# Coimisiún na Scrúduithe Stáit
# State Examinations Commission

## JUNIOR CERTIFICATE EXAMINATION, 2005

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

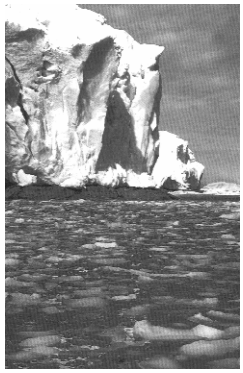
## THURSDAY, 16 JUNE - MORNING, 9.30 to 12.00

**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*) Describe, using a diagram, how to measure the density of a *liquid*. (15)

Give the unit used to express density measurements. (3)

Explain why icebergs float on water. (6)

(*b*) Describe a laboratory experiment to show that light is a form of energy. (9)

Give **two** observations that suggest that light travels in straight lines. (6)

Draw a diagram showing the effect of a convex lens on parallel light rays.

Name a *second* lens type. (9)

**[Turn over**

**5.** (*a*) Georg Ohm published his law in 1827. Ohm's law states the *relationship* between voltage and current for a metallic conductor.

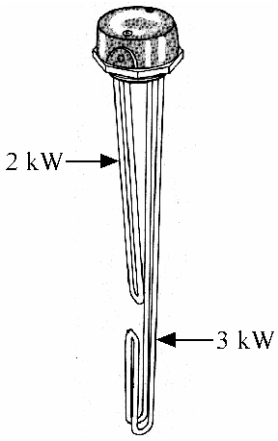
A pupil performed an experiment to verify Ohm's law and got the results given in the table.
Draw a graph, on graph paper, of voltage against current. (12)

| Voltage (volts) | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Current (amps) | 0.00 | 0.05 | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 |

State, using words or a formula, the *relationship* shown by the graph. (6)

Calculate the resistance of the conductor used in the experiment. (6)

(*b*) The diagram shows a 2 kW/3 kW dual immersion heater of the type used to heat water in the home. The shorter 2 kW element heats water for the sinks and the longer 3 kW element heats water for baths. One element is turned on at a time; the sink element heats less water than the bath element.




What *property* of water makes it possible to heat different amounts of water in the same tank? (6)

What *unit* does the ESB use to price electricity? (3)

If a unit of electricity costs 10 cent what is the *cost* of heating water for one week if the 2 kW element is on for three hours each day and the 3 kW element is on for one hour each day? (6)

If the electricity supply to the heater is 230 volts calculate the *current* in the 3 kW element when it is switched on. (9)

## SECTION C - CHEMISTRY (48 marks)

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

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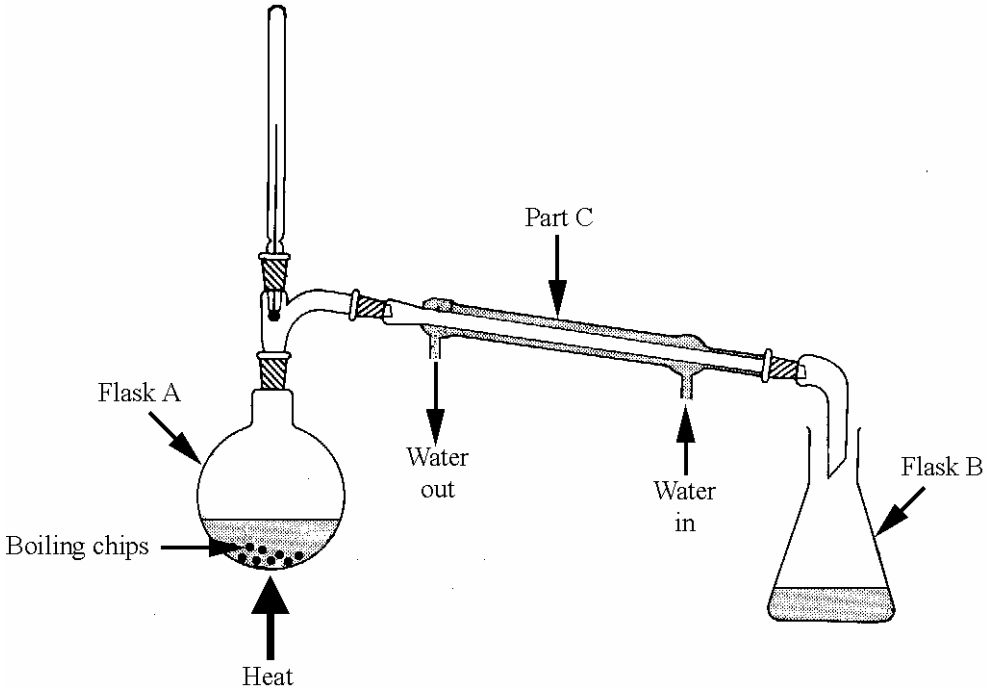
**6.** (*a*) Pairs of liquids can be miscible (liquids that mix to form a solution) or immiscible (liquids that do not mix to form a solution).

Name the method of separation shown in the diagram. (3)




Name two *miscible* liquids that can be separated by this method. (6)

Which flask **A** or **B** contains the mixture? (3)

Why is cold water flowing through part **C** in the direction shown? (3)

Explain, using a labelled diagram, how two *immiscible* liquids could be separated. (9)

(*b*) Draw a diagram showing the *nuclear composition* and the *electronic structure* of the sodium atom $^{23}_{11}Na$. (9)

Describe the formation of a sodium *ion* and a chloride *ion* from *atoms* of sodium and chlorine. (9)

Sodium ions and chloride ions can combine to form an ionic bond. Give **two** characteristic properties of *ionic compounds*. (6)

**7.** (*a*) A pupil collected water from four sources in bottles labelled **A**, **B**, **C** and **D**. The four water samples were tested before treatment, after boiling and after passing through an ion exchanger. Equal volumes of each sample were tested for hardness by finding the volume of soap solution required to produce a lather. The results of the tests are given in the table.

| Water sample | Volume of soap solution added to water sample which was: | | |
|---|---|---|---|
| | Untreated ($cm^3$) | Boiled ($cm^3$) | Ion exchanged ($cm^3$) |
| **A** | 1 | 1 | 1 |
| **B** | 3 | 1 | 1 |
| **C** | 4 | 2 | 1 |
| **D** | 3 | 3 | 1 |

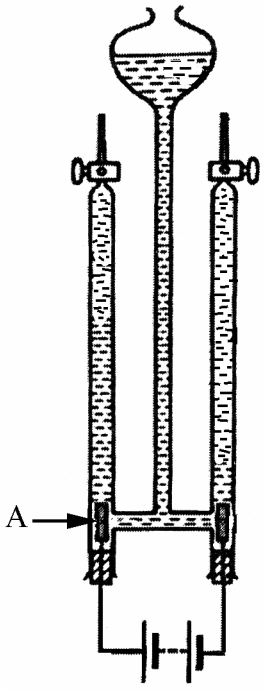
Study the table and identify the sample which has:
(i) most hardness
(ii) a mixture of permanent and temporary hardness
(iii) only permanent hardness
(iv) no hardness
(v) only temporary hardness. (15)

Give the name *or* formula of a substance that causes temporary hardness in water. (3)

Name **one** treatment, other than the removal of hardness, that water for domestic use undergoes. Give a reason why the treatment you have named is carried out. (6)

(*b*) Explain the term *electrolysis*. (6)

The diagram shows a Hoffman voltameter filled with water for an experiment to investigate the electrolysis of water.




What must be added to the water for this experiment to work? (3)

Name the gas produced at the electrode labelled **A** during this experiment and describe a simple test to confirm your answer. (9)

Name a suitable material for use as electrodes in this experiment. (3)

Give **one** application of electrolysis. (3)

## SECTION D - BIOLOGY (48 marks)

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

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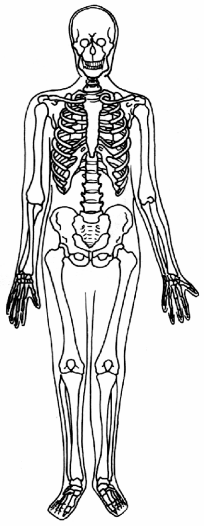
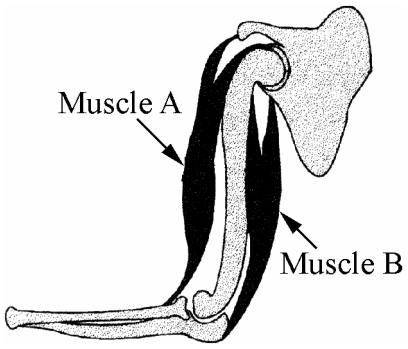
**8.** (*a*) The diagram shows the human skeleton.



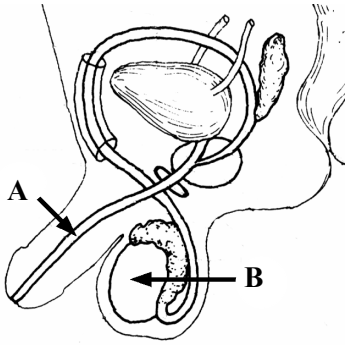
Say how the skeleton *protects* two named organs. (6)

Name **two** parts of a *synovial joint* that help with the free movement of that joint. (6)




Describe, using labelled diagrams, how pairs of *antagonistic muscles* can produce two-way movement of bones that have a *synovial joint* between them. (12)

(*b*) The diagram shows the male reproductive system.




Name parts **A** and **B** and give their roles in sexual reproduction. (12)

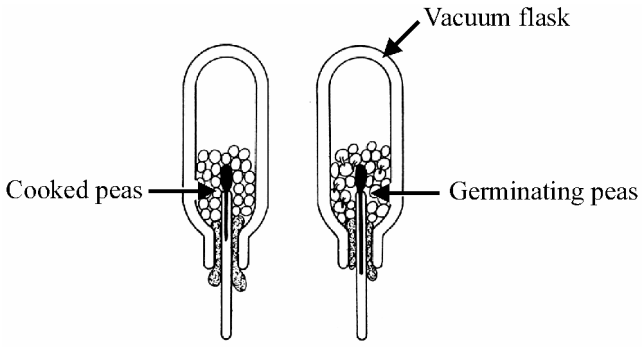
Explain the terms

(i) *fertilisation* and

(ii) *implantation*. (12)

**[Turn over**

**9.** (*a*) The diagram shows an experiment to demonstrate that germinating peas produce heat. The thermometer in the flask on the right shows a higher temperature than the one in the flask on the left.




(i) Why are vacuum flasks used in this experiment? (3)

(ii) Why are the peas in the flask on the left cooked? (3)

(iii) Why are the flasks 'upside down'? (3)

(iv) Name the *process* that releases the heat and carbon dioxide in the germinating peas. (3)

(v) Outline a simple test for carbon dioxide gas. (6)

(vi) What is meant by the term '*germination*' when applied to seeds? (6)

(*b*) Name the *tissue* that transports water and minerals upwards in plants. (3)

Describe, using a labelled diagram, a simple experiment to show the upward movement of water in the stem of a named plant. (9)

What is *phototropism*? (6)

How can phototropism can be demonstrated by a simple laboratory experiment? (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 sun is the star in the centre of our solar system.

Name **one** planet that is closer to the sun than the earth **one** planet that is further away from the sun. (6)

Stars release vast amounts of heat and light and other forms of energy. What is the *source* of this energy? (3)

Name a natural satellite of the earth. (3)

Give **two** reasons why the earth is the only planet, as far as we know, that can *support life* in our solar system. (6)

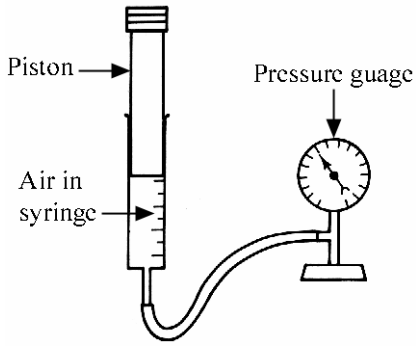
(*b*) What causes the tidal rise and fall of waters on earth? (3)

Explain the term '*spring tide*'. (3)

Draw a diagram showing how a spring tide can be produced. (6)

Why do we have **two** spring tides each month? (6)

(*c*) The apparatus shown in the diagram can be used to investigate the way the *volume* of a gas *changes* with *pressure*. The syringe has volume markings on it.




Describe how one could use this apparatus to make suitable measurements for such an investigation. (6)

How could these measurements be used to find the *relationship* between pressure and volume for a gas? (6)

State the *relationship* between pressure and volume of a gas at constant temperature. (6)

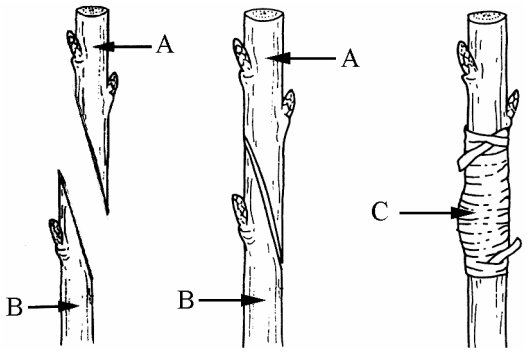
**[Turn over**

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

(*a*) Describe an experiment to measure the water content of a soil sample. (12)

Name **two** media, other than soil, for growing plants. (6)

(*b*) Name the method of *propagation* of plants shown in the diagram. (3)




What are parts **A** and **B** called? (6)

Name a suitable material for **C**. (3)

Give **one** precaution that you could take to increase the chance of success of this attempt at propagation excluding binding **A** and **B** together. (3)

Name a plant that can be propagated in this way. (3)

(*c*) What is a *mulch*? (3)

Give **two** reasons why mulches are used. (6)

What is meant by *biological control* of garden pests?
Give **one** example. (9)

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

(*a*) Many different materials are used in the construction and in the fitting-out of our homes.

(i) Name a plastic that is used to make gutters and down pipes.
(ii) Give **one** use for aluminium in house construction.
(iii) Name a fabric that is used to make curtains.
(iv) Give **one** use for pine (deal) in the construction of a house. (12)

Select **one** material from your answers, and give a reason why it might *deteriorate* in time and give a way in which it might be *protected*. (6)

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

(i) PLASTICS

Name the raw material from which plastics are manufactured.
What is the origin of this material? (6)

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

(ii) METALS

Give **one** reason why metals are mixed with other substances to form alloys.
Name an alloy. (6)

Describe an experiment to compare the thermal (heat) conductivity of two metals. (12)

(iii) TEXTILES

Name **one** natural fibre and **one** synthetic fibre commonly mixed together in fabrics. (6)

Describe an experiment to compare the resistance to wear of two fabrics. (12)

(iv) TIMBER

Name a manufactured board and explain how it is made. (6)

Describe an experiment to show the effect of grain direction on the strength of timber. (12)

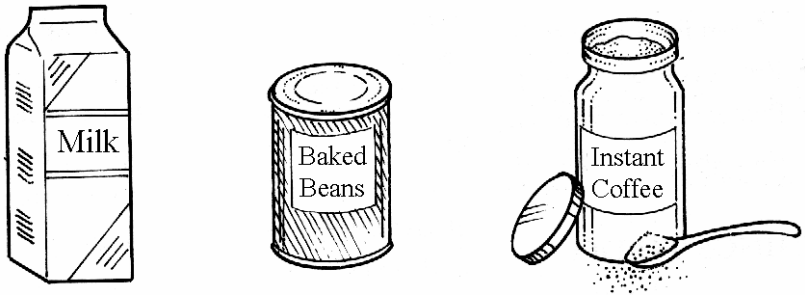
**[Turn over**

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

(*a*) Name **two** food types that make up a balanced diet. Give the *role* played by **one** of the food types you have named in maintaining health. (9)

Describe an experiment to show the *presence of glucose*, a reducing sugar, in a food. (9)

(*b*)




Select **two** of the food products shown in the diagram and state the method of *preservation* that has been used for each product. **Two different** methods of preservation must be selected. (6)

Explain how **both** methods of preservation that you have named work. (6)

The list of ingredients on the label of the baked beans include sugar, modified starch and salt. Give **one** advantage and **one** disadvantage of the use of additives in food. (6)

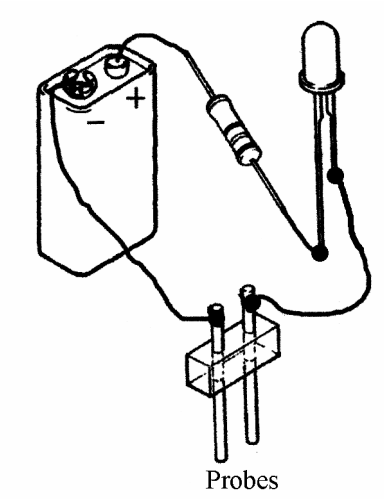
(*c*) Yoghurt is made from milk.

Describe how yoghurt can be made in a school laboratory. (12)

Name **two** ways in which meat is processed. (6)

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

(*a*) A pupil made the simple *water detector* shown in the diagram. The LED glowed dimly when the probes were in water.




Draw a circuit diagram, using circuit symbols, of this circuit. The probes can be shown by two parallel lines. (9)

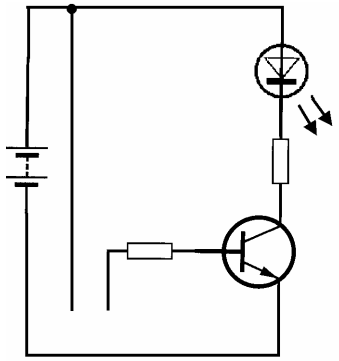
Why is there a resistor in the circuit? (3)

Would the circuit work, as described above, if the battery connections were reversed? Give a reason for your answer. (6)

(*b*) The pupil wished to improve the sensitivity of the circuit above and added another component **A**, shown in the diagram, with a second resistor. The LED glowed brightly in the modified circuit when the probes where immersed in water.


Name the added component **A**. (3)

The circuit diagram shows the modified circuit.



Component **A** has three terminals (connections). Draw the circuit symbol for **A** in your answer-book, then label and name the three terminals. (9)

Copy the diagram of the modified circuit into your answer-book and show where a switch could be inserted to turn on/off the circuit. (3)

If the modified circuit was to be used to alert someone that a bath was full of water what component could replace the LED to make it more effective? (3)

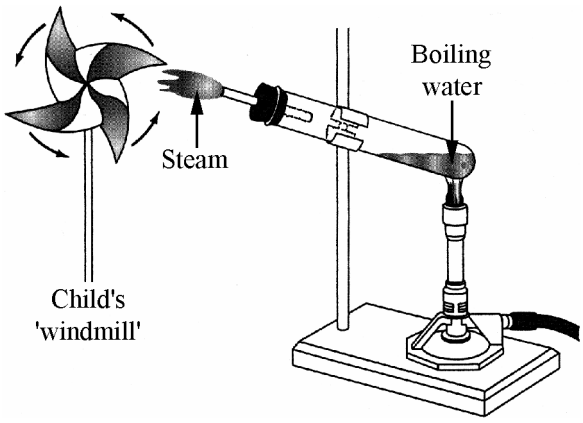
**[Turn over**

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

(*a*) A pupil did a project on energy conversions and set-up the demonstration shown in the diagram.

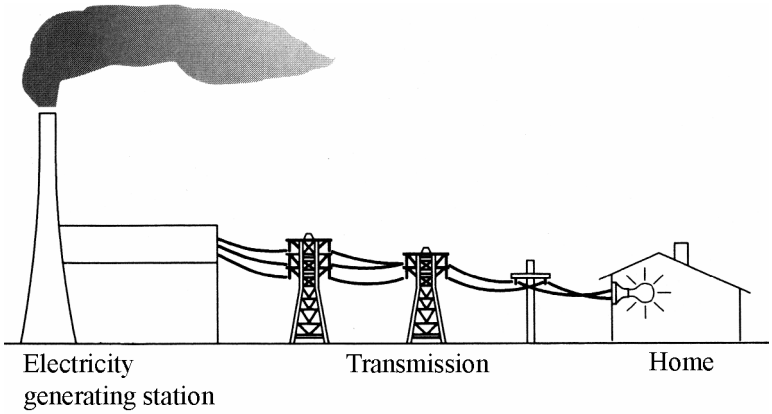
The demonstration shows how a steam turbine works.

Write down **two** *energy conversions* taking place in the demonstration that lead to the child's 'windmill' turning. (12)




What *energy conversion* occurs when a mobile phone is being charged? (6)

(*b*) Electricity generating stations use steam turbines that work like the demonstration in the diagram in (*a*) above.




These steam turbines turn generators (dynamos) at high speed.
What energy conversion occurs in a generator (dynamo)? (6)

Draw a labelled diagram of a simple generator (dynamo). (9)

Electricity is transmitted as a.c. and its voltage is *increased* leaving the generating station and then is *reduced* before it reaches your home.
Name a *device* that can change a.c. voltage. (3)