



**Coimisiún na Scrúduithe Stáit  
State Examinations Commission**

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**LEAVING CERTIFICATE EXAMINATION, 2004**

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**PHYSICS – ORDINARY LEVEL**

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**MONDAY, 21 JUNE – MORNING 9.30 TO 12.30**

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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 verify Boyle's law, a student measured the volume of a gas at different pressures. The table shows the measurements recorded by the student.

Pressure /kPa	100	111	125	143	167	200	250
Volume /cm <sup>3</sup>	5.0	4.5	4.0	3.5	3.0	2.5	2.0
$\frac{1}{\text{volume}}$ /cm <sup>-3</sup>			0.25				

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

Copy this table and fill in the last row by calculating  $\frac{1}{\text{volume}}$  for each measurement. (7)

Plot a graph on graph paper of pressure against  $\frac{1}{\text{volume}}$ . (12)

Explain how your graph verifies Boyle's law. (6)

Give one precaution that the student took in carrying out the experiment. (3)

2. In a report of an experiment to measure the specific heat capacity of a substance (e.g. water *or* a metal), a student wrote the following.

"I assembled the apparatus needed for the experiment.

During the experiment I took a number of measurements of mass and temperature.

I used these measurements to calculate the specific heat capacity of the substance."

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

What measurements of mass did the student take during the experiment? (6)

What temperature measurements did the student take during the experiment? (6)

Give a formula used to calculate the specific heat capacity of the substance. (10)

Give one precaution that the student took to get an accurate result. (6)

3. You carried out an experiment to measure the wavelength of a monochromatic light source.

Name a monochromatic light source. (6)

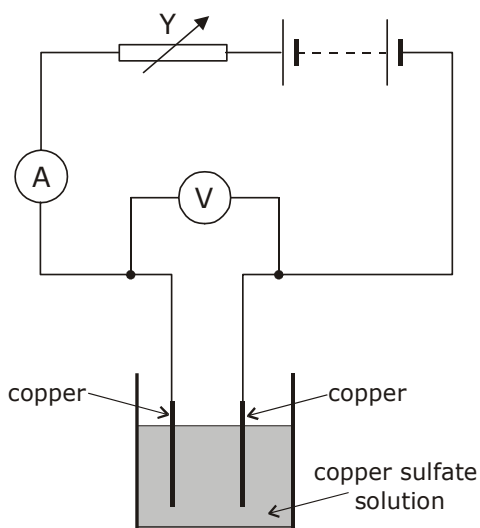
Draw a labelled diagram of the apparatus that you used in the experiment. (12)

What readings did you take during the experiment? (9)

What formula did you use to calculate the wavelength of the light? (9)

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

4. The diagram shows a circuit used to investigate the variation of current with potential difference for a copper sulfate solution.



Name the instrument used to measure the current. (6)

How was the potential difference measured in the experiment? (4)

Name the apparatus Y and give its function in the experiment. (9)

The following table shows the values recorded for the current and the potential difference during the experiment.

Potential Difference/V	0	0.5	1.0	1.5	2.0	2.5	3.0
Current/A	0	0.3	0.6	0.9	1.2	1.5	1.8

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

Calculate the slope of your graph and hence determine the resistance of the copper sulfate solution. (9)

## 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.

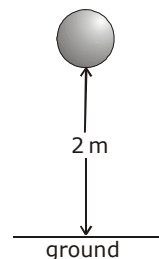
(a) A student holds a metal ball 2 m above the ground.

The mass of the ball is 5 kg.

Calculate the potential energy of the ball.

(7)

( $E_p = mgh$ , acceleration due to gravity,  $g = 9.8 \text{ m s}^{-2}$ )



(b) Explain the term thermometric property.

(7)

(c) Give one application of the Doppler effect.

(7)

(d) Name two primary colours of light.

(7)

(e) Which one of the following is **not** part of the electromagnetic spectrum?

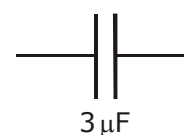
**sound waves**

**microwaves**

**ultraviolet radiation**

(7)

(f) Name the electrical component represented in the diagram.



(7)

(g) Name two safety devices that are used in domestic electric circuits.

(7)

(h) A conductor of length 50 cm is carrying a current of 5 A. It is placed at right angles to a magnetic field of flux density 3 T. Calculate the force on the conductor.

( $F = IlB$ )

(7)

(i) Which one of the following is emitted from a metal surface when suitable light shines on the metal?

**protons**

**neutrons**

**electrons**

**atoms**

(7)

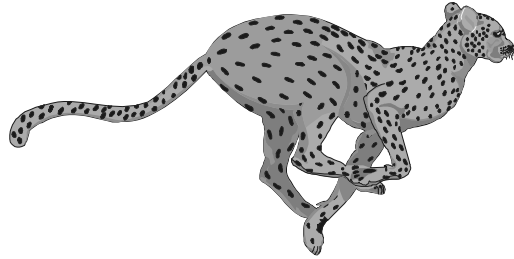
(j) What is nuclear fission?

(7)

6. Define (i) velocity, (ii) acceleration. (12)

Describe an experiment to measure the velocity of a moving object. (12)

The cheetah is one of the fastest land animals.



A cheetah can go from rest up to a velocity of  $28 \text{ m s}^{-1}$  in just 4 seconds and stay running at this velocity for a further 10 seconds.

Sketch a velocity–time graph to show the variation of velocity with time for the cheetah during these 14 seconds. (11)

Calculate the acceleration of the cheetah during the first 4 seconds. (9)

Calculate the resultant force acting on the cheetah while it is accelerating. The mass of the cheetah is 150 kg. (6)

Name two forces acting on the cheetah while it is running. (6)

$$(v = u + at, F = ma)$$

7. Heat can be transferred by conduction. What is meant by conduction? (12)  
Name two other ways of transferring heat. (12)

Describe an experiment to show how different solids conduct heat at different rates. (12)

The  $U$ -value of a house is a measure of the rate of heat loss to the surroundings. (8)  
Give two ways in which the  $U$ -value of a house can be reduced. (8)

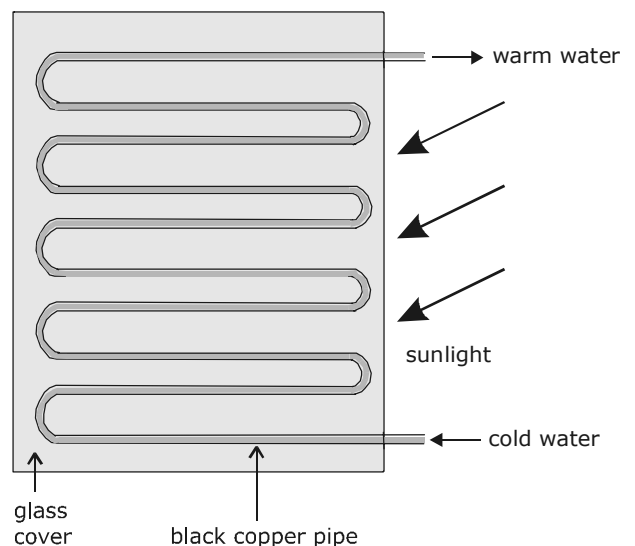
The diagram shows a solar panel (solar heater) which can be used in the heating of a house.

What energy conversion takes place in a solar panel? (6)

(i) Why are the pipes in the solar panel usually made from copper? (6)

(ii) Why are the pipes in the solar panel usually painted black? (6)

(iii) Why does warm water rise to the top of the solar panel? (6)

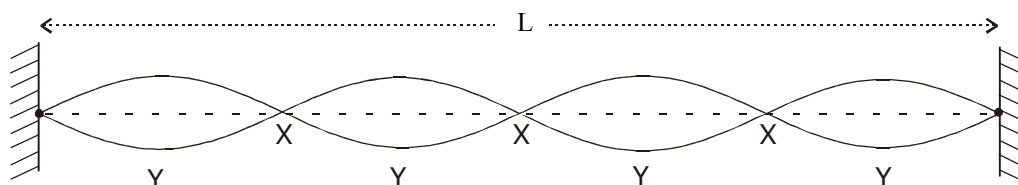


8. Sound from a vibrating object can cause diffraction and interference.

Explain the underlined terms. (12)

Describe an experiment to demonstrate the interference of sound. (11)

The diagram shows a stationary wave (standing wave) on a vibrating stretched string.



What is the name given to the points on the string marked (i) X, (ii) Y?

How many wavelengths are contained in the distance marked L? (15)

State two factors on which the natural frequency of a stretched string depends. (9)

A note of wavelength 1.4 m is produced from a stretched string. If the speed of sound in air is  $340 \text{ m s}^{-1}$ , calculate the frequency of the note. (9)

$$(c = f\lambda)$$

9. What is an electric current?

An electric current can cause a heating effect. Name two other effects of an electric current. (18)

Describe an experiment to show the heating effect of an electric current.

State two factors on which the heating effect of an electric current depends. (18)

An electric heater has a power rating of 2 kW when connected to the ESB mains supply of 230 V. Calculate the current that flows through the heater. (6)

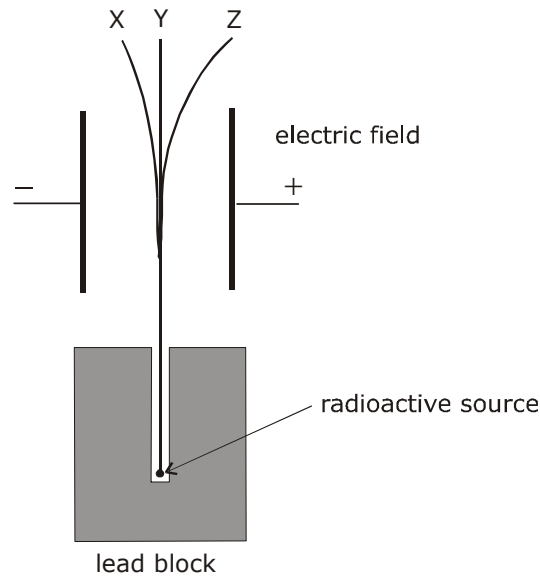
What is the kilowatt-hour? (6)

Calculate the cost of using a 2 kW electric heater for 3 hours at 10 cent per kilowatt-hour. (8)

$$(P = VI)$$

10. What is radioactivity? (9)  
Name the French physicist who discovered radioactivity in 1896. (6)

The diagram illustrates that three types of radiation are emitted from a radioactive source.



- Name the radiations labelled (i) X, (ii) Y, (iii) Z, in the diagram.  
Which one is the most ionising? (18)

- Name a detector of ionising radiation.  
Outline the principle on which the detector works. (12)

Great care has to be taken when dealing with radioactive sources.

Give:

- (i) two precautions that should be taken when dealing with radioactive sources;
- (ii) one use of a radioactive source;
- (iii) one harmful effect of radiation. (11)

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

Optical fibres are made of very transparent glass or plastic. The fibres contain at least two layers. Guiding light in an optical fibre depends on how light travels through different media. Light waves are bent, or refracted, as they pass between materials of different refractive index. The amount of bending depends on the refractive index and the angle at which light strikes the surface.

Sometimes light cannot leave the material of higher refractive index. If it strikes the surface at a large enough angle, it is reflected back into the material. The critical angle, for what is called total internal reflection, depends on the difference in refractive indexes. An optical fibre guides light by using total internal reflection.

(Adapted from New Scientist, 13 October 1990)

- (a) Draw a diagram to show how a ray of light is transmitted through an optical fibre. (7)
- (b) How is the escape of light from the sides of an optical fibre prevented? (7)
- (c) Name a material that is used in the manufacture of optical fibres. (7)
- (d) What is the bending of light as it moves from one medium to another called? (7)
- (e) What is meant by the refractive index of a material? (7)
- (f) Define the critical angle. (7)
- (g) When will total internal reflection occur? (7)
- (h) Give one use for optical fibres. (7)

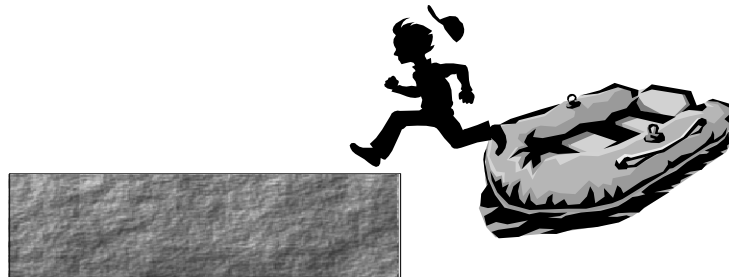


12. Answer any **two** of the following parts (a), (b), (c), (d).

(a) Define momentum. Give the unit of momentum. (9)

State the principle of conservation of momentum. (9)

The diagram shows a child stepping out of a boat onto a pier. The child has a mass of 40 kg and steps out with an initial velocity of  $2 \text{ m s}^{-1}$  towards the pier. The boat, which was initially at rest, has a mass of 50 kg. Calculate the initial velocity of the boat immediately after the child steps out. (10)



$$(p = mv)$$

(b) A concave mirror can produce a real or a virtual image, depending on the position of the object.

Give one difference between a real image and a virtual image. (6)

Use a ray diagram to show the formation of a real image by a concave mirror. (6)

A concave mirror has a focal length of 20 cm. An object is placed 30 cm in front of the mirror. How far from the mirror will the image be formed? (10)

Give two uses for a concave mirror. (6)

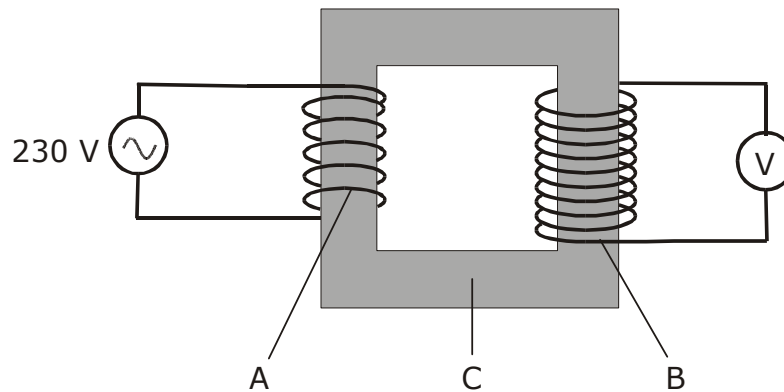
$$\left( \frac{1}{f} = \frac{1}{u} + \frac{1}{v} \right)$$

(c) A transformer is a device based on the principle of electromagnetic induction.

What is electromagnetic induction?

Name another device that is based on electromagnetic induction. (9)

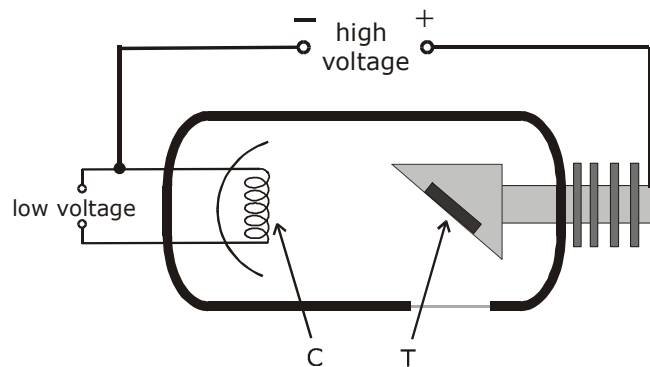
Name the parts of the transformer labelled A, B and C in the diagram. (9)



Part A has 400 turns of wire and part B has 1200 turns. Part A is connected to a 230 V a.c. supply. What is the voltage across part B? (10)

$$\left( \frac{V_i}{V_o} = \frac{N_p}{N_s} \right)$$

(d) The diagram shows an X-ray tube.



What are X-rays? (6)

How are electrons emitted from the cathode C? (6)

What is the function of the high voltage across the X-ray tube? (6)

Name a suitable material for the target T in the X-ray tube.  
Give one use of X-rays. (10)

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