Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2005

PHYSICS – ORDINARY LEVEL

MONDAY, 20 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. In an experiment to investigate the relationship between force and acceleration a student applied a force to a body and measured the resulting acceleration. The table shows the measurements recorded by the student.

Force / N	0.1	0.2	0.3	0.4	0.5	0.6	0.7
acceleration / m s^{-2}	0.10	0.22	0.32	0.44	0.55	0.65	0.76

Draw a labelled diagram of the apparatus used in the experiment. (9)

Outline how the student measured the applied force. (6)

Plot a graph, on graph paper of the acceleration against the applied force. Put acceleration on the horizontal axis (X-axis). (12)

Calculate the slope of your graph and hence determine the mass of the body. (9)

Give one precaution that the student took during the experiment. (4)

2. In a report of an experiment to measure the specific latent heat of vaporisation of water, a student wrote the following.

"Steam at 100 ^{o}C was added to cold water in a calorimeter.
When the steam had condensed, measurements were taken.
The specific latent heat of vaporisation of water was then calculated."

Draw a labelled diagram of the apparatus used. (12)

List two measurements that the student took before adding the steam to the water. (9)

How did the student find the mass of steam that was added to the water? (9)

How did the student make sure that only steam, and not hot water, was added to the calorimeter? (6)

Give one precaution that the student took to prevent heat loss from the calorimeter. (4)

3. You carried out an experiment to measure the focal length of a converging lens.

Draw a labelled diagram of the apparatus that you used in the experiment. (12)

Describe how you found the position of the image formed by the lens. (6)

What measurements did you take? (9)

How did you get a value for the focal length of the converging lens from your measurements? (9)

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

4. In an experiment to measure the resistivity of the material of a wire, a student measured the length, diameter and the resistance of a sample of nichrome wire.

The table shows the measurements recorded by the student.

resistance of the wire / Ω	26.4		
length of the wire / mm	685		
diameter of the wire / mm	0.20	0.19	0.21

(i) Describe how the student measured the resistance of the wire. (6)

(ii) Name the instrument used to measure the diameter of the wire.
Why did the student measure the diameter of the wire in three different places? (12)

(iii) Using the data, calculate the diameter of the wire.
Hence calculate the cross-sectional area of the wire. $(A = \pi r^2)$ (12)

(iv) Calculate the resistivity of nichrome using the formula $\rho = \frac{RA}{L}$. (6)

(v) Give one precaution that the student took when measuring the length of the wire. (4)

SECTION B (280 marks)

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

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

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

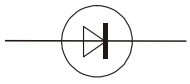
(b) A car accelerates from 10 m s^{-1} to 30 m s^{-1} in 5 seconds.
What is its acceleration? ($v = u + at$). (7)

(c) Which one of the following is the unit of power? (7)
joule **kelvin** **kilogram** **watt**

(d) Name two methods by which heat can be transferred. (7)

(e) A wave motion has a frequency of 5 hz and a wavelength of 200 m.
Calculate the speed of the wave. ($c = f \lambda$) (7)

(f) Infrared radiation is part of the electromagnetic spectrum. Name two other radiations that are part of the electromagnetic spectrum. (7)

(g) Name the electrical component represented in the diagram.  (7)

(h) List two safety devices that are used in domestic electric circuits. (7)

(i) What is the photoelectric effect? (7)

(j) Name a material used as shielding in a nuclear reactor. (7)

6. Define pressure and give the unit of pressure. (12)

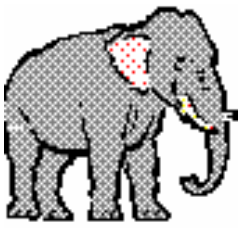
Name an instrument used to measure pressure. (5)

The earth is covered with a layer of air called the atmosphere. What holds this layer of air close to the earth? (6)

Describe an experiment to show that the atmosphere exerts pressure. (12)

The type of weather we get depends on the atmospheric pressure. Describe the kind of weather we get when the atmospheric pressure is high. (6)

The African elephant is the largest land animal.



An elephant weighs 40 000 N and is standing on all four feet each of area 0.2 m^2. Calculate the pressure exerted on the ground by the elephant. (9)

Why would the pressure on the ground be greater if the elephant stood up on just two feet? (6)

($P = F/A$)

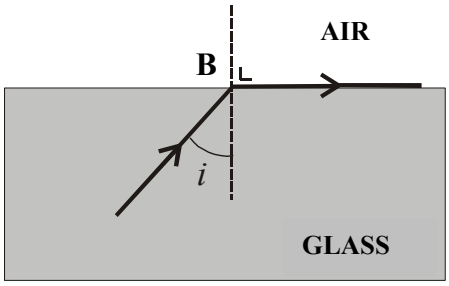
7. Reflection and refraction can both occur to rays of light.

What is meant by the reflection of light?

State the laws of reflection of light. (15)

Describe an experiment to demonstrate one of the laws of reflection of light. (12)

The diagram shows a ray of light travelling from glass to air.
At B the ray of light undergoes refraction.



Explain what is meant by refraction. (6)

What special name is given to the angle of incidence i, when the effect shown in the diagram occurs? (6)

In the diagram the value of the angle i is 41.8^{o}.
Calculate a value for the refractive index of the glass. (6)

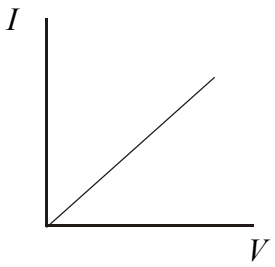
Draw a diagram to show what happens to the ray of light when the angle of incidence i is increased to 45^{o}. (6)

Give one application of the effect shown in the diagram you have drawn. (5)

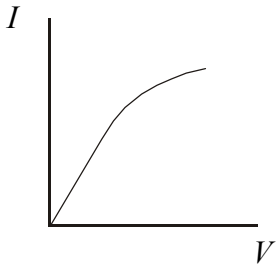
($n = \frac{1}{\sin C}$)

8. State Ohm's Law. (9)

The graphs show how current (I) varies with potential difference (V) for (*a*) a metal, (*b*) a filament bulb.



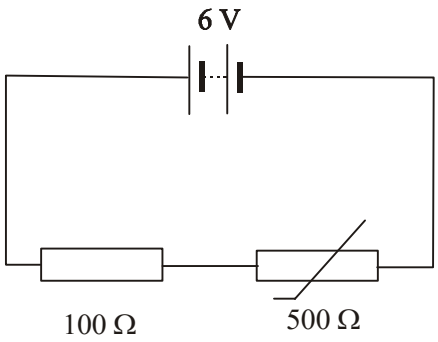
(*a*) a metal



(*b*) a filament bulb

Which conductor obeys Ohm's law? Explain your answer. (12)

The circuit diagram shows a 100 Ω resistor and a thermistor connected in series with a 6 V battery. At a certain temperature the resistance of the thermistor is 500 Ω.



Calculate

(i) the total resistance of the circuit;

(ii) the current flowing in the circuit;

(iii) the potential difference across the 100 Ω resistor. (18)

As the thermistor is heated, what happens to

(iv) the resistance of the circuit?

(v) the potential difference across the 100 Ω resistor? (12)

Give a use for a thermistor. (5)

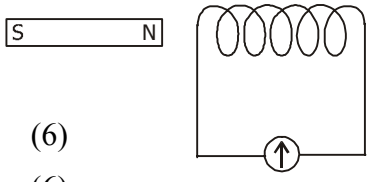
9. What is a magnetic field? (6)

Draw a sketch of the magnetic field around a bar magnet. (9)

Describe an experiment to show that a current carrying conductor in a magnetic field experiences a force.

List two factors that affect the size of the force on the conductor. (18)

A coil of wire is connected to a sensitive galvanometer as shown in the diagram.



What is observed when the magnet is moved towards the coil? (6)

Explain why this occurs. (6)

Describe what happens when the speed of the magnet is increased. (6)

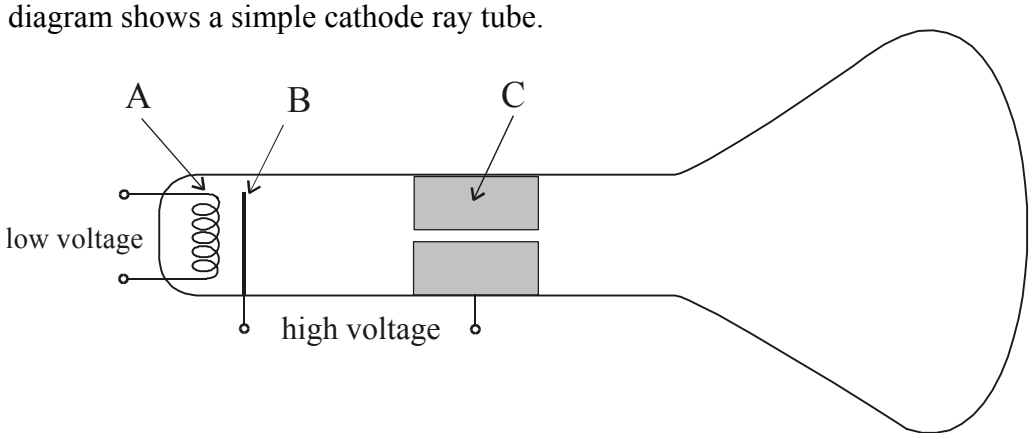
Give one application of this effect. (5)

10. The electron is one of the three main subatomic particles.

Give two properties of the electron.

Name another subatomic particle. (12)

The diagram shows a simple cathode ray tube.



Name the parts labelled A, B and C. (12)

Electrons are emitted from A, accelerated across the tube and strike the screen.

(i) Explain how the electrons are emitted from A. (9)

(ii) What causes the electrons to be accelerated across the tube? (6)

(iii) What happens when the electrons hit the screen? (6)

(iv) How can a beam of electrons be deflected? (6)

(v) Give one use of a cathode ray tube. (5)

11. Read the following passage and answer the accompanying questions.

There are different forms of energy. Fuels such as coal, oil and wood contain chemical energy. When these fuels are burnt, the chemical energy changes into heat and light energy. Electricity is the most important form of energy in the industrialised world, because it can be transported over long distances via cables. It is produced by converting the chemical energy from coal, oil or natural gas in power stations.

In a hydroelectric power station the potential energy of a height of water is released as the water flows through a turbine, generating electricity.

Energy sources fall into two broad groups: renewable and non-renewable. Renewable energy sources are those which replenish themselves naturally and will always be available – hydroelectric power, solar energy, wind and wave power, tidal energy and geothermal energy. Non-renewable energy sources are those of which there are limited supplies and once used are gone forever. These include coal, oil, natural gas and uranium.

(Adapted from the Hutchinson Encyclopaedia of Science, 1998).

(a) Define energy. (7)

(b) What energy conversion takes place when a fuel is burnt? (7)

(c) Name one method of producing electricity. (7)

(d) Give one factor on which the potential energy of a body depends. (7)

(e) What type of energy is associated with wind, waves and moving water? (7)

(f) Give one disadvantage of non-renewable energy sources. (7)

(g) How does the sun produce heat and light? (7)

(h) In Einstein's equation $E = mc^2$, what does c represent? (7)

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

(a) To calibrate a thermometer, a thermometric property and two fixed points are needed.

What does a thermometer measure? (6)

What are the two fixed points on the Celsius scale? (6)

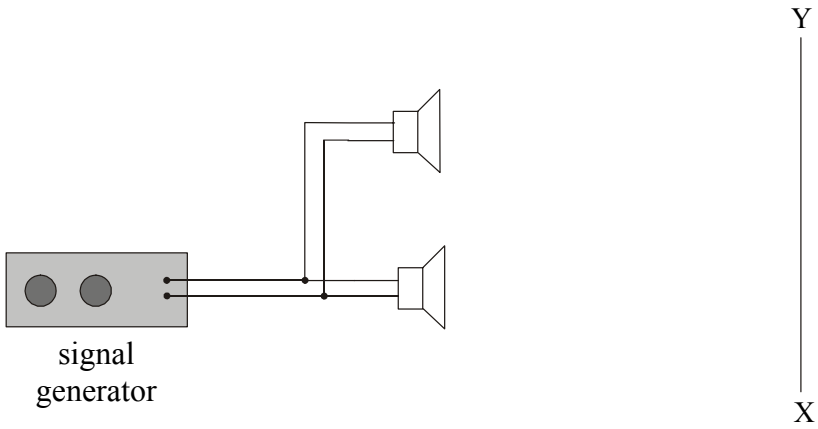
Explain the term thermometric property. (6)

Name the thermometric property used in a mercury thermometer. (6)

Give an example of another thermometric property. (4)

(b) What is meant by (i) diffraction, (ii) interference, of a wave? (12)

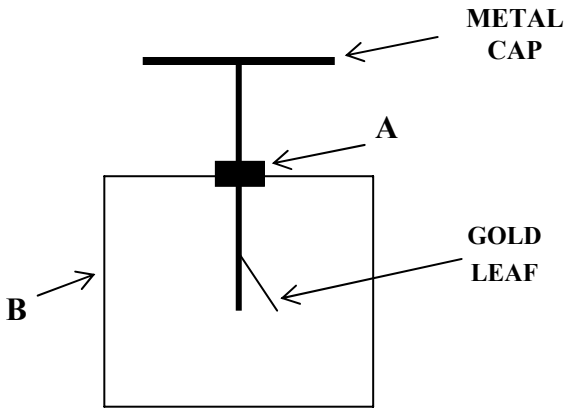
In an experiment, a signal generator was connected to two loudspeakers, as shown in the diagram. Both speakers are emitting a note of the same frequency and same amplitude.



A person walks along the line XY. Describe what the person hears.
What does this experiment demonstrate about the nature of sound? (12)

What is meant by the amplitude of a wave? (4)

(c) The diagram shows a gold leaf electroscope.



Name the parts labelled A and B. (6)

Give one use of an electroscope. (6)

Explain why the gold leaf diverges when a positively charged rod is brought close to the metal cap. (9)

The positively charged rod is held close to the electroscope and the metal cap is then earthed. Explain why the gold leaf collapses. (7)

(d) Na–25 is a radioactive isotope of sodium. It has a half life of 1 minute.

What is meant by radioactivity? (6)

Name a detector of radioactivity. (6)

Explain the term half life. (6)

What fraction of a sample of Na–25 remains after 3 minutes? (6)

Give one use of a radioactive isotope. (4)

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