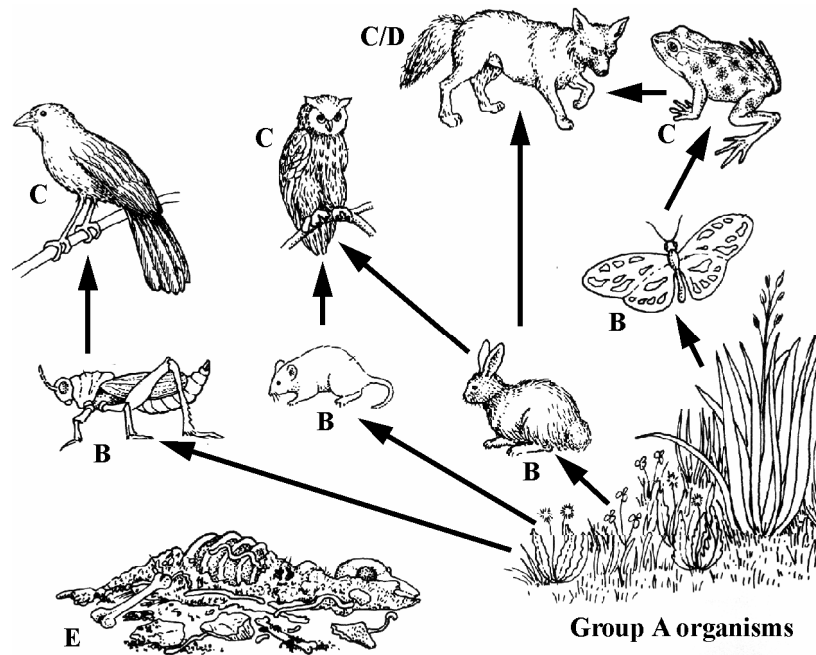


(b) A pupil performed an experiment, in a school laboratory, to show the action of a *digestive enzyme* on a *food substance*.

- (i) Name an *enzyme* suitable for such an experiment. (3)
- (ii) Name a *food substance* on which the enzyme that you have named will act. (3)
- (iii) Describe any *preparation* of the food required before the experiment is performed. If none is required say why. (3)
- (iv) Give the *temperature* at which the enzyme-food mix should be maintained for the experiment to work. (3)
- (v) How much *time* is needed for digestion of the food in this experiment? (3)
- (vi) Describe a *test* to confirm that digestion has occurred. (6)
- (vii) Name the *end product* of the process. (3)

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9. (a) The diagram shows part of a *food web* of an *ecosystem* from a mixed grassland and hedgerow habitat. Study the diagram carefully.



The arrows represent feeding e.g. group **B** eat group **A**. Group **E** recycles essential materials from animal and plant wastes and from the remains of dead plants and animals. Arrows should link all animals and plants with group **E**, but these arrows are omitted from the diagram for clarity.

- (i) Group **A** are producers. How do organisms in group **A** get their *food*? (3)
  - (ii) What *name* is given to group **B** organisms based on their *feeding*? (3)
  - (iii) What are group **E** organisms *called*? Name **two** *types of organism* that belong to this group. (9)
  - (iv) Would you expect the numbers of organisms to increase or to decrease from group **A** to group **C** or **D**. Give a reason for your answer. (9)
- (b) Distinguish between *pollination* and *fertilisation*. (12)

Why is *seed dispersal* important for plants?  
Name **one** way in which seeds are *dispersed*. (6)

Give **two** conditions necessary for the *germination* of seeds. (6)

**SECTION E - APPLIED SCIENCE (72 marks)**

Answer TWO questions from this section.

**10. EARTH SCIENCE.** Answer any **two** of the following, (a), (b), (c).

- (a) The solar system is part of the milky way galaxy. If we could look at the milky way from a very great distance it would resemble the spiral galaxy in the photograph. The milky way is part of a still larger system known as the universe.

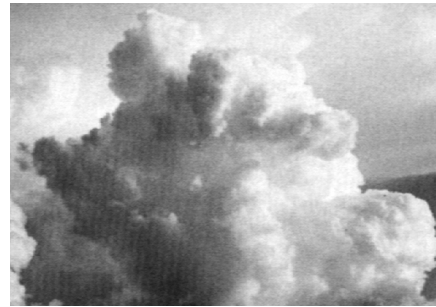


Explain clearly the underlined terms.

(18)

- (b) Name the *type of cloud* in the photograph.

(3)



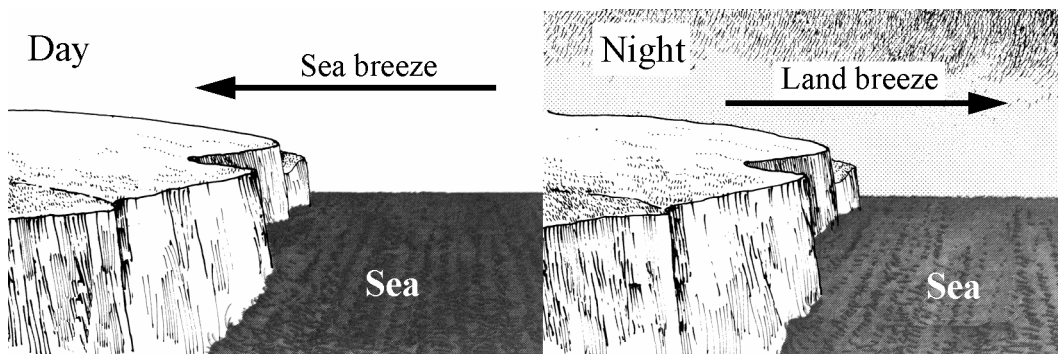
How are clouds *formed*?

(9)

Why can clouds disappear on hot days?

(6)

- (c) The diagram shows land and sea breezes.



Describe how **both** land and sea breezes arise.

(18)

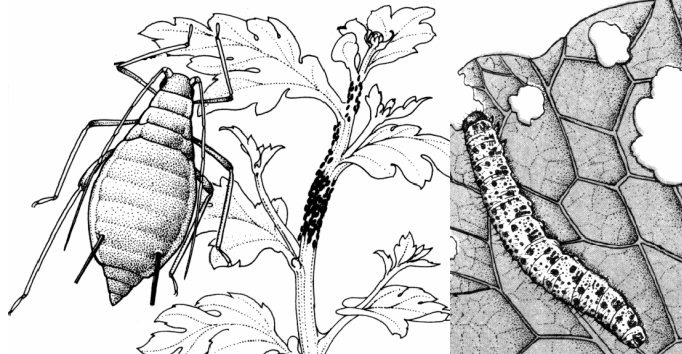
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**11. HORTICULTURE.** Answer any **two** of the following, (a), (b), (c).

- (a) The diagram shows an aphid, an aphid infected plant and the caterpillar of the cabbage white butterfly feeding on a cabbage leaf.

Outline the *life cycle* of an aphid *or* the *life cycle* of the cabbage white butterfly. (12)

Give a *biological* control of one pest and a *chemical* control of a second pest. (6)



- (b) Name **three** types of grass commonly grown in lawns for amenity use. (9)

Describe how you would investigate the ability of a grass that you have named to tolerate *cutting* and being *walked* on by people. (9)

- (c) (i) Describe how to measure the moisture (water) content of soil. (15)

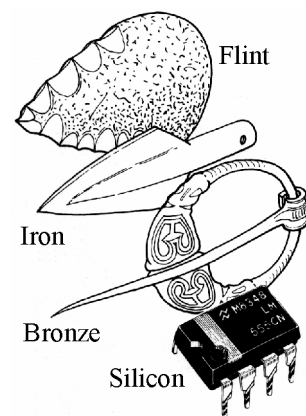
(ii) Give **one** precaution that you would take to help ensure success when propagating a plant by taking cuttings. (3)



**12. MATERIALS SCIENCE.** Answer **both** parts, (a) and (b).

- (a) People have been using materials for tens of thousands of years in creative and useful ways.

Name **two simple items** that you use regularly e.g. 'cling film'. For **each** item named give the *principal material* used in its manufacture and state *why* this material is used. (18)



- (b) Answer **one** of the following.

(i) PLASTICS

All plastics are polymers. Explain this statement. (6)

Describe an experiment to compare the *thermal insulating* properties of two plastics. (12)

(ii) METALS

What is an *ore*? (6)

Describe an experiment to extract a metal from its ore. (12)

(iii) TEXTILES

Name a textile *fibre* and say how it can be formed into a *yarn*. (6)

Describe an experiment to compare the *absorbency* of two textiles. (12)

(iv) TIMBER

Name a tree that produces *hardwood* and name a tree that produces *softwood* in Ireland. (6)

Describe an experiment to show **one effect of moisture** on wood. (12)

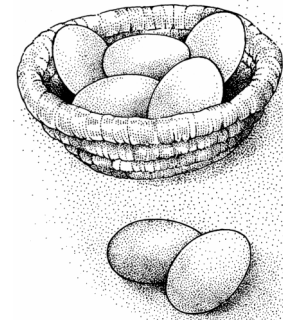
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13. **FOOD.** Answer any **two** of the following, (a), (b), (c).

(a) Eggs are about 12.5% *protein*, 10.8% fat, zero% carbohydrate fibre and sodium. They are rich in certain *vitamins*.

(i) Select **any two** vitamins and give a good *source*, excluding eggs, for each vitamin selected. (6)

(ii) Give the *function* of protein in our bodies. Describe how to *test* a sample of food for the *presence of protein*. (12)



(b) *Biotechnology* produces many products including: foods like cheese, alcoholic drinks, antibiotics, bread, enzymes, vaccines, insulin...

(i) Explain the term *biotechnology*. (6)

(ii) Name the *micro-organism* used in the production of alcoholic drinks by fermentation. (3)

(iii) Outline a laboratory experiment to show the production of *alcohol* by *fermentation*. (9)

(c) A French Chef, Nicolas Appert, in 1809, helped to supply Napoleon's armies with preserved food by sealing the food in containers, then heating the package and contents appropriately.

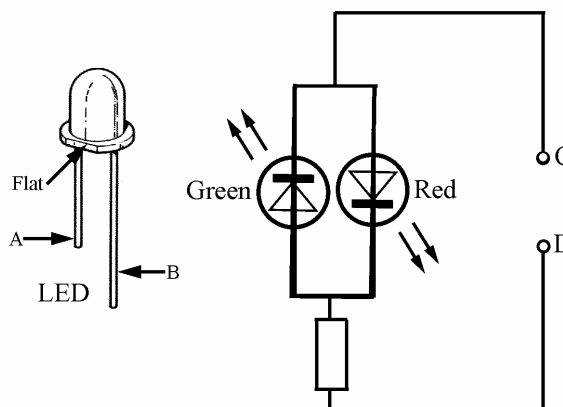
(i) Name a *method* of food preservation, used today, that is the same as or similar to Appert's and name a food preserved in this way. (6)

(ii) Some foods, e.g. milk, shelled eggs and some prepared sea food are *pasteurised* before use. Explain clearly why pasteurisation works. How is milk pasteurised? (12)



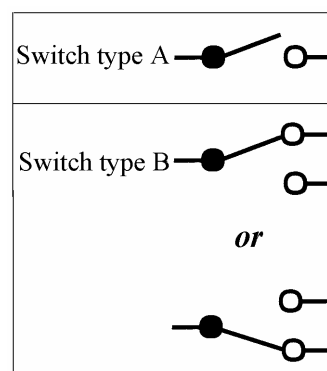
**14. ELECTRONICS.** Answer **both** parts, (a) and (b).

- (a) The diagram shows an LED and a circuit with a red LED and a green LED.  
An LED is a *diode* that gives out light when a current passes through it.



- (i) What is a *diode*? (3)
- (ii) Which 'leg' of the LED is the cathode (negative)? (3)
- (iii) Why is there a resistor in the circuit with the LEDs? (3)
- (iv) Why is there only *one* resistor for *two* LEDs? (3)
- (v) Match the battery connectors, **C** and **D**, with the plus and minus terminals of a battery and say which LED lights. Note there *two* ways of doing this. (6)

- (b) Two types of switches are shown in the diagram; switch type **A** and switch type **B**. Type **A** can only be *on* **or** *off*, it is shown in the *off* position in the diagram. Type **B** has two positions so it can be *on* for one part of a circuit and *off* for a second part of the same circuit and then reversed as shown in the diagram.



Draw a *circuit diagram* using two type **B** switches, a battery, a resistor and an LED. It must be possible to turn on /off the LED at *either* switch independently of the second switch just like the 'landing light'. (18)

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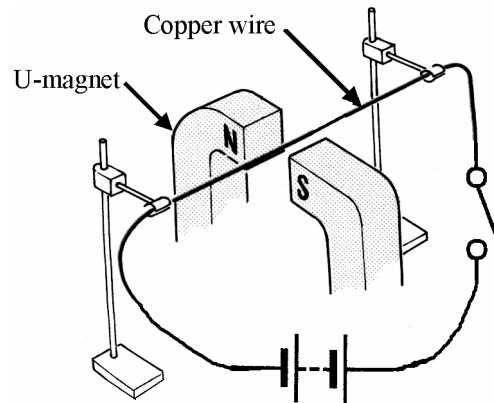
**15. ENERGY CONVERSIONS.** Answer **both** parts, (a) and (b).

- (a) What happens to the copper wire when the switch is closed? (3)

This experiment shows the principle of the electric motor.

Draw a labelled drawing of a simple d.c. motor. (9)

Give a *useful* energy change that occurs when a d.c. motor is connected to a battery and is running. (6)



- (b) The diagram shows a system, which *generates* electrical energy and *stores* energy in batteries for later use.

- (i) Name the *kind* of energy that the water in the reservoir has. (3)
- (ii) What *kind* of energy has the water running down the penstock? (3)
- (iii) Give the *useful* energy change that happens in the dynamo (generator). (6)

When electrical energy is produced at a power station it is often converted to other forms for storage.

- (iv) What *type* of energy is stored in batteries? (3)
- (v) Identify another environmentally friendly way of generating electrical energy. (3)

