Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE EXAMINATION 2008

PHYSICS – ORDINARY LEVEL

MONDAY, 16 JUNE – MORNING 9:30 TO 12:30

Answer **three** questions from **section A** and **five** questions from **section B**.

SECTION A (120 marks)

Answer **three** questions from this section.
Each question carries 40 marks.

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1. A student carried out an experiment to find the acceleration of a moving trolley. The student measured the velocity of the trolley at different times and plotted a graph which was then used to find its acceleration. The table shows the data recorded.

velocity/m s^{-1}	0.9	1.7	2.5	3.3	4.1	4.9
time/s	0	2	4	6	8	10

(i) Describe, with the aid of a diagram, how the student measured the velocity of the trolley. (15)

(ii) Using the data in the table, draw a graph on graph paper of the trolley's velocity against time. Put time on the horizontal axis (X-axis). (15)

(iii) Find the slope of your graph and hence determine the acceleration of the trolley. (10)

2. You carried out an experiment to find the speed of sound in air, in which you measured the frequency and the wavelength of a sound wave.

(i) With the aid of a diagram describe the adjustments you carried out during the experiment. (12)

(ii) How did you find the frequency of the sound wave? (6)

(iii) How did you measure the wavelength of the sound wave? (9)

(iv) How did you calculate the speed of sound in air? (9)

(v) Give one precaution you took to get an accurate result. (4)

3. An experiment was carried out to measure the refractive index of a substance.
The experiment was repeated a number of times.

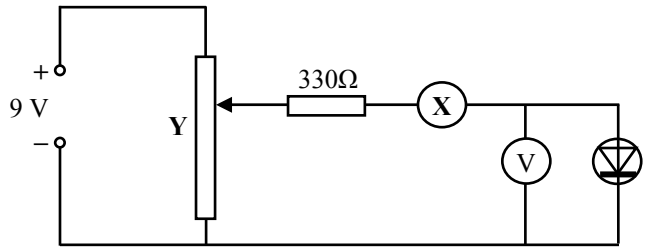
(i) Draw a labelled diagram of the apparatus that could be used in this experiment. (12)

(ii) What measurements were taken during the experiment? (12)

(iii) How was the refractive index of the substance calculated? (10)

(iv) Why was the experiment repeated? (6)

4. The diagram shows a circuit used to investigate the variation of current with potential difference for a semiconductor diode in forward bias.



(i) Name the apparatus **X**. What does it measure? (6)

(ii) Name the apparatus **Y**. What does it do? (6)

(iii) What is the function of the 330 Ω resistor in this circuit? (6)

The table shows the values of the potential difference used and its corresponding current recorded during the experiment.

potential difference/V	0	0.2	0.4	0.6	0.8	1.0
current/mA	0	3	6	14	50	100

Using the data in the table, draw a graph on graph paper of the current against the potential difference. Put potential difference on the horizontal axis (X-axis). (12)

What does the graph tell you about the variation of current with potential difference for a semiconductor diode? (10)

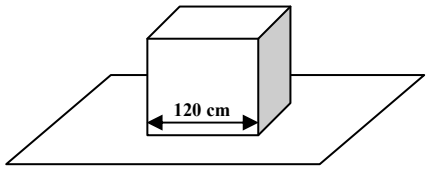
SECTION B (280 marks)

Answer **five** questions from this section.
Each question carries 56 marks.

5. Answer any **eight** of the following parts (*a*), (*b*), (*c*), etc.

(*a*) State the principle of conservation of momentum. (7)

(*b*) A solid block in the shape of a cube of length 120 cm rests on a table. The weight of the block is 25 N. Calculate the pressure it exerts on the table. (7)
($P = \frac{F}{A}$)



(*c*) Which of the following is the unit of energy? (7)

kelvin **watt** **newton** **joule**

(*d*) What physical quantity is measured in decibels? (7)

(*e*) A concave lens has a power of 0.1 cm^{-1}. What is the focal length of the lens? (7)
($P = \frac{1}{f}$)

(*f*) Give one effect of static electricity? (7)

(*g*) Give two uses for the instrument shown. (7)

(*h*) What is the colour of the live wire in an electric cable? (7)

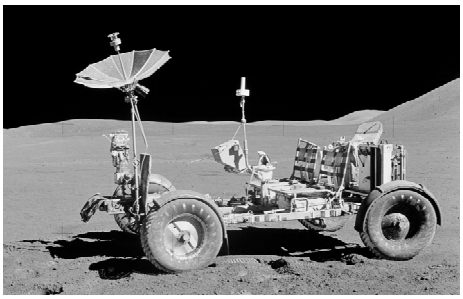
(*i*) State two properties of X-rays. (7)

(*j*) What is nuclear fusion? (7)

6. The weight of an object is due to the gravitational force acting on it.
Newton investigated the factors which affect this force.

Define force and give the unit of force.
State Newton's law of universal gravitation. (18)

Calculate the acceleration due to gravity on the moon.
The radius of the moon is 1.7×10^6 m and the mass of the moon is 7×10^{22} kg. (16)

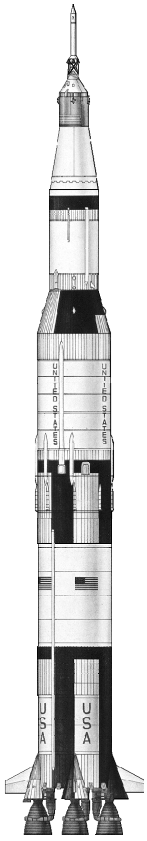


A lunar buggy designed to travel on the surface of the moon had a mass of 2000 kg when built on the earth.

(i) What is the weight of the buggy on earth?

(ii) What is the mass of the buggy on the moon?

(iii) What is the weight of the buggy on the moon? (16)



A powerful rocket is required to leave the surface of the earth.
A less powerful rocket is required to leave the surface of the moon.
Explain why. (6)

($W = mg$, $g = \frac{GM}{R^2}$, $G = 6.7 \times 10^{-11}$ N m^2 kg^{-2},
acceleration due to gravity on earth = 9.8 m s^{-2})

7. The temperature of an object is measured using a thermometer, which is based on the variation of its thermometric property.

(i) What is meant by temperature?

(ii) What is the unit of temperature?

(iii) Give an example of a thermometric property. (18)

The rise in temperature of an object depends on the amount of heat transferred to it and on its specific heat capacity.

(iv) What is heat?

(v) Name three ways in which heat can be transferred.

(vi) Define specific heat capacity. (21)

A saucepan containing 500 g of water at a temperature of 20 °C is left on a 2 kW ring of an electric cooker until it reaches a temperature of 100 °C. All the electrical energy supplied is used to heat the water.

Calculate:

(i) the rise in temperature of the water;

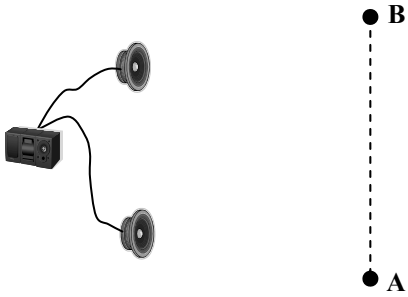
(ii) the energy required to heat the water to 100 °C;

(iii) the amount of energy the ring supplies every second;

(iv) the time it will take to heat the water to 100 °C. (17)

($Q = mc\Delta\theta$, $P = \frac{W}{t}$, specific heat capacity of water = 4200 J kg^{-1} K^{-1})

8. The diagram shows a signal generator connected to two loudspeakers emitting the same note.



A person walks slowly along the line **AB**.

(i) What will the person notice?
(ii) Why does this effect occur?
(iii) What does this tell us about sound? (21)

Describe an experiment to demonstrate that sound requires a medium to travel. (14)

The pitch of a note emitted by the siren of a fast moving ambulance appears to change as it passes a stationary observer.

(i) Name this phenomenon.
(ii) Explain how this phenomenon occurs.
(iii) Give an application of this phenomenon. (21)

9. An electric current flows in a conductor when there is a potential difference between its ends.

(i) What is an electric current? (6)
(ii) Give two effects of an electric current. (6)
(iii) Name a source of potential difference. (4)

Describe an experiment to investigate if a substance is a conductor or an insulator. (10)

The two headlights of a truck are connected in parallel to a 24 V supply.

(i) Draw a circuit diagram to show how the headlights are connected to the supply. (6)
(ii) What is the advantage of connecting them in parallel? (6)
(iii) Why should a fuse be included in such a circuit? (6)

The resistance of each headlight is 20 Ω.

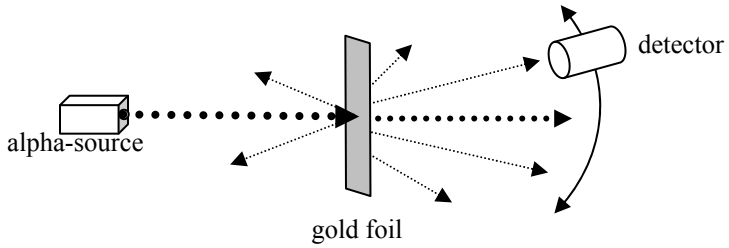
Calculate:

(iv) the total resistance in the circuit; (6)
(v) the current flowing in the circuit. (6)

($V = IR$; $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$)

10. Give two properties of an electron. (9)

The diagram shows the arrangement used by Rutherford to investigate the structure of the atom. During the investigation he fired alpha-particles at a thin sheet of gold foil in a vacuum.



(i) What are alpha-particles? (9)

(ii) Describe what happened to the alpha-particles during the experiment. (9)

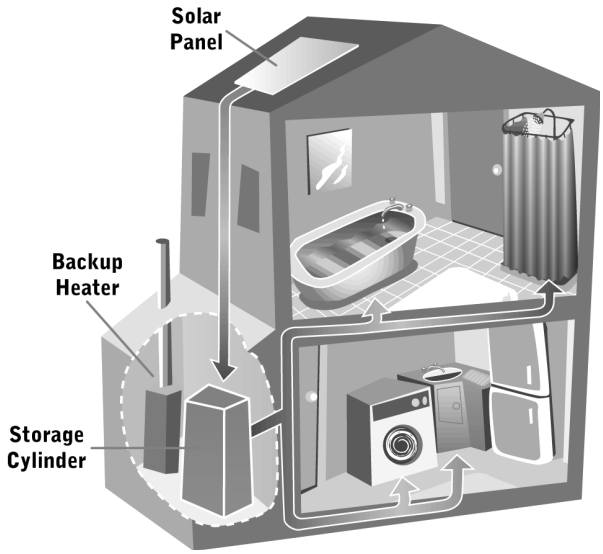
(iii) What conclusion did Rutherford make about the structure of the atom? (9)

(iv) How are the electrons arranged in the atom? (9)

(v) Name a device used to detect alpha-particles. (6)

(vi) Why was it necessary to carry out this experiment in a vacuum? (5)

11. Read this passage and answer the questions below.



Energy is essential to the comfort of our homes. There are many ways of reducing energy needs and meeting those needs with renewable sources. The main sources of renewable energy are the sun (solar energy), the wind, moving water (hydropower, wave and tidal energy), heat below the surface of the earth (geothermal energy) and biomass (wood, waste, crops).

Solar heating systems are used in many homes. These systems have two main parts: a solar panel and a hot water storage cylinder. Typically, a panel is placed on the roof, facing directly south. However, a good output can still be achieved between south-east and south-west.

The sun heats a black metal plate in the panel, which, in turn, heats water in pipes in the panel. To move the heated water between the panel and the storage cylinder, a system either uses a pump or the tendency of water to naturally circulate as it is heated. The solar water heating system needs to be backed up by a conventional heat source.

(Adapted from '*Renewable energy in the home' a guide* by Sustainable Energy Ireland.)

(*a*) State two uses of energy in the home. (7)

(*b*) Give two ways to reduce energy needs in the home. (7)

(*c*) List the main sources of renewable energy. (7)

(*d*) What are the main parts of a solar heating system? (7)

(*e*) Why does a solar panel need to face south? (7)

(*f*) What is the function of the backup heater? (7)

(*g*) Why are parts of the solar panel painted black? (7)

(*h*) What is the name given to the tendency of water to circulate as it is heated? (7)

12. Answer any **two** of the following parts (*a*), (*b*), (*c*), (*d*).

(*a*) Define (i) velocity, (ii) acceleration. (9)

A speedboat starts from rest and reaches a velocity of 20 m s^{-1} in 10 seconds.
It continues at this velocity for a further 5 seconds.
The speedboat then comes to a stop in the next 4 seconds.

(i) Draw a velocity-time graph to show the variation of velocity of the boat during its journey. (6)

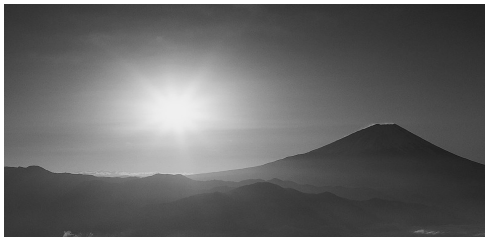
(ii) Use your graph to estimate the velocity of the speedboat after 6 seconds. (3)

(iii) Calculate the acceleration of the boat during the first 10 seconds. (6)

(iv) What was the distance travelled by the boat when it was moving at a constant velocity? (4)

($v = u + at$)

(*b*) Sunlight is made up of different colours and invisible radiations.



(i) How would you show the presence of the different colours in light? (9)

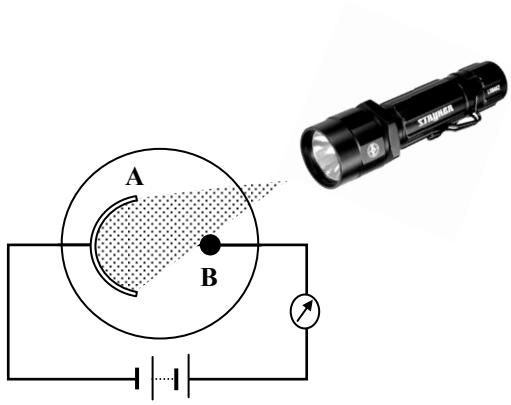
(ii) Name two radiations in sunlight that the eye cannot detect. (6)

(iii) Describe how to detect one of these radiations. (9)

(iv) Give a use for this radiation. (4)

(*c*) What is the photoelectric effect? (6)

A photocell is connected to a sensitive galvanometer as shown in the diagram. When light from the torch falls on the photocell, a current is detected by the galvanometer.



(i) Name the parts of the photocell labelled **A** and **B**. (6)

(ii) How can you vary the brightness of the light falling on the photocell? (6)

(iii) How does the brightness of the light effect the current? (4)

(iv) Give a use for a photocell. (6)

(*d*) What is electromagnetic induction? (6)

A magnet and a coil can be used to produce electricity.
How would you demonstrate this? (16)

The electricity produced is a.c. What is meant by a.c.? (6)

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