WARNING: You must return this section with your answer-book otherwise marks will be lost.

Write Your Examination Number here

AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA

LEAVING CERTIFICATE EXAMINATION, 1998

PHYSICS — ORDINARY LEVEL

THURSDAY, 18 JUNE — AFTERNOON 2.00 to 5.00

Answer **all** questions in Section A.

Answer **two** questions from Section B and **three** questions from Section C.

SECTION A (120 marks)

Answer each question in this section.
Each question carries the same number of marks.
Write your answers in the spaces provided.
Write your examination number at the top.
Be sure to return this section of the examination paper, enclosing it in the answer-book you use in answering Sections B and C.

1. Answer *five* of the following items, (i), (ii), (iii), etc. In the case of each item write the letter corresponding to the correct answer in the box provided.

(i) The momentum of a car of mass 1000 kg moving with a velocity of 20 m s^{-1} is

A. 0.5 kg m s^{-1}
B. 50 kg m s^{-1}
C. 200 kg m s^{-1}
D. 20 000 kg m s^{-1}
E. 200 000 kg m s^{-1}.

Answer ☐ (6)

(ii) The unit of power is

A. the farad
B. the joule
C. the watt
D. the pascal
E. the tesla.

Answer ☐ (6)

(iii) An astronomical telescope contains

A. a diverging lens and a prism
B. a converging lens and a prism
C. two prisms
D. two diverging lenses
E. two converging lenses.

Answer ☐ (6)

(iv) All types of radiation in the electromagnetic spectrum

A. are detected by the human eye
B. are deflected in a magnetic field
C. travel at the same speed in a vacuum
D. cannot travel through a vacuum
E. have the same frequency.

Answer ☐ (6)

(v) Faraday's first law of electrolysis may be written as $m = zIt$. In this equation z is

A. the gravitational constant
B. the electrochemical equivalent
C. the electronic charge
D. the current
E. the voltage.

Answer ☐ (6)

(vi) The diagram, Fig. 1, shows a machine for generating electric charge at very high voltages. The machine is named after

A. Nicholas Callan
B. Michael Faraday
C. Robert van de Graaff
D. E. T. S. Walton
E. André Ampère.

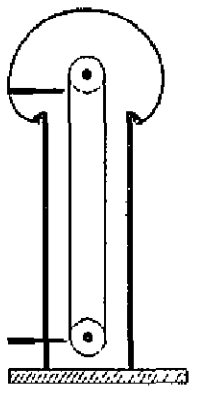

Fig. 1

Answer ☐ (6)

2. Answer *five* of the following.

(i) Give two examples of scalar quantities.

1. .....

2. ..... (6)

(ii) State one of Newton's laws of motion. .....

..... (6)

(iii) The graph in Fig. 2 was obtained in an experiment to verify Boyle's law.

Clearly label the X and Y axes. (6)

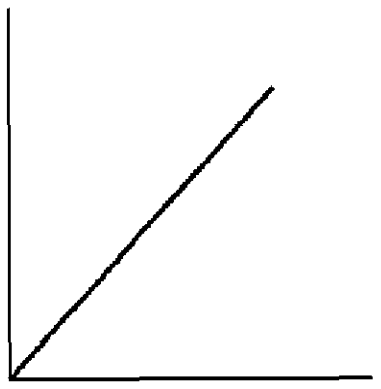

Fig. 2

(iv) Name two of the primary colours.

1. .....

2. ..... (6)

(v) In Einstein's equation $E = mc^2$ what does c stand for? .....

..... (6)

(vi) The photoelectric effect is the emission of .....from the surface

of a metal by ..... (6)

3. Answer *five* of the following.

(i) What is meant by a thermometric property?.....

..... (6)

(ii) The arrangement shown in Fig. 3 can be used as a thermometer. What is the thermometric property on which this type of thermometer is based?

..... (6)

(iii) When the arrangement shown in Fig. 3 is being used as a thermometer the galvanometer shows a deflection if junction A

is either ..... or

..... than junction B. (6)

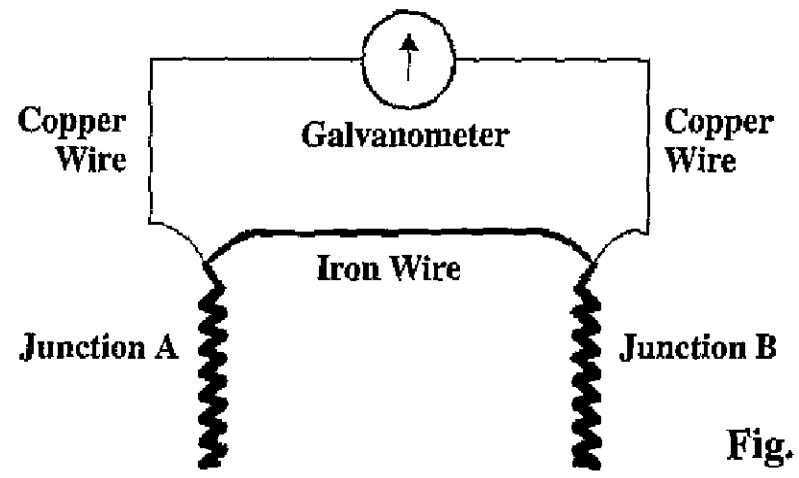

Fig. 3

(iv) On the Celsius temperature scale the two fixed points are the..... of water and the ..... of water. (6)

(v) The temperature of a beaker of water on the Celsius scale is 20 °C. What is the temperature of the water on the Kelvin scale? ..... (6)

(vi) A solid is heated until it melts. While it is melting its ..... does not change. (6)

4. Answer *five* of the following.

(i) Name a commonly used semiconductor material. ..... (6)

(ii) What is a p-n junction?.....

..... (6)

(iii) Draw a labelled diagram showing the structure of either a bipolar transistor or a unipolar (field effect) transistor. (6)

(iv) Draw the symbol for either a bipolar transistor or a unipolar (field effect) transistor. (6)

(v) Give one application of a transistor. .....

..... (6)

(vi) The brighter the light shining on a light-dependent resistor the..... its resistance. (6)

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PHYSICS — ORDINARY LEVEL

Section A is on a separate sheet which provides spaces for your answers. The completed sheet should be enclosed in your answer-book.

Write your answers to Sections B and C in your answer-book.

SECTION B (80 marks)

Answer **two** of the questions from this section.

Each question carries the same number of marks.

5. In a laboratory experiment the velocity of a body was measured at various times. The following table shows the data obtained in the experiment.

Velocity/m s^{-1}	0.38	0.70	1.04	1.40	1.78	2.12	2.46	2.80
Time/s	0	1.5	3.0	4.5	6.0	7.5	9.0	10.5

(i) Draw a labelled diagram showing how the apparatus might have been arranged in this experiment. (9)

(ii) Using the above data draw a graph on graph paper of velocity against time. (18)

(iii) From the graph find the acceleration of the body. (12)

6. In an experiment to determine the focal length of a concave mirror an object was placed at different positions in front of the mirror so that a real image was produced in each case. The following values for the object distance and the image distance were obtained.

Object distance, u/cm	15	25	35
Image distance, v/cm	28.9	16.6	14.2

(i) Sketch a diagram to show how the apparatus might have been arranged in this experiment. (9)

(ii) Explain how the position of the image might have been found in each case. (12)

(iii) Using the formula $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$, or otherwise, use the above data to find an average value for the focal length, f, of the mirror. (18)

7. The following is part of a student's report of an experiment to measure the resistivity of nichrome.

"The length and resistance of the wire were measured. The diameter of the wire was found at different points along its length."

(i) Name the instrument which would have been used to measure the diameter of the wire. (6)

(ii) Give the steps involved in finding the length of the wire. (9)

(iii) The four values obtained for the diameter of the wire were:

1.8×10^{-4} m; 1.9×10^{-4} m; 1.7×10^{-4} m; 2.0×10^{-4} m.

From these values calculate an average value for the diameter of the wire. (6)

(iv) The length of the wire, l, was found to be 1.26 m and the resistance of the wire, R, was found to be 52.4 Ω.

Use the equation $R = \frac{\rho l}{A}$ to calculate a value for the resistivity of nichrome. (18)

SECTION C (200 marks)

Answer **three** questions from this section.

Each question carries the same number of marks.

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8. (*a*) Explain the term coefficient of static friction. (6)

Fig. 4 shows a block of weight W resting on a rough horizontal surface. The block is acted upon by a horizontal force T as shown in the diagram. The block is on the point of moving.

As well as W and T two other forces act on the block. One of these forces is equal in magnitude to W and one is equal in magnitude to T.

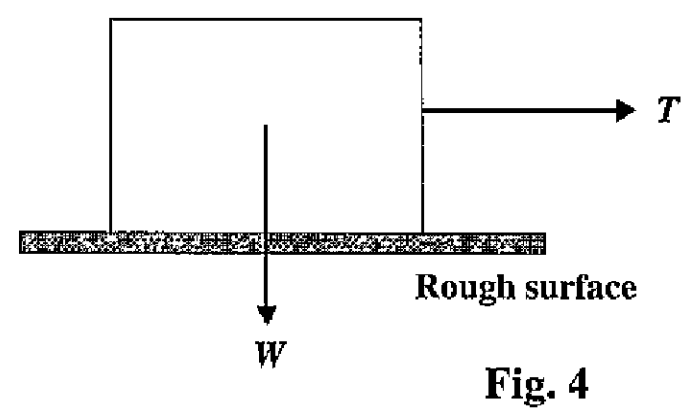

Fig. 4

Copy the diagram in Fig. 4. Name the other two forces and show their positions on the diagram. (12)

Given that the mass of the block is 8.0 kg find the value of W. Hence calculate the coefficient of static friction between the block and the surface, given that T equals 40 N. (Take $g = 9.8$ m s^{-2}.) (15)

(*b*) State the principle of conservation of energy. (6)

A car of mass 1200 kg is moving with a velocity of 15 m s^{-1}. What is the kinetic energy of the car? (9)

The car is brought to a stop by applying the brakes. Calculate the force needed to bring the car to a stop in a distance of 50 m. (12)

Name the main form of energy into which the kinetic energy of the car is converted as it is brought to a stop. (6)

9. "All waves may show diffraction and interference effects but not all waves may be polarised."

Explain the underlined terms. (18)

What type of wave is a sound wave? (6)

Describe a laboratory experiment to measure the speed of sound in air. (24)

Fig. 5 represents a wave motion. What is (i) the amplitude, (ii) the wavelength, of the wave? (6)

If it takes the wave in Fig. 5 a time of 0.5 s to travel a distance of one wavelength calculate:

(i) the velocity of the wave;

(ii) the frequency of the wave. (12)

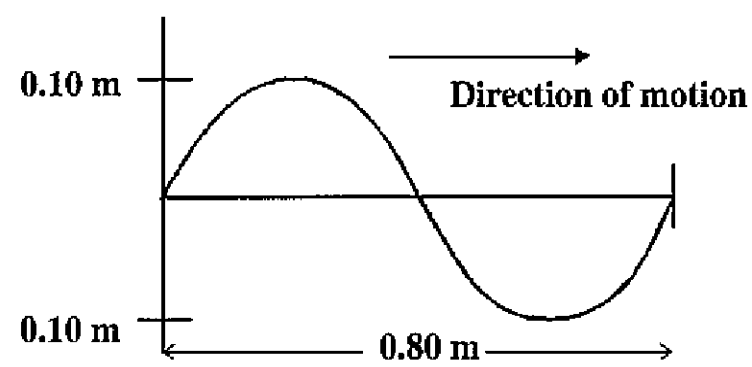

Fig. 5

10. (*a*) State Coulomb's law of force between electric charges. (9)

Draw a labelled diagram of a gold leaf electroscope and explain how it may be used to show that a particular object is a conductor. (24)

(*b*) Define potential difference. (9)

Calculate the work done in transferring a charge of 6 C from one point to another when the potential difference between the points is 4 V. (9)

Calculate the total resistance of the two resistors shown in Fig. 6. (9)

Calculate the total current flowing through the resistors when the voltmeter registers 2.8 V. (6)

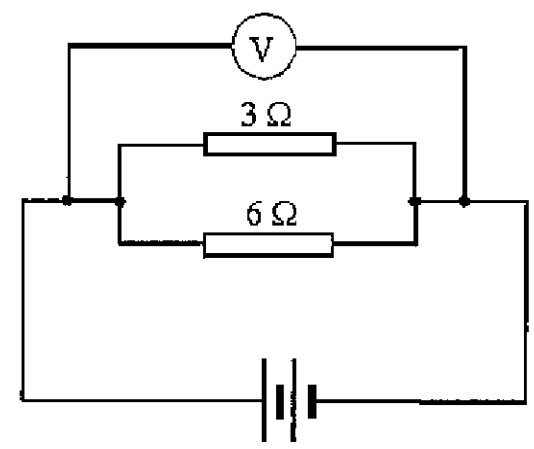

Fig. 6

11. Describe an experiment to show the magnetic field due to a current in a solenoid. (12)

Fig. 7 shows an electromagnetic relay in a circuit with a battery and an electric motor, M.

Explain why the motor is switched on when the terminals of the coil are connected to a battery or power supply. (15)

Why does the coil of the relay have an iron core? (6)

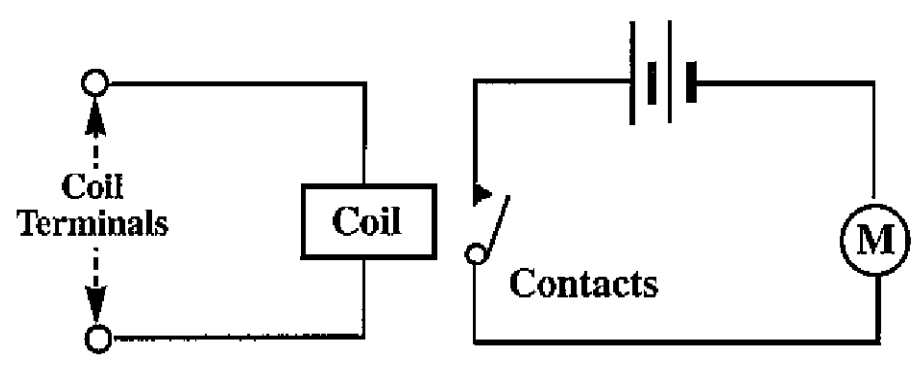

Fig. 7

An electric motor operates on the principle that a current-carrying conductor in a magnetic field experiences a force. Describe an experiment to demonstrate this principle. (12)

Name three parts of an electric motor and give the function of one of these parts. (15)

Name another device which operates on the same principle as the electric motor. (6)

12. "Some nuclei are radioactive. They disintegrate into smaller nuclei and emit various types of radiation. The half-life of a radioactive substance may be a tiny fraction of a second or many billions of years."

Explain the underlined terms. (12)

Name three types of radiation that may be emitted by radioactive nuclei. Of the three, state which type of radiation is the most ionising and which is the most penetrating. (15)

Describe an experiment to measure the half-life of a short-lived radioactive isotope. (24)

State how artificial radioactive isotopes (radio-isotopes) are produced and give two uses of these isotopes. (15)

13. Answer any *two* of the following.

(a) Explain what is meant by the refraction of light and give one example. (12)

Describe an experiment to measure the refractive index of a liquid *or* a solid. (21)

(*b*) State three methods by which heat energy may be transferred. (9)

Give a brief explanation of each of the methods which you have named. (18)

How may the U-value of a structure be reduced? (6)

(*c*) State one of the laws of electromagnetic induction and outline an experiment to demonstrate it. (18)

When the primary coil of a transformer is connected to a 220 V supply the voltage in the secondary coil is 10 V. Calculate the number of turns in the secondary coil if there are 1320 turns in the primary. (9)

Give one use of transformers in the home. (6)

(*d*) Give two properties of electrons. (6)

Describe how a beam of electrons may be produced in a cathode ray tube. (15)

Fig. 8 shows a beam of electrons passing between two horizontal metal plates and onto a screen. State what will be observed on the screen if a voltage is applied between the plates and give another method of achieving the same effect. (12)

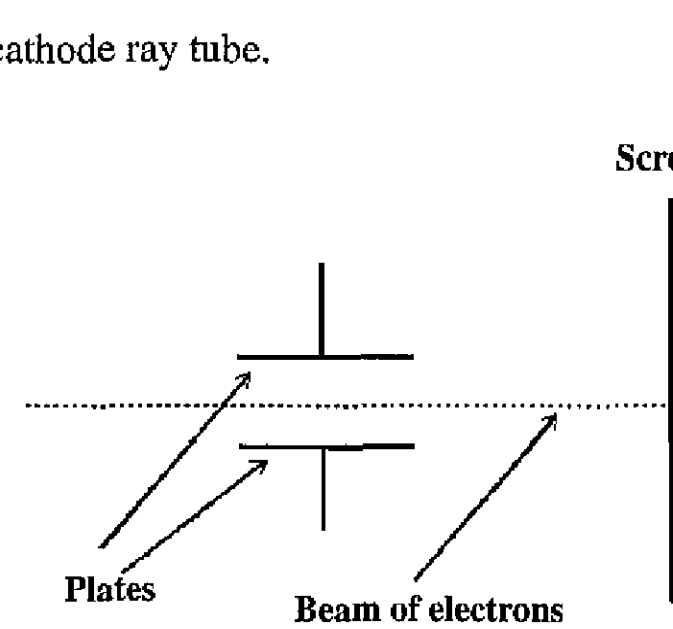

Fig. 8