Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2004

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

THURSDAY, 17 JUNE - AFTERNOON, 2.00 to 4.30

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*) A car was travelling at 30 m/s when the brakes were applied. The car came to rest in 12 seconds. The table gives the velocity of the car at two second intervals during this time.

Velocity (m/s)	30	25	20	15	10	5	0
Time (s)	0	2	4	6	8	10	12

Draw a graph, on graph paper, of velocity against time.
Put velocity on the y-axis. (12)

Use the graph to find

(i) the time taken for the velocity of the car to reduce to 12.5 m/s (3)

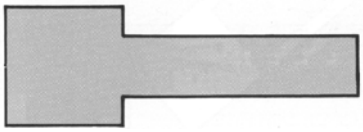
(ii) the velocity of the car 3 seconds after the brakes were applied (3)

(iii) the acceleration of the car. (6)

[Turn over

(*b*) Define *centre of gravity*. (6)

Describe, using a labelled diagram, an experiment to locate the centre of gravity of the sheet of card shown in the diagram. (9)

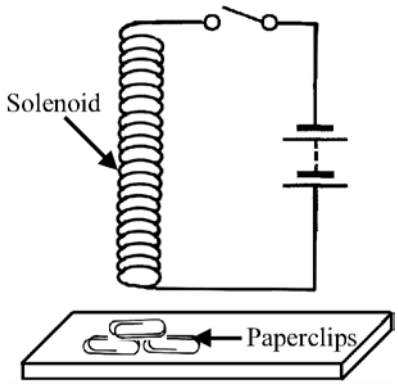


The double-decker bus shown in the photograph is being tested for stability.

What is meant by *stability*? (3)

Where do you think that the centre of gravity of a double-decker bus is located? Give a reason for your answer. (6)

5. (*a*) The diagram shows a solenoid held over some paperclips.



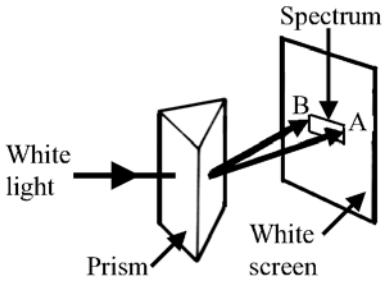
What happens to the paperclips when
(i) the switch is closed
(ii) the switch is opened again? (6)

Describe how to plot the magnetic field of a solenoid through which a direct current flows. (9)

Draw a sketch of the magnetic field produced showing two magnetic field lines, one on each side of the solenoid. (6)

(*b*) The headlight bulb of a car is connected to a 12 volts supply. If the current flowing through the bulb is 5 amps calculate the resistance of the filament of the bulb. What effect of electricity causes the filament to give out light? (12)

(*c*) The diagram shows the production of a spectrum of white light.



A and **B** are the colours <u>refracted</u> least and most, respectively, by the prism.

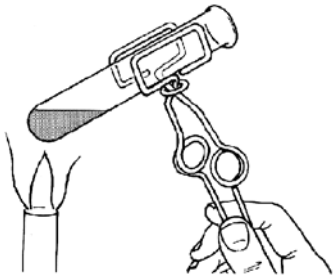
Name colours **A** and **B** and explain the underlined term. (15)

SECTION C - CHEMISTRY (48 marks)

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

---

6. (*a*) Iron and sulphur are elements.
When a mixture of iron filings and sulphur powder is heated, as shown in the diagram, a reaction takes place and a compound is formed.

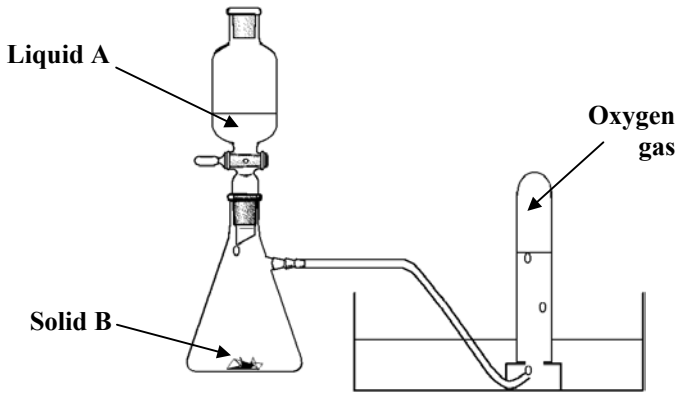


Explain the **three** underlined terms. (15)

In this reaction the sulphur atoms gain two electrons. Draw a diagram showing the arrangement of the electrons in the sulphide ion, S^{2-}.
The atomic number of sulphur is 16. (3)

Is sulphur oxidised or reduced in this reaction?
Give a reason for your answer. (6)

(*b*)



The diagram shows the preparation of oxygen by the reaction of liquid **A** with solid **B**.

Name a suitable liquid **A** and a suitable solid **B** for this preparation. (6)

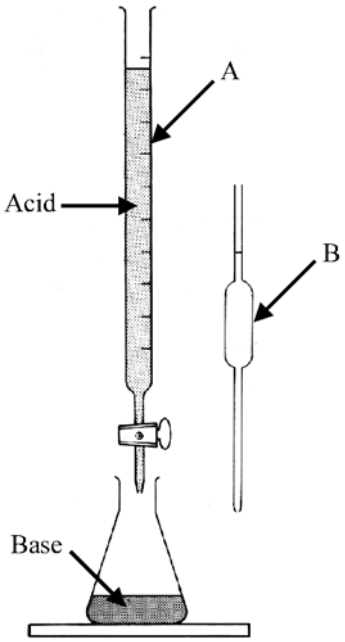
Solid **B** is not used up in this reaction but it speeds up the breakdown of liquid **A**. What are substances like **B** called? (3)

How would you test the gas collected to show that it is oxygen? (6)

Magnesium burns in oxygen to produce magnesium oxide.
Write a balanced equation for this reaction. (9)

[Turn over

7. (*a*) A pupil prepared the salt, sodium chloride, in a school laboratory using the items shown in the diagram.



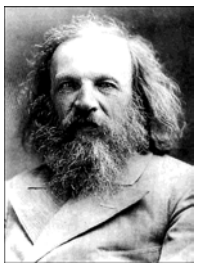
Name the pieces of equipment **A** and **B**. (6)

How is the amount of acid required to neutralise the base determined? (6)

The salt produced, by this experiment, is dissolved in water. Describe, using a labelled diagram, how a pure sample of salt can be obtained from the salt solution. (9)

How could the pupil ensure that the final product was colourless? (3)

(*b*) Dmitri Mendeleev was professor of chemistry at the University of St Petersburg when he arranged the elements in a table in 1869.
The diagram shows the arrangement of the first twenty elements in a short modern version of this table.



H 1							He 2
Li 3	Be 4	B 5	C 6	N 7	O 8	F 9	Ne 10
Na 11	Mg 12	Al 13	Si 14	P 15	S 16	Cl 17	Ar 18
K 19	Ca 20						

What is this table called? (3)

Name **one** alkali metal and **one** halogen whose symbols are in the table above. (6)

Why does helium appear in the same group as neon and argon? (3)

Compare the reaction, if any, of magnesium and calcium with cold water. (6)

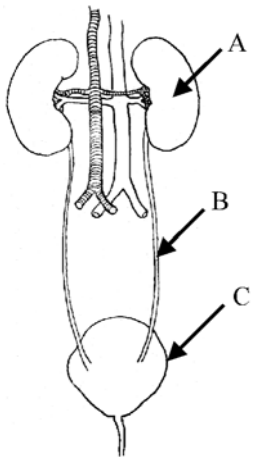
Choose any group and state the arrangement of the electron(s) in the outer orbits of the atoms of the elements in that group. (6)

SECTION D - BIOLOGY (48 marks)

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

---

8. (*a*) Explain the term *excretion*. (6)

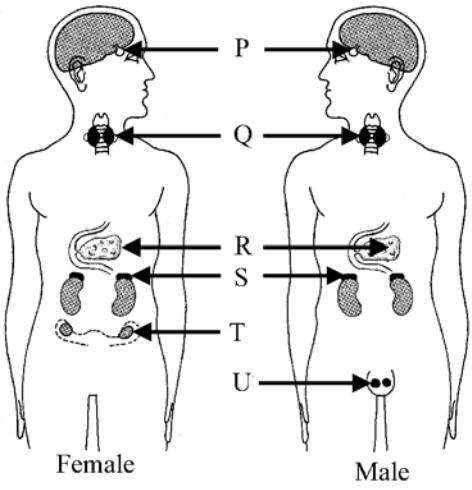


The diagram shows the urinary system.

Name the parts labelled **A**, **B** and **C**. (9)

Give **one** function for **each** of the parts **A**, **B** and **C**. (9)

(*b*) What is a *hormone*? (6)



The diagram shows the locations of the major glands of the endocrine (hormone) system in our bodies.

Select **one** of the glands labelled **P**, **Q**, **R**, etc. Identify the gland that you have selected by writing down its letter. Name the selected gland and name **one** hormone secreted by it. (6)

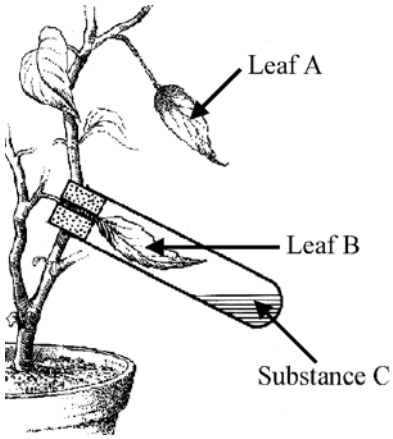
Give the functions of *sensory* and *motor nerves*. (12)

[Turn over

9. (*a*) Copy and complete the equation for photosynthesis, given below, entering the formulae for substances **X** and **Y**.

$$\mathbf{6CO_2 + 6H_2O \rightarrow X + 6Y} \qquad (6)$$

Carbon dioxide is necessary for photosynthesis. The experiment shown in diagram is used to demonstrate this.



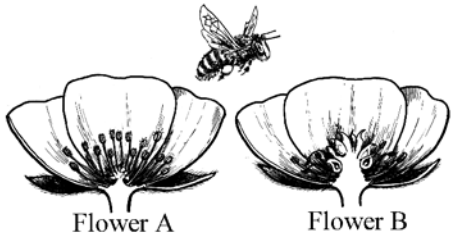
How was the plant prepared for this experiment? (3)

Substance **C** removes carbon dioxide from the air in the test tube. Name a substance suitable for this purpose. (3)

What environmental condition, not shown in the diagram, does the plant need for photosynthesis to occur? (3)

State how leaves **A** and **B** could be tested to see if photosynthesis has occurred. (9)

(*b*) A bee visits flower **A** and then visits flower **B**. Flower **A** has mature anthers and flower **B** has mature carpels.



Why do bees and other insects visit flowers? (3)

Explain the roles played by (i) the anthers, (ii) the bee, and (iii) the carpels in plant reproduction. (9)

Name a flowering plant **and** give its method of seed dispersal. (6)

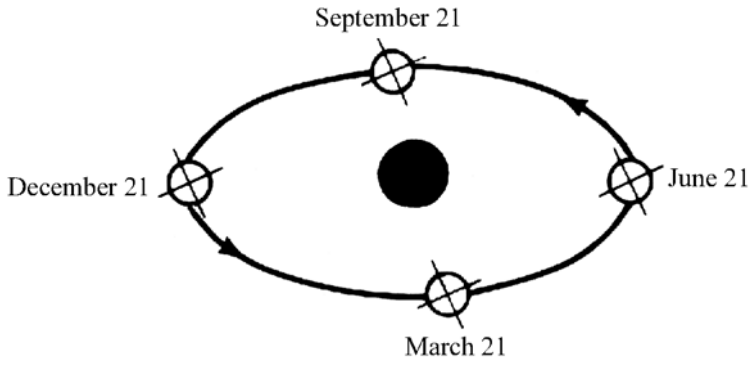
Give **two** conditions necessary for seed germination. (6)

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 diagram shows the annual orbit of the Earth around the Sun.
This view exaggerates changes in distance from the Earth to the Sun during its orbit; the true shape of the Earth's orbit is almost circular.



Explain with the help of this diagram why the seasons summer and winter are experienced in Ireland. (12)

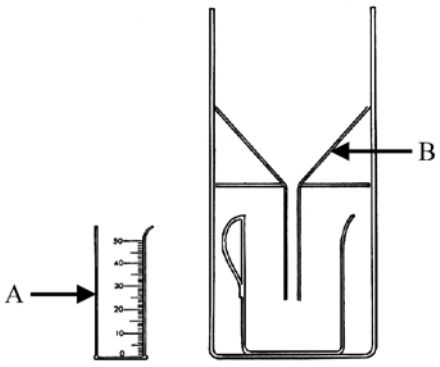
How long does it take for the earth to complete one orbit of the sun? (6)

(*b*) What instrument is used to measure atmospheric pressure? (3)

How does atmospheric pressure change with increasing height above the surface of the Earth? Give a reason for your answer. (6)

List **three** environmental conditions associated with the formation of frost. (9)

(*c*) Name the weather-recording instrument shown in the diagram. (3)



What units are used on item **A**? (3)

Give the function of part **B**. (3)

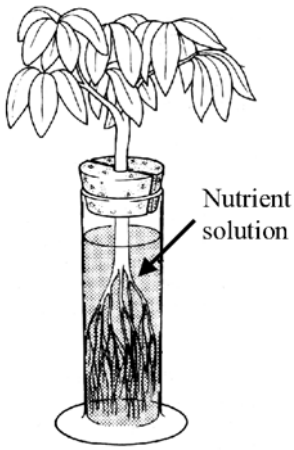
Describe how this instrument should be installed in a weather station. (6)

Name the instrument used to measure wind speed. (3)

[Turn over

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

(*a*) An experiment to investigate the effect of deficiencies of different mineral nutrients on plant growth was carried out using young plants as shown in the diagram.



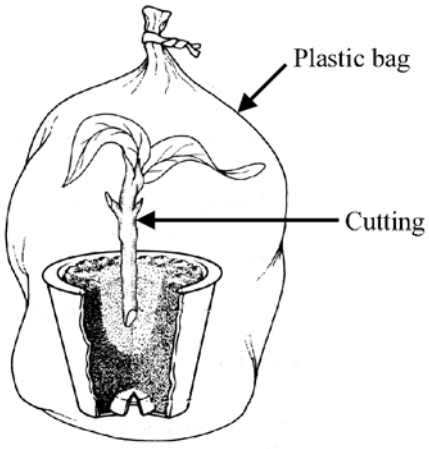
Name **three** *major* mineral nutrients needed by plants for healthy growth. (9)

Give **one** effect of deficiency on the health of a plant for **each** of the nutrients that you have named. (9)

(*b*) Plants need to be protected against pests.
Describe (i) the *biological* control of a *named* pest
(ii) the *chemical* control of a *different* named pest. (12)

Give **two** ways, apart from simply putting them in water, of caring for cut flowers. (6)

(*c*) The diagram shows a softwood cutting ready for rooting.



Name a plant from which such a cutting could be taken. (3)

What is the purpose of the plastic bag? (3)

Why are the lower leaves removed? (3)

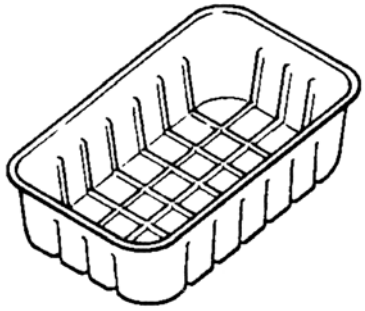
Give **one** other preparation of the cutting that might be carried out. (3)

What material, apart from soil, could be used in the pot? (3)

Following suitable preparation give **one** condition that will help the rooting of the cutting. (3)

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

(*a*) Name a *metal*, a *plastic* and a third *different material* that is used to make packages for food distributed in retail outlets. (9)



Give **one** property of **each** of the materials that you have named that makes it suitable for this use. (9)

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

(i) PLASTICS

All plastics are polymers. Explain the underlined term. (6)

Describe an experiment to compare the flexibility of two plastics. (12)

(ii) METALS

Name an *alloy* and state a use for it. (6)

Describe the extraction of a named metal from one of its compounds in a school laboratory. (12)

(iii) TEXTILES

Name a synthetic fibre used in the manufacture of yarn.
How might this yarn be made into fabrics? (6)

Describe an experiment to compare the insulating properties of two fabrics. (12)

(iv) TIMBER

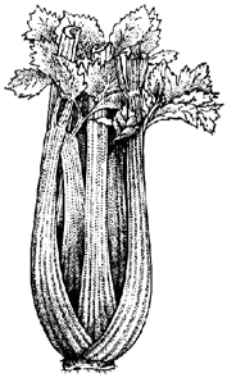
Name a tree that produces a hardwood and name a tree that produces a softwood. (6)

Describe an experiment to compare the density of a hardwood with the density of a softwood. (12)

[Turn over

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

(*a*) Fresh fruit and vegetables are important sources of vitamins, minerals and fibre.



Name **one** vitamin and **one** mineral that we need to stay healthy. (6)

What is fibre? (3)

How does fibre help to protect our health? (3)

Give **two** ways in which a diet could be unbalanced. (6)

(*b*) Name **two** foods, **one** that is suitable for **each** method of preservation listed: (i) dehydration, (ii) irradiation. (6)

Explain how **one** of the methods listed works. (6)

Give **one** advantage and **one** disadvantage of the use of additives in food. (6)

(*c*) Louis Pasteur proved, by his experiments in 1856, that all true fermentations were produced by the action of micro-organisms on various substances.

Describe how to produce alcohol by fermentation in a school laboratory. (9)

Give **two** other examples of the use of micro-organisms in food processing. (6)

Why are most beers pasteurised? (3)

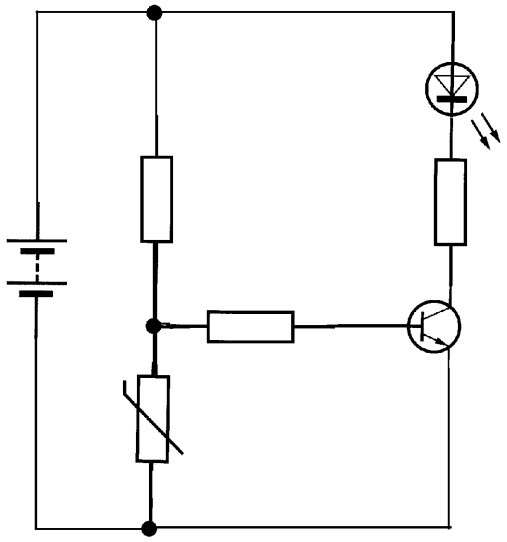
14. ELECTRONICS. Answer **both** parts, (*a*) and (*b*).

(*a*) Given two switches of the type shown in the diagram, a lamp and a suitable battery draw **two** circuit diagrams where:

(i) the lamp lights only when *both* switches are closed
(ii) the lamp lights if *either* switch is closed. (12)

How does the circuit in (ii) above differ from the that used for two-way switching in, for example, a landing light. (6)

(*b*) Identify (i) the *thermistor* (ii) the *transistor* in the circuit shown by drawing their circuit symbols and naming them in your answer-book. (6)



What are the functions of the thermistor and the transistor in this circuit? (6)

This circuit is used to indicate that the oven of a cooker has reached a preset temperature.

Where would the thermistor be positioned in the cooker? (3)

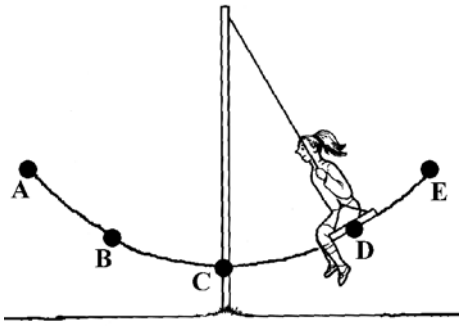
What happens to the LED when the oven has reached the preset temperature? (3)

[Turn over

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

(*a*) What do you understand by *potential energy* and by *kinetic energy*? (6)

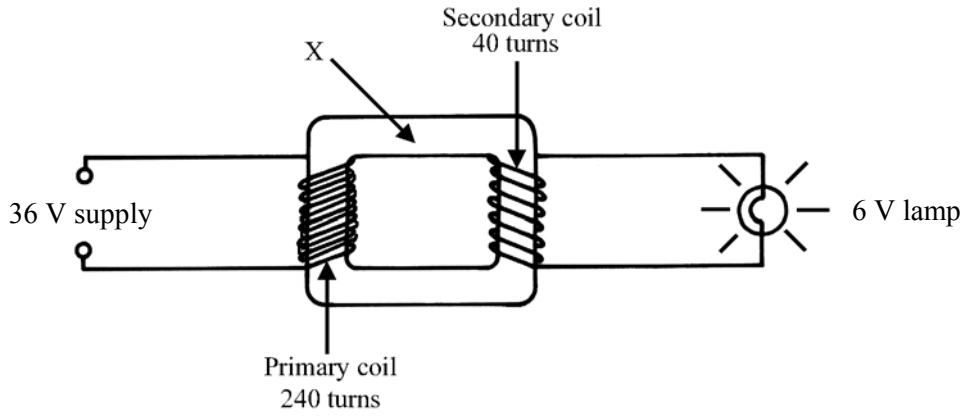
The diagram shows a girl swinging.
The curved line shows her path.



Pick **one** point **A**, **B**, etc. from the diagram for **each** of the following:
(i) the girl has only potential energy
(ii) the girl has maximum kinetic energy
(iii) the girl has least potential energy (9)

Give an example of the conversion of kinetic energy to heat. (3)

(*b*) The diagram shows a transformer changing 36 volts to 6 volts to light a lamp continuously.



Is the 36 volt supply delivering an alternating or direct current to the transformer? (3)

Give **one useful** energy change that takes place in a transformer when it is operating? (3)

Name part **X** and name the material that this part is made of. (6)

If the secondary coil in this transformer were replaced by a 400 turn coil would the output voltage be increased of decreased? Give a reason for your answer. (6)