UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

4203780552

PHYSICS **0625/31**

Paper 3 Extended **October/November 2011**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = 10 m / s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **15** printed pages and **1** blank page.

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1 **(a)** Define *acceleration*. Explain any symbols in your definition.

.....

.....[1]

(b) Fig. 1.1 shows a graph of speed against time for a train. After 100 s the train stops at a station.

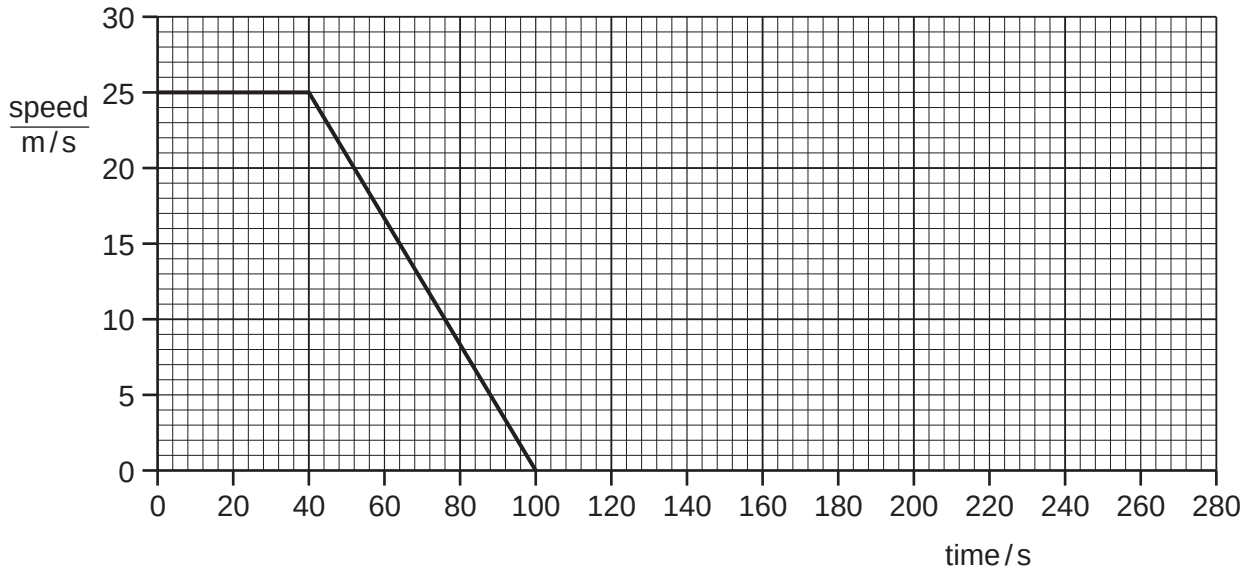


Fig. 1.1

(i) For the time interval between 40 s and 100 s, calculate the distance travelled by the train.

distance = ...[2]

(ii) The train stops for 80 s, then accelerates to 30 m/s with an acceleration of 0.60 m/s^2. It then travels at constant speed.

Complete the graph for the interval 100 s to 280 s, showing your calculations in the space below.

[5]

[Total: 8]

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2 **(a)** Energy from the Sun evaporates water from the sea. Some of this water eventually drives a hydroelectric power station. Give an account of the processes and energy changes involved.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

(b) In a hydroelectric power station, 200 000 kg of water per second fall through a vertical distance of 120 m. The water passes through turbines to generate electricity, and leaves the turbines with a speed of 14 m / s.

(i) Calculate the gravitational potential energy lost by the water in 1 second. Use $g = 10\,m/s^2$.

potential energy lost = ...[2]

(ii) Calculate the kinetic energy of the water leaving the turbines in 1 second.

kinetic energy = ...[2]

[Total: 8]

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3 **(a)** State the two conditions required for the equilibrium of a body acted upon by a number of forces.

1. .....

.....

2. .....

.....[2]

(b) Fig. 3.1 shows a diagram of an arm with the hand holding a weight of 120 N.

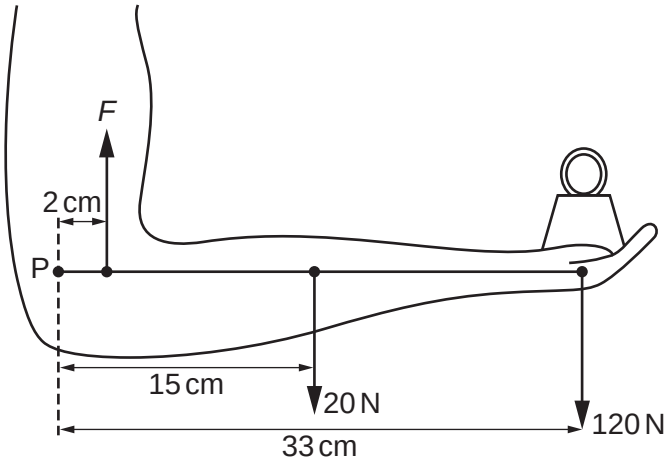


Fig. 3.1

The 20 N force is the weight of the forearm, acting at its centre of mass. *F* is the force in the muscle of the upper arm. P is the point in the elbow about which the arm pivots. The distances of the forces from point P are shown.

(i) By taking moments about point P, calculate the force *F*.

force *F* = ...[3]

(ii) A force acts on the forearm at point P. Calculate this force and state its direction.

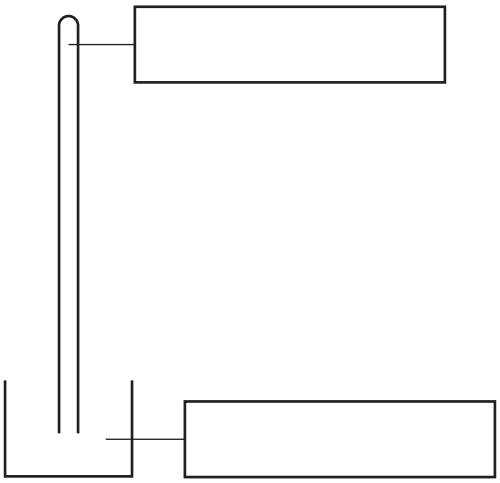
force = ...

direction = ...[2]

[Total: 7]

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4 **(a)** Complete Fig. 4.1 to show a simple mercury barometer. Insert the correct labels in the boxes. Label with the letter *h* the measurement required to calculate the pressure of the atmosphere.



[3]

Fig. 4.1

(b) The value of *h* taken using this barometer is 0.73 m. The density of mercury is 13 600 kg / m^3. Calculate the value of the atmospheric pressure suggested by this measurement. Use $g = 10\,m/s^2$.

atmospheric pressure = ...[2]

(c) Standard atmospheric pressure is 0.76 m of mercury. Suggest a reason why the value of *h* in **(b)** is lower than this.

.....

.....[1]

[Total: 6]

5 **(a)** Equal volumes of a gas held at constant pressure, a liquid and a solid undergo the same temperature rise.

(i) State which of the three, solid, liquid or gas,

1. expands the most, ...

2. expands the least. .....

(ii) Explain why the pressure of the gas must be kept constant for this comparison.

.....

.....[2]

(b) Fig. 5.1 shows an alcohol thermometer.

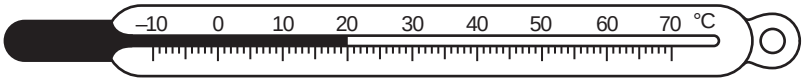


Fig. 5.1

(i) State two properties of alcohol which make it suitable for use in a thermometer.

1. .....

.....

2. .....

.....[2]

(ii) State **two** changes to the design of this thermometer which would make it more sensitive.

1. .....

.....

2. .....

.....[2]

(c) Explain why it is an advantage for the glass surrounding the alcohol in the bulb of the thermometer to be very thin.

.....

.....[1]

[Total: 7]

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6 **(a)** Fig. 6.1 shows the position of layers of air, at one moment, as a sound wave of constant frequency passes through the air. Compressions are labelled C. Rarefactions are labelled R.



Fig. 6.1

(i) State how Fig. 6.1 would change if

1. the sound had a higher frequency,

.....[1]

2. the sound were louder.

.....

.....

.....[2]

(ii) On Fig. 6.1, draw a line marked with arrows at each end to show the wavelength of the sound. [1]

(b) In an experiment to measure the speed of sound in steel, a steel pipe of length 200 m is struck at one end with a hammer. A microphone at the other end of the pipe is connected to an accurate timer. The timer records a delay of 0.544 s between the arrival of the sound transmitted by the steel pipe and the sound transmitted by the air in the pipe.

The speed of sound in air is 343 m / s. Calculate the speed of sound in steel.

speed of sound in steel = ...[3]

[Total: 7]

7 **(a)** Fig. 7.1 shows a ray of monochromatic red light, in air, incident on a glass block at an angle of incidence of 50°.

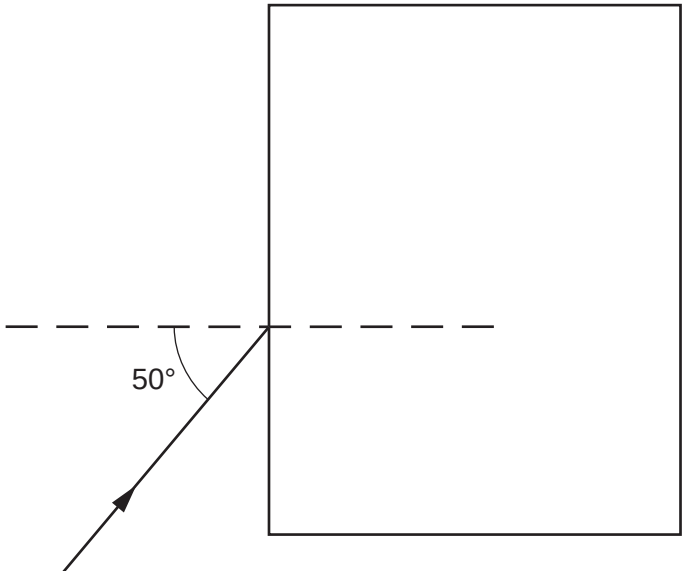


Fig. 7.1

(i) State what is meant by *monochromatic* light.

.....[1]

(ii) For this red ray the refractive index of the glass is 1.52. Calculate the angle of refraction for the ray.

angle of refraction = ...[2]

(iii) Without measuring angles, use a ruler to draw the approximate path of the ray in the glass block and emerging from the block. [2]

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(b) The red ray in Fig. 7.1 is replaced by a ray of monochromatic violet light. For this violet ray the refractive index of the glass is 1.54. The speed of light in air is 3.00×10^8 m/s.

(i) Calculate the speed of the violet light in the glass block.

speed = ...[2]

(ii) Use a ruler to draw the approximate path of this violet ray in the glass block and emerging from the block. Make sure this path is separated from the path drawn for the red light in **(a)(iii)**. Mark both parts of this path with the letter V. [2]

[Total: 9]

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8 **(a)** In Fig. 8.1, a magnet is moving towards one end of a solenoid connected to a sensitive centre-zero meter. During this movement a current is induced in the solenoid.

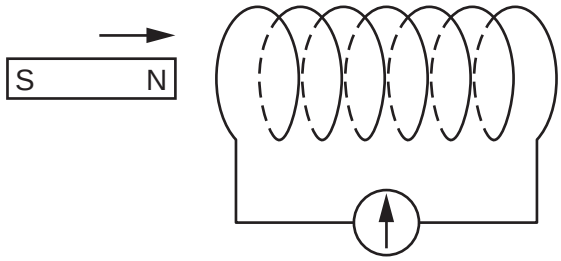


Fig. 8.1

Suggest **three** possible changes to the system in Fig. 8.1 that would increase the induced current.

1. .....

2. .....

3. .....[3]

(b) Fig. 8.2 shows a transformer. P is the primary coil. S is the secondary coil. The coils are wound on an iron core.

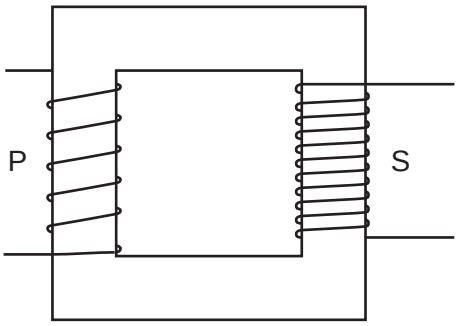


Fig. 8.2

P has 200 turns and S has 800 turns. The e.m.f. induced across S is 24 V. The current in S is 0.50 A. The transformer operates with 100% efficiency.

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Calculate

(i) the voltage of the supply to P,

voltage = ...[2]

(ii) the current in P.

current = ...[2]

[Total: 7]

9 The graphs in Fig. 9.1 show the relation between the current *I* and the potential difference *V* for a resistor and a lamp.

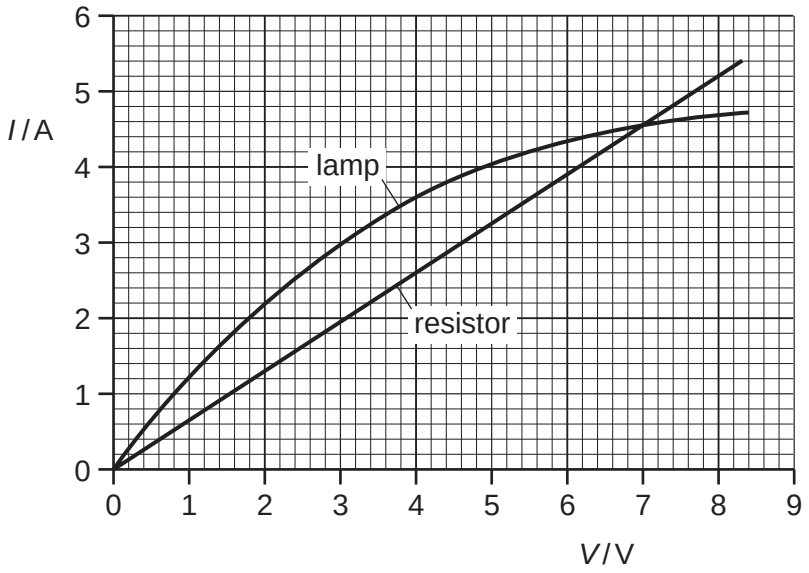


Fig. 9.1

(a) (i) Describe how, if at all, the resistance varies as the current increases in

1. the resistor, ...

2. the lamp. .....[2]

(ii) State the value of the potential difference when the resistor and the lamp have the same resistance.

potential difference = ...[1]

(b) The two components are connected **in parallel** to a supply of e.m.f. 4.0 V. Calculate the total resistance of the circuit.

total resistance = ...[4]

[Total: 7]

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10 (a) In Fig. 10.1, A is a 1000 Ω resistor, C is a transistor, and D is a lamp. S is a 9 V supply.

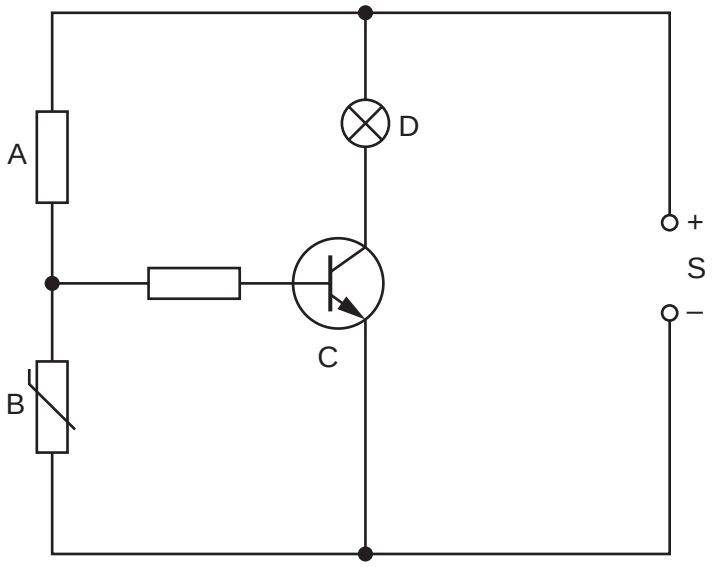


Fig. 10.1

(i) Name the component labelled B.

.....[1]

(ii) At 20 °C the resistance of B is 800 Ω.
At 100 °C the resistance of B is 25 Ω.

In terms of the p.d. across B, explain what happens in the circuit as the temperature varies from 20 °C to 100 °C.

.....

.....

.....

.....

.....

.....[4]

(b) Suggest a practical use for this circuit.

.....

.....[1]

[Total: 6]

11 Fig. 11.1 shows the main components of a cathode-ray oscilloscope.

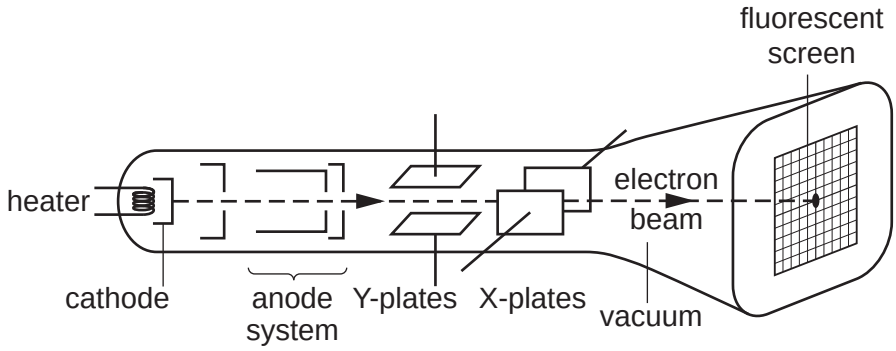


Fig. 11.1

(a) State the purpose of

(i) the heater,

.....

.....

(ii) the cathode,

.....

.....

(iii) the anode system.

.....

.....

.....

[4]

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(b) Without deflection, the electron beam produces a spot at the centre of the fluorescent screen. A deflection of the spot towards the top of the screen is required.

(i) Describe how the Y-plates can be used to bring about this deflection.

.....

.....

(ii) Fig. 11.2 shows the Y-plates.



Fig. 11.2

On Fig. 11.2, sketch the pattern of the electric field produced between the plates.

[4]

[Total: 8]

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