Centre Number	Candidate Number

Candidate Name _____

CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Ordinary Level

PHYSICS 5054/2

PAPER 2 Theory

MAY/JUNE SESSION 2002

1 hour 45 minutes

Candidates answer on the question paper.
Additional materials:
Answer paper

TIME 1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and on any separate answer paper used.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.

Write your answers on the lined pages provided and, if necessary, continue on the separate answer paper provided.

At the end of the examination, fasten any separate answer paper used securely to the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

Candidates are reminded that **all** quantitative answers should include appropriate units.

Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of physics than for correct answers.

FOR EXAMINER'S USE	
Section A	
Section B	
Q9	
Q10	
Q11	
TOTAL	

This question paper consists of 13 printed pages and 3 lined pages.

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Local Examinations Syndicate

[Turn over

Section A

Answer **all** the questions in this section.

1 Fig. 1.1 shows a car travelling at 30 m/s on a level road. At this speed the car has to overcome a total force of 600 N opposing the car.

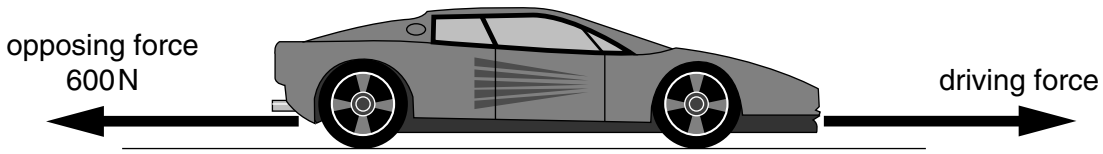

Fig. 1.1

(a) (i) Calculate the distance travelled by the car in 10 s.

distance = ...

(ii) State the value of the driving force produced by the engine for a steady speed of 30 m/s.

.....
[2]

(b) Explain why the car slows down when it climbs a hill, even though the driving force is unchanged.

.....

.....

.....[1]

(c) While on the level road and travelling at 30 m/s, the driving force becomes zero. The mass of the car is 800 kg. Calculate the deceleration of the car.

deceleration = ...[2]

2 The mass of air in a classroom is 500 kg. The density of air is 1.2 kg/m^3.

(a) (i) Define the term *density*.

.....

.....

.....

(ii) Calculate the volume of air in the classroom.

volume = ...
[3]

(b) At the start of the day the temperature of the air in the classroom is 18 °C. Calculate the energy needed to raise the temperature of the air in the classroom from 18 °C to 30 °C. The specific heat capacity of air is 970 J/(kg °C).

State clearly the formula that you use in your calculation.

energy = ...[3]

[Turn over

3 Fig. 3.1 shows an electric kettle used to heat water to its boiling point.

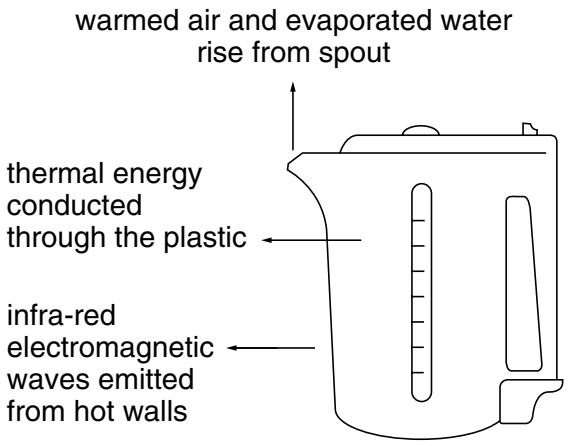

Fig. 3.1

(a) Describe, in terms of the motion of particles, how thermal energy is conducted through the walls of the kettle.

.....

.....

.....

.....[2]

(b) Infra-red waves are emitted from the hot walls of the kettle.

State one use of infra-red waves in the home, other than for heating.

.....

.....[1]

(c) Water may evaporate or boil inside the kettle.

Explain the differences between boiling and evaporation.

.....

.....

.....

.....

.....[3]

4 Fig.4.1 shows three wavefronts in a beam of yellow light passing through air. The wavefronts are one wavelength apart. The beam meets a glass surface. AB is a ray of light that shows the direction of travel of the wavefronts.

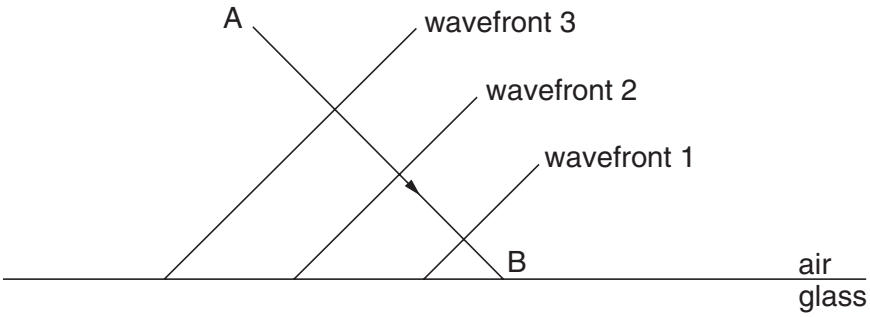

Fig. 4.1

(a) Complete Fig. 4.1 by

(i) continuing the ray AB to show the ray inside the glass,

(ii) continuing wavefront 1 inside the glass. [2]

(b) State what happens to the speed and wavelength of the waves as the beam moves from the air to the glass.

(i) speed .....

(ii) wavelength .....[2]

(c) The beam of yellow light in Fig. 4.1 is replaced with a beam of red light.

Describe two ways in which the completed Fig. 4.1 would change.

1. .....

.....

2. .....

.....[2]

[Turn over

5 Fig. 5.1 shows an electrical circuit.

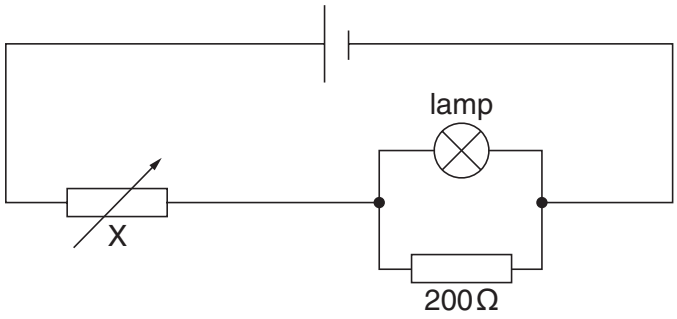

Fig. 5.1

(a) State the name of component X.

.....[1]

(b) Fig. 5.2 shows the graph of current against potential difference for the lamp.

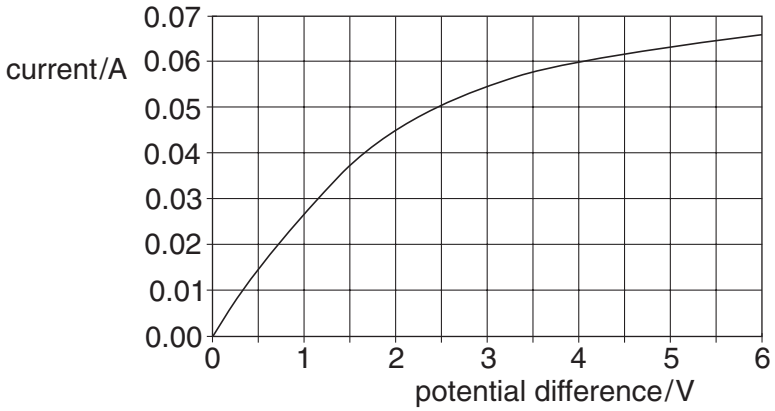

Fig. 5.2

The potential difference across the lamp is 2.5 V. Determine

(i) the current in the lamp,

current = ...

(ii) the current in the 200 Ω resistor,

current = ...

(iii) the current in component X.

current = ...
[5]

6 Fig. 6.1 shows a crane lifting some bricks during the building of a house.

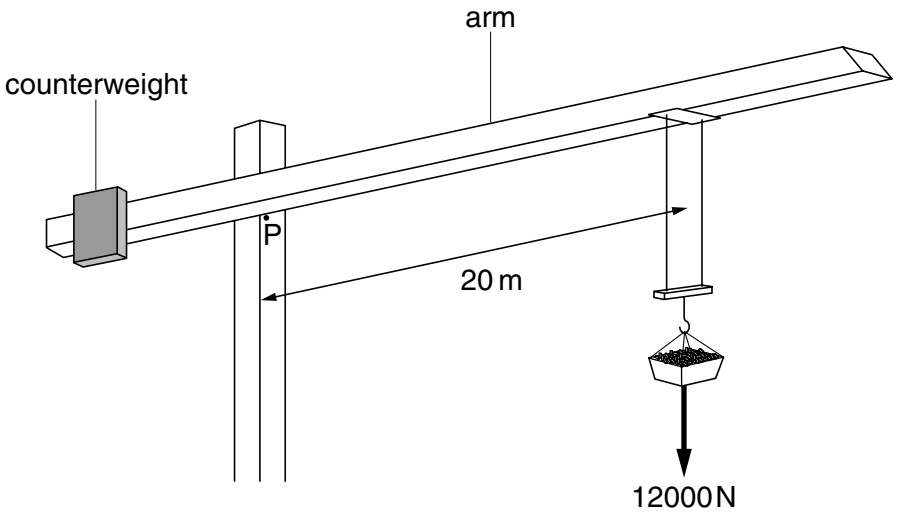

Fig. 6.1

The weight of the bricks produces a turning effect, or moment, on the arm of the crane about the point P. The weight of the bricks is 12000 N.

(a) Calculate the moment of this force, using the distance marked on Fig. 6.1.

moment = ...[2]

(b) (i) Explain why the counterweight is necessary.

.....

.....

.....

(ii) Suggest one advantage of being able to move the counterweight along the arm.

.....

.....
[2]

(c) Calculate the useful work done by the crane in lifting the 12000 N load through a height of 15 m.

work = ...[2]

[Turn over

7 A normal eye can focus light from a near object and from a far object. In this question you may ignore refraction of light at the cornea, as shown in Fig. 7.1.

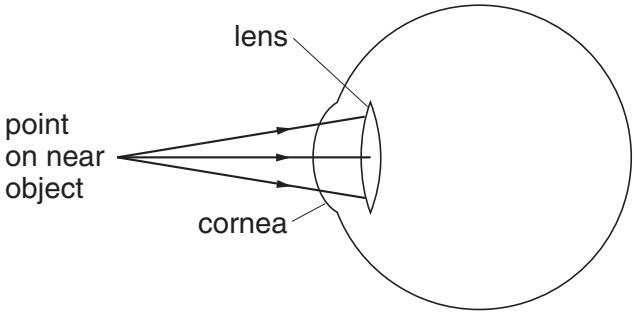

Fig. 7.1

(a) Fig. 7.1 shows rays of light from a near object hitting the lens of a normal eye.

(i) Complete Fig. 7.1 to show how the lens of the eye focuses the rays of light.

(ii) Describe the image formed on the back of the eye. Tick the correct boxes.

real	☐	larger than object	☐	upside down	☐
virtual	☐	smaller than object	☐	right way up	☐

[3]

(b) A short-sighted person can see near objects clearly but not far objects.
Fig. 7.2 shows how the lens of an eye with this defect would focus rays from a far object.

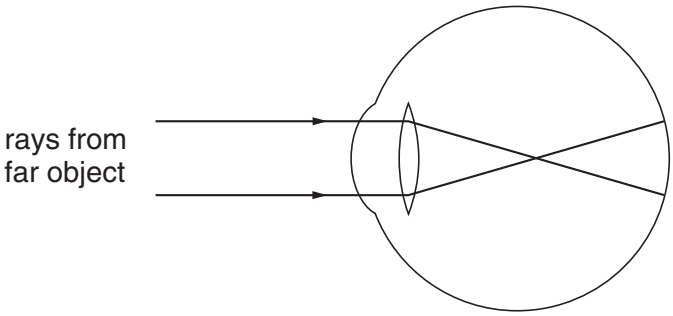

Fig. 7.2

(i) State what type of lens is used to correct this defect.

.....

(ii) On Fig. 7.3, show how this type of lens is used to focus rays from the far object.

[3]

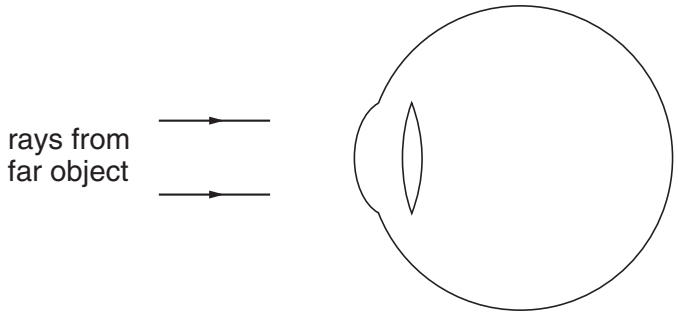

Fig. 7.3

8 One method of painting a metal panel uses electrostatic charges. A paint spray produces paint droplets, all of which are given a positive charge. The metal panel is given a negative charge, as shown in Fig. 8.1.

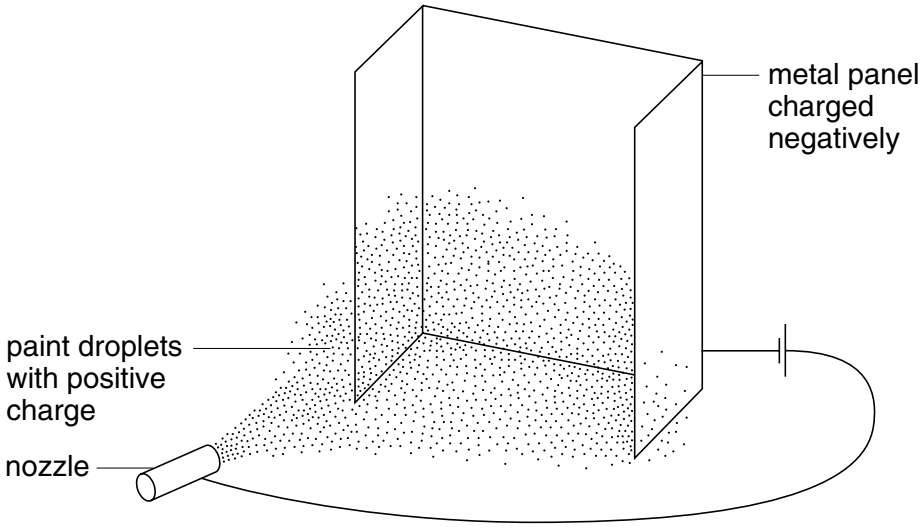

Fig. 8.1

(a) State the effect that charges have on each other.

(i) like charges .....

(ii) unlike charges .....
[1]

(b) **(i)** Explain why the droplets spread out as they leave the nozzle in Fig. 8.1.

.....

.....

(ii) Explain why it is important that the metal panel has a negative charge.

.....

.....
[2]

(c) State one advantage of using electrostatics in this way to paint the metal panel.

.....

.....

.....[1]

Section B

Answer **two** questions from this section.

Use the lined pages provided and, if necessary, continue on the separate sheets available from the Supervisor.

9 A coal-fired power station produces electricity by burning coal.
Fig. 9.1 shows the block diagram of the power station.

(a)

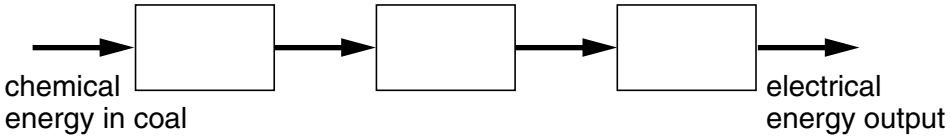

Fig. 9.1

Each of the boxes should contain one of the three labels *turbine*, *generator* or *boiler*.

(i) Copy the block diagram in Fig. 9.1 and label the boxes.

(ii) Describe the useful energy changes that occur in each box of the block diagram.

(iii) Burning coal can cause problems in the area around the power station. State one of these problems.

[5]

(b) Coal is a non-renewable source of energy.

(i) Explain what is meant by *non-renewable*.

(ii) State two other non-renewable sources of energy.

(iii) State two renewable sources of energy.

[5]

(c) A power station provides 300 kW of electrical power and wastes 900 kW as thermal energy produced in its operation.

(i) Calculate the efficiency of the power station. State clearly the equation that you use.

(ii) Calculate the electrical energy output from the power station in one hour. State clearly the equation that you use and give your answer in joules.

[5]

[Turn over

10 Mains electrical circuits contain fuses or circuit breakers.

(a) **(i)** State the purpose of a fuse in a circuit and explain how it works.

(ii) An electric kettle rated at 2000 W is connected to a 230 V mains supply.
Calculate the current in the kettle and suggest a suitable fuse rating.

[7]

(b) Fig. 10.1 shows a design for a simple circuit breaker.

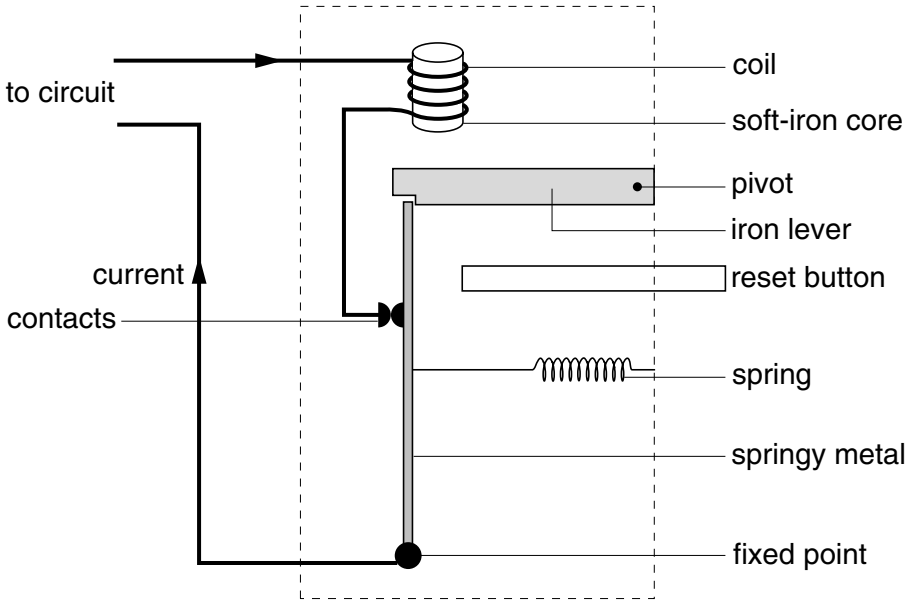

Fig. 10.1

(i) When there is a large current in the circuit, the circuit breaker operates.
Explain what happens to the soft-iron core, iron lever, spring and contacts. [4]

(ii) The current now stops.
Explain what happens to the soft-iron core, iron lever, spring and contacts. [3]

(iii) State how the current is switched on again after the circuit breaker has operated. [1]

11 Table 11.1 gives details about some radioactive isotopes.

radioactive isotope	type of radiation emitted	half-life
Uranium-238	alpha-particle	4.5×10^9 years
Uranium-235	alpha-particle	7.1×10^8 years
Carbon-14	beta-particle	5600 years
Strontium-90	beta-particle	28 years
Cobalt-60	gamma-ray	5 years
Technetium-99	gamma-ray	6 hours

Table 11.1

(a) (i) Uranium-235 has a proton number (atomic number) of 92 and a nucleon number (mass number) of 235.
Describe the structure of an atom of Uranium-235. [4]

(ii) Uranium-235 and Uranium-238 are isotopes.
Explain what is meant by this statement. [2]

(iii) Uranium-235 can be involved in nuclear fission.
Describe what happens to a nucleus in nuclear fission. [3]

(iv) When the Earth was formed there was about 64 times more Uranium-235 present than there is now. Use this information to estimate the age of the Earth. [3]

(b) Radioactive sources are used to detect leaks from pipes underground.
A liquid containing the source is placed in the pipe. Some liquid leaks from the pipe and the radiation it emits can be detected above ground.

(i) State the most suitable radioactive isotope in Table 11.1 for this purpose.

(ii) Explain why the half-life of the isotope you have chosen and the radiation it emits are suitable for this purpose. [3]

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