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WARNING

You must return this paper with your answer-book, otherwise marks will be lost.



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

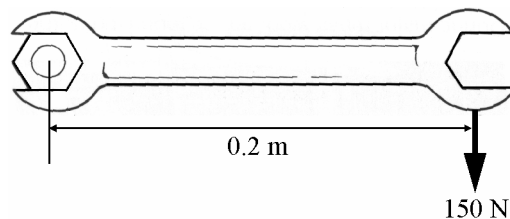
SECTION A (144 marks) TO BE ANSWERED BY ALL CANDIDATES.

(See separate sheet for Sections B, C, D and E.)

Answer *each* of the questions 1, 2 and 3. There are **TEN** parts in each question. Answer any **EIGHT** parts. All questions carry equal marks. Answer the questions in the spaces provided. Return this Section of the examination paper. Enclose it in the answer-book you use in answering the other Sections.

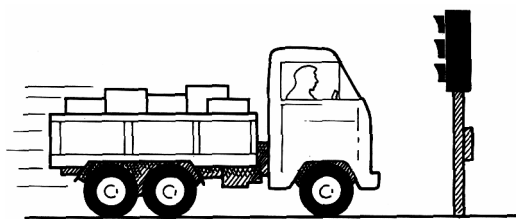
1. Answer **eight** of the following, (a), (b), (c), etc.

(a) Calculate the *moment of the force* acting shown in the diagram.



[Turn over

- (b) A truck was travelling at 15 m/s when the driver applied the brakes and it stopped in 10 s. Calculate its average *acceleration*.



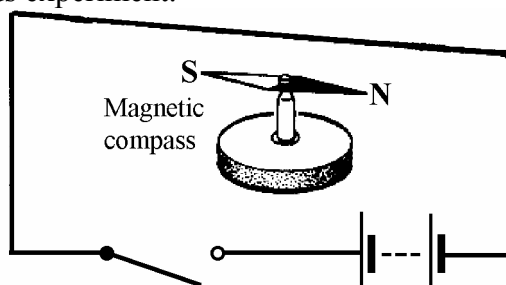
- (c) A body is in *stable equilibrium* if when it is slightly displaced and released it returns to its original position. How does the *centre of gravity* of such a body behave if it is in stable equilibrium?

- (d) A domestic electric grill is rated 1500 W. If a unit of electricity costs 12 cent how much does it *cost* to use the grill for 20 minutes a day for 30 days?

- (e) Hans Christian Oersted (1777-1851), a Danish physicist, used the apparatus shown in the diagram to perform a famous experiment.

What happens to the compass needle when the switch is closed?

What *conclusion* can be made as a result of this experiment?

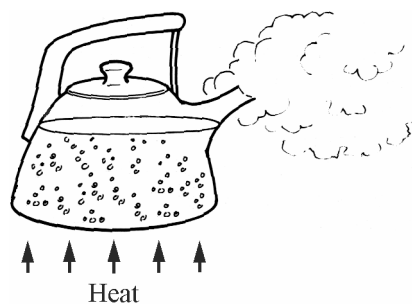


- (f) When wiring a house to use *mains* electricity to which; *earth*, *live* or *neutral* should *fuses* be connected?

Give a reason for your answer.

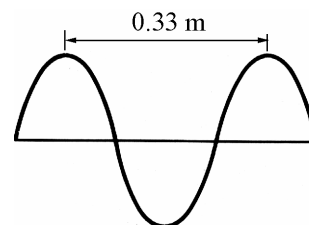
- (g) The kettle shown in the diagram was heated on a gas cooker. A pupil found that the temperature of the boiling water did not increase even though it was still being heated.

If there is no temperature change produced by this heat what *other effect* is the heat having on the water?



- (h) Why are alcohol-in-glass thermometers used to measure *lower* temperatures while mercury-in-glass is used to measure *higher* temperatures?

- (i) The wave shown in the diagram has a velocity of 330 m/s. What is the *frequency* of this wave?



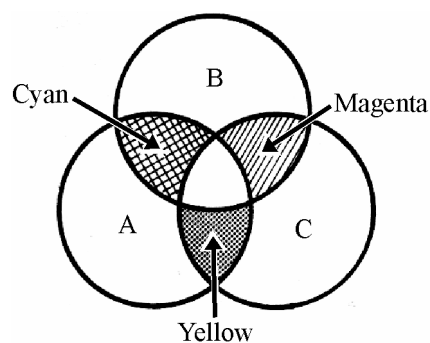
- (j) Understanding coloured light is important in many areas. Recently its application in digital imaging and electronic colour is significant.

Name *any two* of the colours **A**, **B**, or **C**.

A _____

B _____

C _____



(8 × 6)

[Turn over

2. Answer **eight** of the following, (a), (b), (c), etc.

- (a) Name the *separation method* shown in the diagram and name a *mixture* that can be separated in this way.

Separation _____

Mixture _____



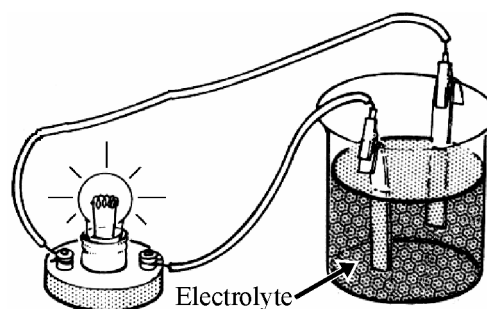
- (b) What is an *element*?

What is a *compound*?

- (c) The diagram shows a simple cell producing electric current from chemical reactions between two *different metals* and an *electrolyte*.

Name *two suitable* metals.

Names _____



What is an *electrolyte*?

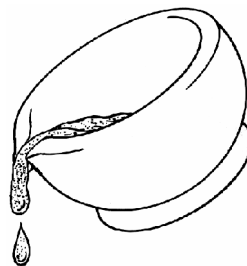
- (d) The pH scale is used to measure acidity and alkalinity. Describe how you would *measure* the pH of a solution.

- (e) Define *oxidation* and *reduction*.

Oxidation _____

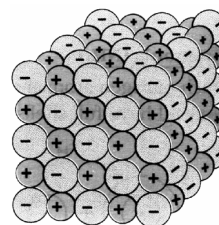
Reduction _____

- (f) A pupil crushed and ground rock salt in the item shown in the diagram, then added water and poured out the mixture. *Name this piece of equipment and its complimentary piece for crushing and grinding solid materials in a laboratory.*



- (g) What are *isotopes*?

- (h) The diagram shows the *crystal structure* of sodium chloride. What do the spheres with the + signs represent?



What *force* holds the particles in a crystal of sodium chloride together?

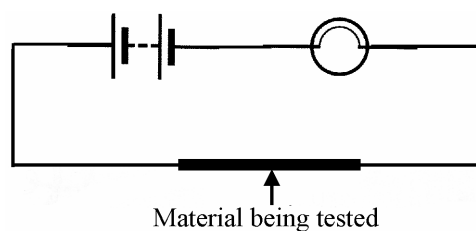
- (i) Define the term *neutralisation*.

- (j) The apparatus shown was used to test the *electrical conductivity* of metals and non-metals.

What result would you get with
(i) a metal (ii) a non-metal?

(i) a metal _____

(ii) a non-metal _____

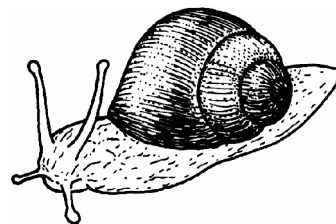


3. Answer **eight** of the following, (a), (b), (c), etc.

(a) Give **two** *characteristics* of living things.

One _____

Two _____

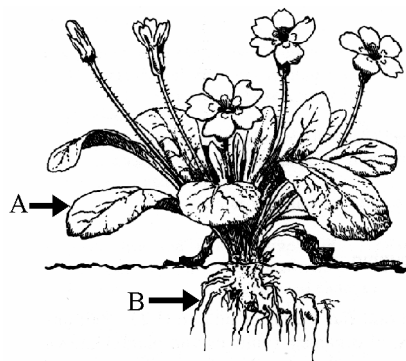


(b) Explain the term *tissue*.

(c) The diagram shows a primrose.
Give **one** *function* for part **A** and
one *function* for part **B**.

A _____

B _____



(d) Name a *hormone* and name the *gland* that secretes it.

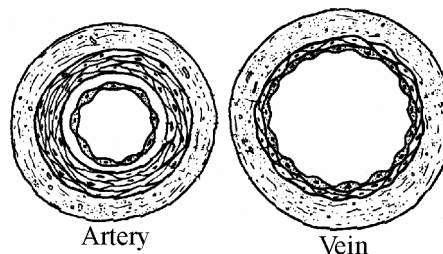
Hormone _____

Gland _____

(e) The diagram shows a *cross section* through an artery and a *cross section* through a vein.

Why has the *artery* got a *much thicker* wall than the vein? Give **one other** *difference* between arteries and veins.

Why? _____



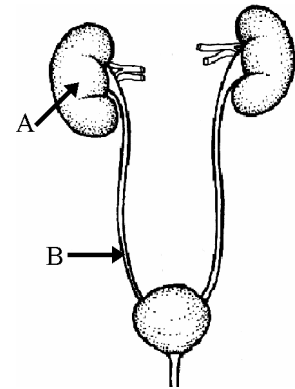
Give _____

- (f) The diagram shows the urinary system.
Give the *function* of part **A**.

Function _____

Give the *name* of part **B**.

Name _____

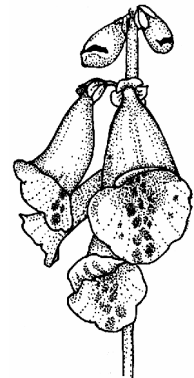


- (g) Complete the equation for photosynthesis.



- (h) The petals of the foxglove shown in the diagram are brightly coloured.
Suggest the way *pollination* happens in the foxglove.

Give **one** *other* feature of a flower pollinated in this way.



- (i) The diagram shows a single celled animal called an amoeba.
The part labelled **A** is the *nucleus*.
Give **two** roles played the *nucleus* in the life of cells.

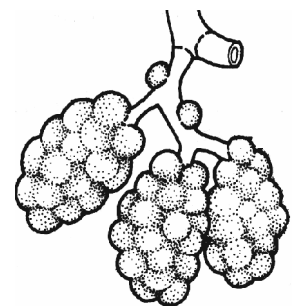
One _____

Two _____



- (j) The diagram shows *alveoli* (air sacs) found in the lung.
What are alveoli surrounded by?

What happens to the air in the alveoli?



(8 × 6)

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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.

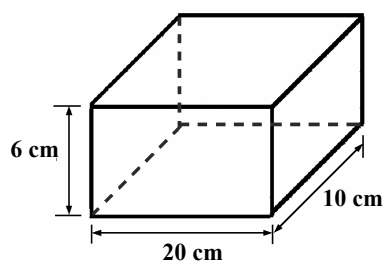
Answer **TWO** questions from **Section E**. All questions carry equal marks.

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)

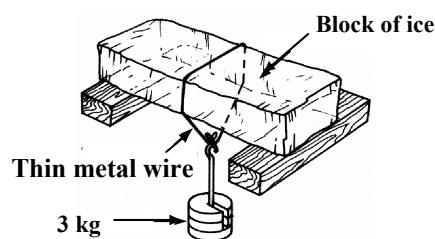


Which of the sides would you stand the block on so as to exert the *greatest pressure* on the ground? (3)

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?



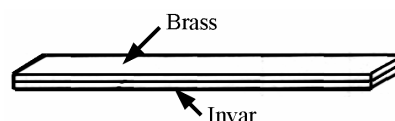
(9)

[Turn over]

- (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.

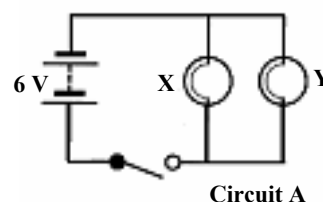
When heated the brass expands more than the invar causing the strip to bend. The strip straightens again when it cools.



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

What are *tog values*? (6)

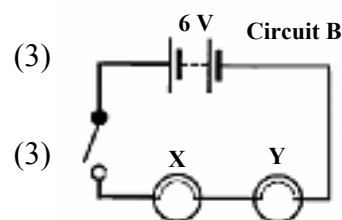
5. (a) Circuits **A** and **B** both contain one switch and two bulbs; however, the parts of the circuits are connected together differently. The bulbs in both circuits are identical, and the single switch controls both bulbs in each circuit.



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

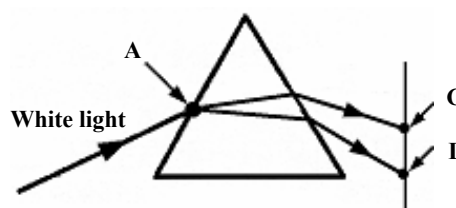
When the switches are closed,

- (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.



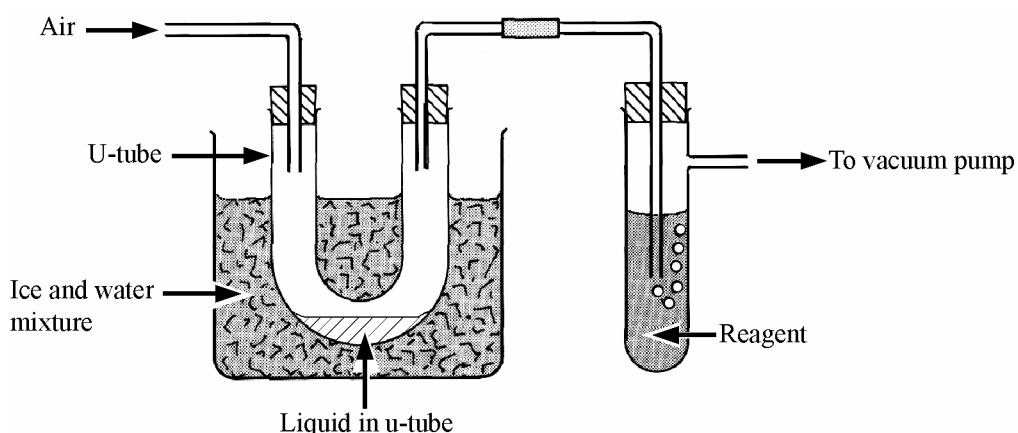
- (i) In the experiment the ray of light changed direction at point **A**. What is this '*bending*' of light called? (3)
- (ii) In the experiment white light was passed through the prism and it separated into a band of coloured lights. What is this *separation* called? What does this experiment tell 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.

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

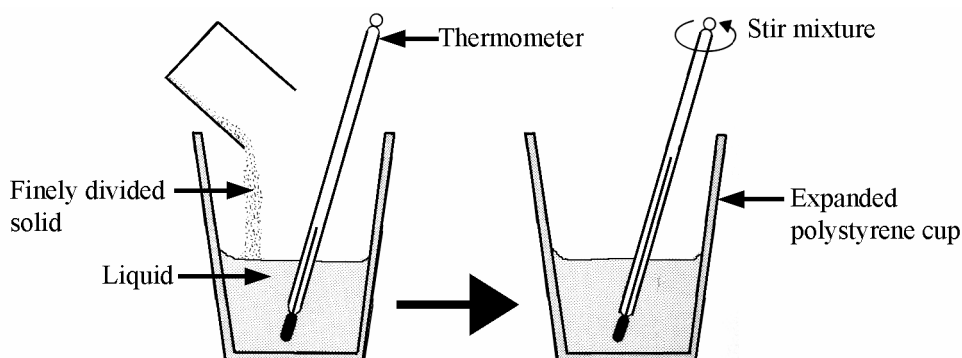


Air was drawn through the apparatus by a vacuum pump. A colourless liquid condensed in the u-tube. The reagent through which the air bubbled turned from colourless and clear to a cloudy white.

- (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)

Turn over

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



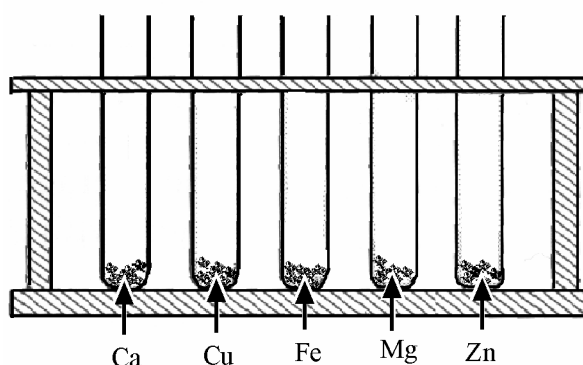
In the experiment illustrated heat was *released*. Note the *rise* in temperature shown by the thermometer.

- (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.

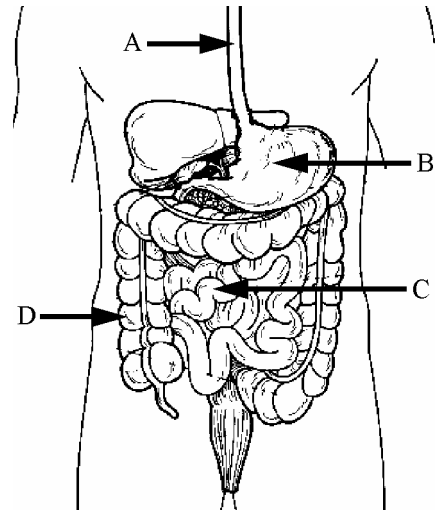
- (i) What is an *atom*? (3)
- (ii) Define *atomic number*. (3)
- (iii) Define *mass number*. (6)
- (iv) Draw a diagram, of a magnesium atom, showing the *electronic structure* and *nuclear composition*. (9)

SECTION D - BIOLOGY (48 marks)

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

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)

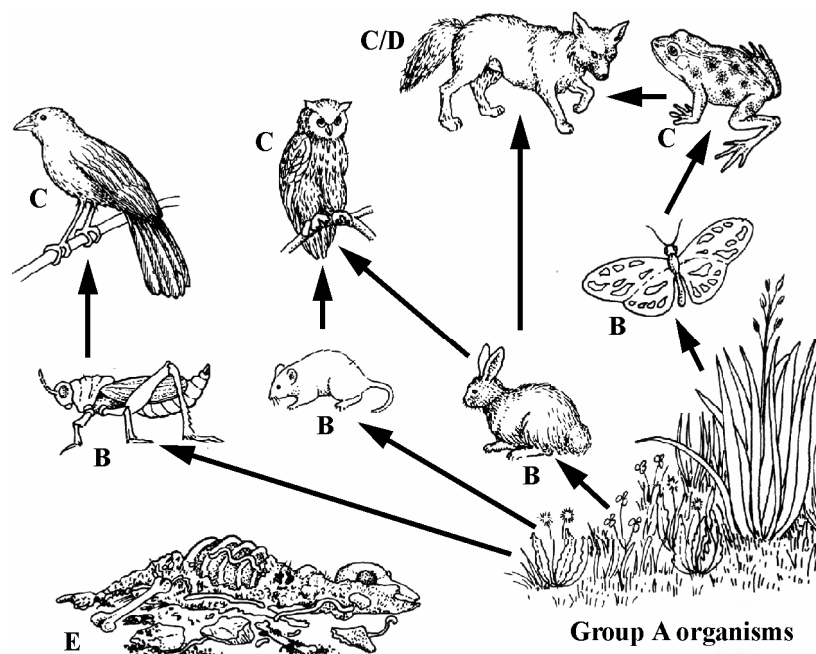


(b) A pupil performed an experiment, in a school laboratory, to show the action of a *digestive enzyme* on a *food substance*.

- (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)

[Turn over

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)



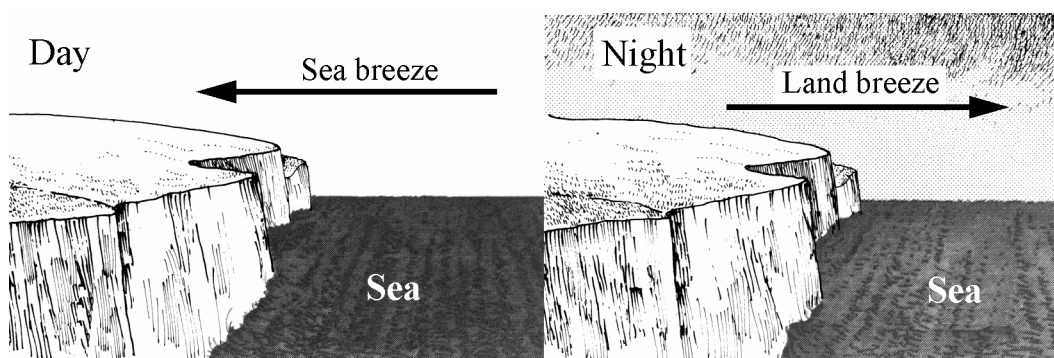
How are clouds *formed*?

(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)

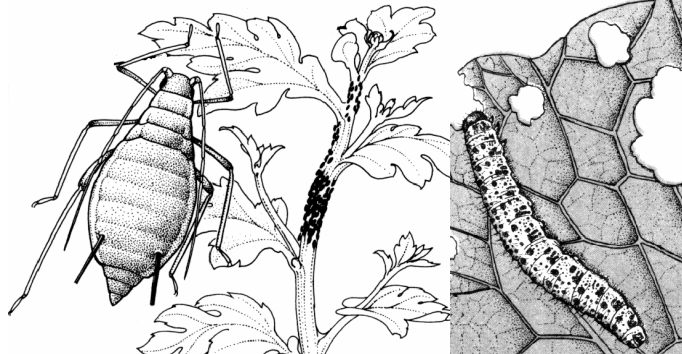
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11. HORTICULTURE. Answer any **two** of the following, (a), (b), (c).

- (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)

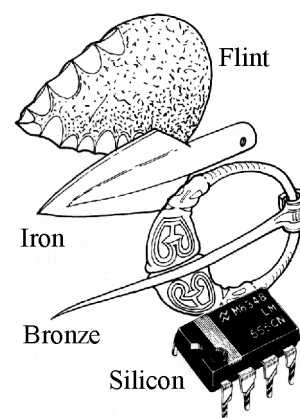
(ii) Give **one** precaution that you would take to help ensure success when propagating a plant by taking cuttings. (3)

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

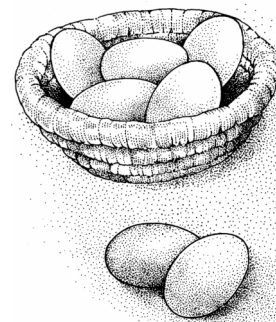
Name a tree that produces *hardwood* and name a tree that produces *softwood* in Ireland. (6)

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

[Turn over

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.

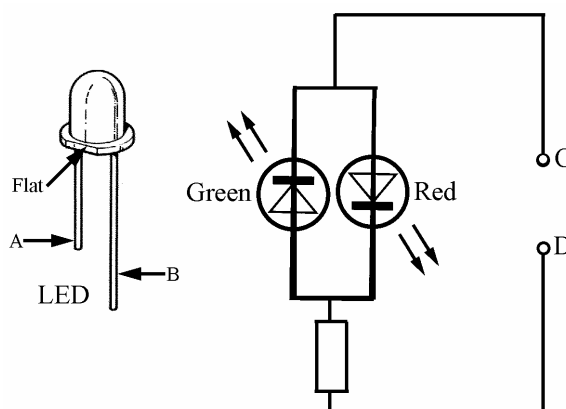


- (i) Name a *method* of food preservation, used today, that is the same as or similar to Appert's and name a food preserved in this way. (6)
- (ii) Some foods, e.g. milk, shelled eggs and some prepared sea food are *pasteurised* before use. Explain clearly why pasteurisation works. How is milk pasteurised? (12)

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

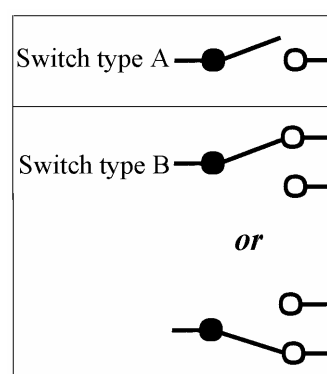
- (a) The diagram shows an LED and a circuit with a red LED and a green LED.

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)

[Turn over

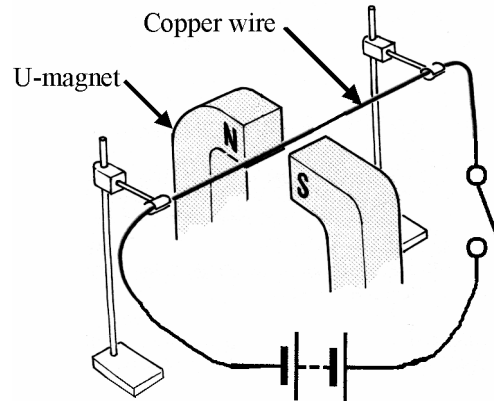
15. ENERGY CONVERSIONS. Answer **both** parts, (a) and (b).

- (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)

