UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

6422850785

PHYSICS **0625/31**

Paper 3 Extended **May/June 2013**

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 or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total	

This document consists of **20** printed pages.

For Examiner's Use

1 **(a)** Define *density*.

....

.... [1]

(b) The density of aluminium is 2.70 g / cm^3. The thickness of a rectangular sheet of aluminium foil varies, but is much less than 1 mm.

A student wishes to find the average thickness. She obtains the following measurements.

mass of sheet = 60.7 g
length of sheet = 50.0 cm
width of sheet = 30.0 cm

Calculate the student's values for

(i) the volume of the sheet,

volume = ... [2]

(ii) the average thickness of the sheet.

thickness = ... [2]

(c) Another student, provided with a means of cutting the sheet, decides to find its average thickness using a single measuring instrument. Assume the surfaces of the sheet are perfectly smooth.

(i) Name a measuring instrument she could use.

.... [1]

(ii) Describe the procedure she should follow to obtain an accurate value of the average thickness of the sheet.

Details of how to read the instrument are not required.

....

....

....

....

....

.... [3]

[Total: 9]

For Examiner's Use

For Examiner's Use

2 **(a)** Underline the vectors in the following list of quantities.

density energy force mass velocity volume [2]

(b) A small metal ball is projected into the air with a velocity of 40 m / s vertically upwards.

The graph in Fig. 2.1 shows how the velocity changes with time until the ball reaches its maximum height.

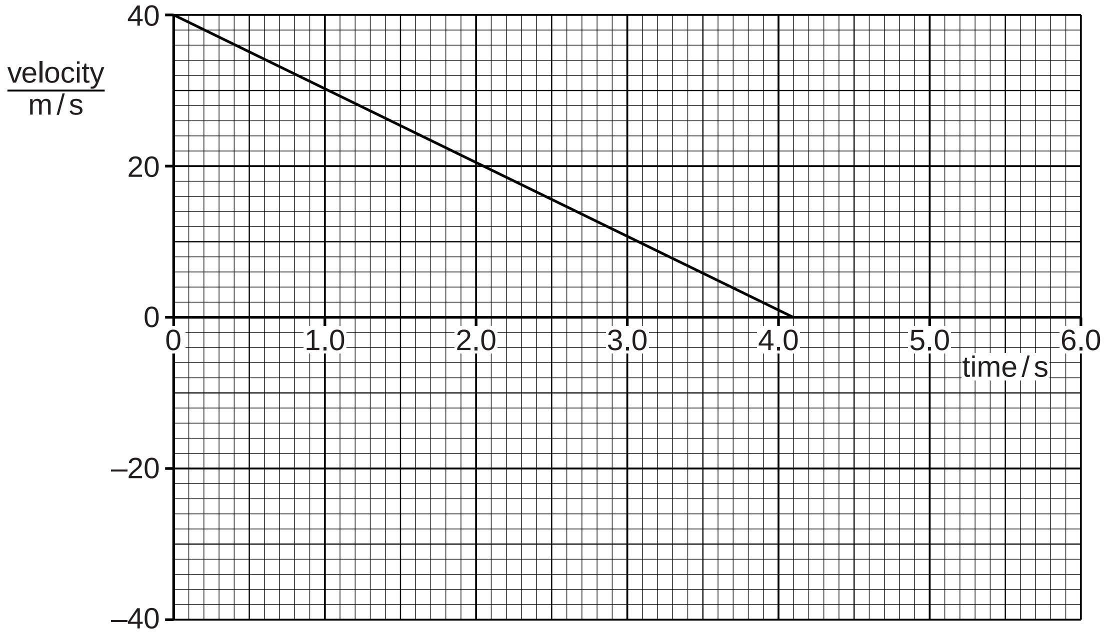

Fig. 2.1

Use the graph to find,

(i) the time at which the ball reaches its maximum height,

time = ... [1]

(ii) the deceleration of the ball,

deceleration = ... [2]

(iii) the maximum height reached by the ball.

For Examiner's Use

maximum height = ... [2]

(c) On Fig. 2.1, add a line to the graph to show how the velocity of the ball changes after it reaches its maximum height. Your line should extend to time 6.0 s. [1]

[Total: 8]

3 Fig. 3.1 shows the descent of a sky-diver from a stationary balloon.

For Examiner's Use

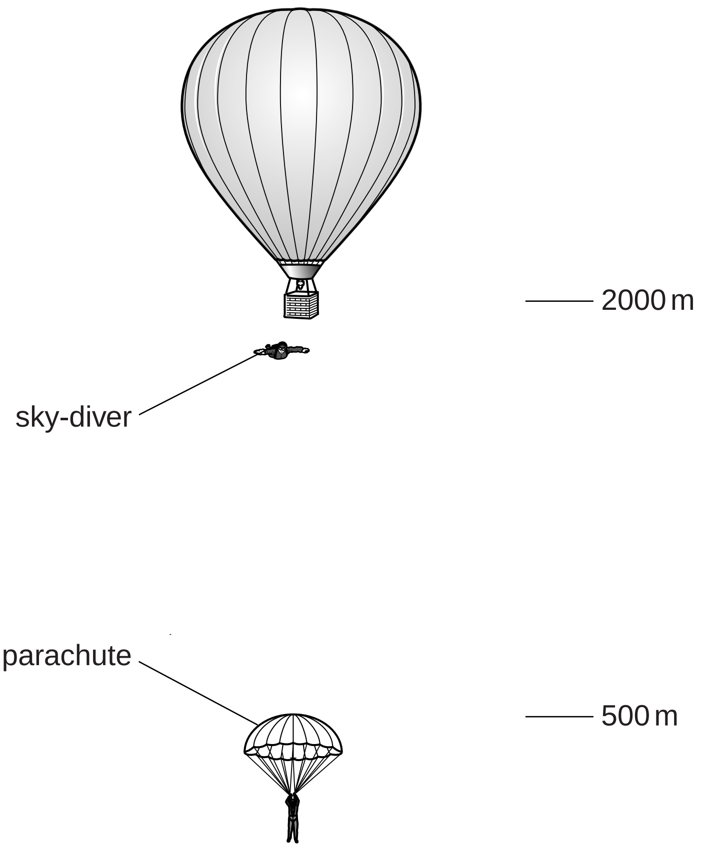

Fig. 3.1 (not to scale)

The sky-diver steps from the balloon at a height of 2000 m and accelerates downwards.

His speed is 52 m/s at a height of 500 m.

He then opens his parachute. From 400 m to ground level, he falls at constant speed.

(a) The total mass of the sky-diver and his equipment is 92 kg.

(i) Calculate, for the sky-diver,

1. the loss of gravitational potential energy in the fall from 2000 m to 500 m,

loss of gravitational potential energy = ... [2]

2. the kinetic energy at the height of 500 m.

kinetic energy = ... [2]

(ii) The kinetic energy at 500 m is not equal to the loss of gravitational potential energy. Explain why there is a difference in the values.

For Examiner's Use

....

....

.... [1]

(b) State

(i) what happens to the air resistance acting on the sky-diver during the fall from 2000 m to 500 m,

.... [1]

(ii) the value of the air resistance during the fall from 400 m to ground.

air resistance = ... [1]

[Total: 7]

4 Fig. 4.1 shows a cross-section of a double-walled glass vacuum flask, containing a hot liquid. The surfaces of the two glass walls of the flask have shiny silvered coatings.

For Examiner's Use

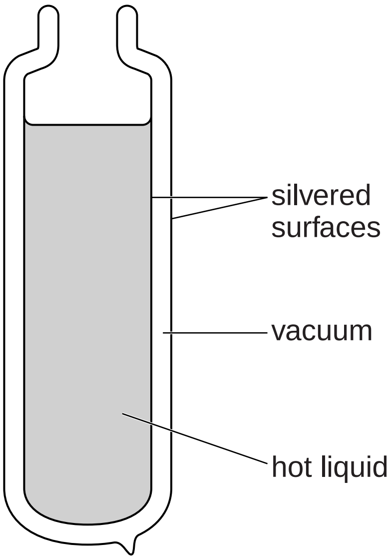

Fig. 4.1

(a) Explain

(i) why the rate of loss of thermal energy through the walls of the flask **by conduction** is very low,

....

....

....

....

(ii) why the rate of loss of thermal energy through the walls of the flask **by radiation** is very low.

....

....

....

....

[3]

(b) Suggest, with reasons, what must be added to the flask shown in Fig. 4.1 in order to keep the liquid hot.

For Examiner's Use

....

....

....

....

....[3]

[Total: 6]

For Examiner's Use

5 **(a)** On a hot day, sweat forms on the surface of a person's body and the sweat evaporates.

Explain, in terms of the behaviour of molecules,

(i) the process of evaporation,

....

....

....

(ii) how this process helps the body to cool down.

....

....

....

....

....

....
[3]

(b) The temperature of a person of mass 60 kg falls from 37.2 °C to 36.7 °C.

(i) Calculate the thermal energy lost from the body. The average specific heat capacity of the body is 4000 J / (kg °C).

thermal energy lost = ... [2]

(ii) The cooling of the body was entirely due to the evaporation of sweat.

Calculate the mass of sweat which evaporated. The specific latent heat of vaporisation of sweat is 2.4×10^6 J/kg.

For Examiner's Use

mass = ... [2]

[Total: 7]

6 **(a)** **(i)** Define *pressure*.

....[1]

(ii) A closed box contains a gas.

Explain, in terms of molecules, how the gas exerts a pressure on the walls of the box.

....

....

....

....

....[3]

(b) Fig. 6.1 shows a flask connected to a pump and also to a manometer containing mercury.

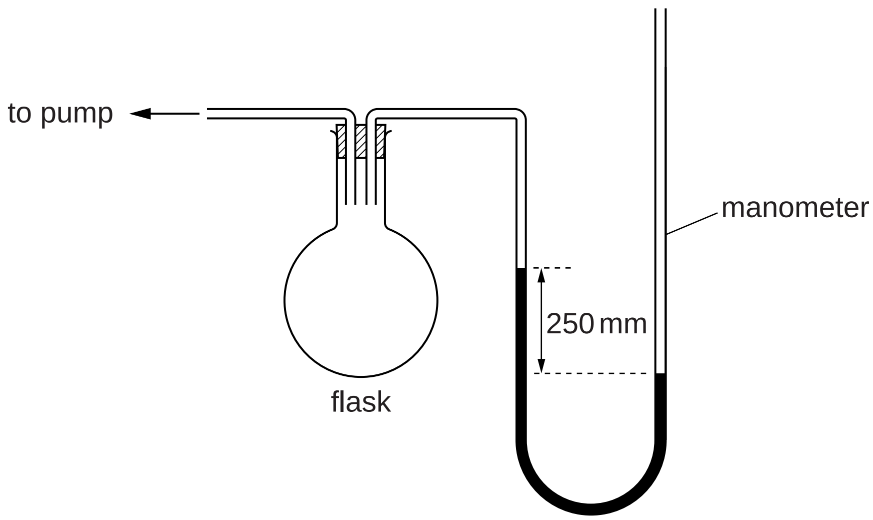

Fig. 6.1

The right-hand tube of the manometer is open to the atmosphere.

The pump has been operated so that the mercury levels differ, as shown, by 250 mm. The density of mercury is 13 600 kg / m^3.

(i) Calculate the pressure, in Pa, due to the 250 mm column of mercury.

pressure = ...[2]

(ii) The pressure of the atmosphere is 1.02×10^5 Pa.

Calculate the pressure of the air in the flask.

For Examiner's Use

pressure = ... [1]

[Total: 7]

7 Fig. 7.1 shows the principal axis PQ of a converging lens and the centre line XY of the lens.

For Examiner's Use

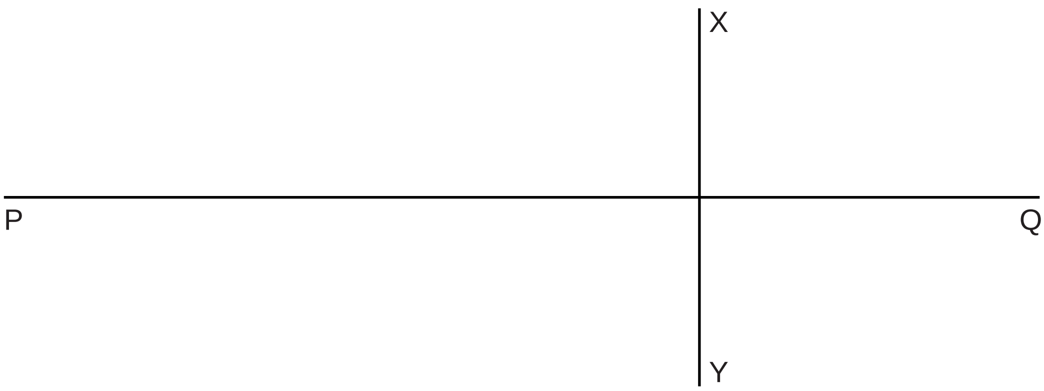

Fig. 7.1

An object 2.0 cm high is placed 2.0 cm to the left of the lens. The converging lens has a focal length of 3.0 cm.

(a) On Fig. 7.1, draw a full-scale diagram to find the distance of the image from the lens, and the height of the image.

distance of image from the lens = ...

height of image = ...
[5]

(b) State and explain whether the image in **(a)** is real or virtual.

....

....[1]

[Total: 6]

For Examiner's Use

For Examiner's Use

8 **(a)** State the range of frequencies of sound which can be heard by a healthy human ear.

.... [1]

(b) Compressions and rarefactions occur along the path of sound waves.

State, in terms of the behaviour of molecules, what is meant by

(i) a *compression*,

....

....

(ii) a *rarefaction*.

....

....
[2]

(c) State the effect on what is heard by a listener when there is

(i) an increase in the amplitude of a sound,

.... [1]

(ii) a decrease in the wavelength of a sound.

.... [1]

(d) A student carries out an experiment to find the speed of sound in air.

He stands facing a high cliff and shouts. He hears the echo 1.9 s later.

He then walks 250 m further away from the cliff and shouts again, hearing the echo 3.5 s later.

Calculate the speed of sound given by this experiment.

speed = ... [3]

[Total: 8]

For Examiner's Use

9 Fig. 9.1 shows the circuit that operates the two headlights and the two sidelights of a car.

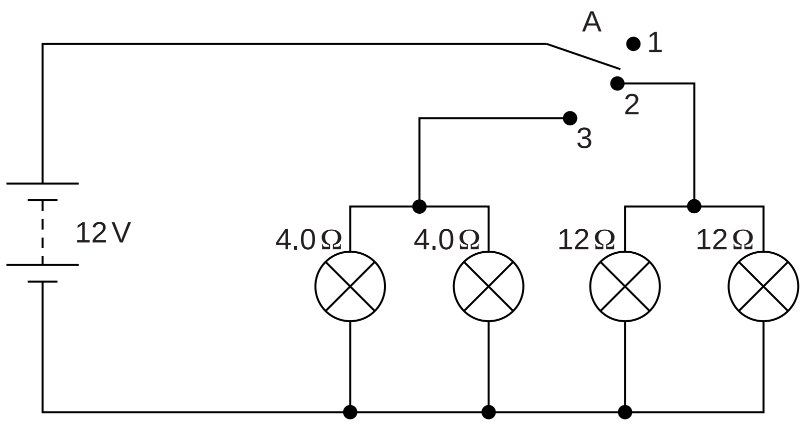

Fig. 9.1

Two of the lamps have resistances of 4.0 Ω when lit. The other two lamps have resistances of 12 Ω when lit. Switch A can be connected to positions 1, 2 or 3.

(a) State what happens when switch A is connected to

(i) position 1, ...

(ii) position 2, ...

(iii) position 3. ....
[1]

(b) **(i)** State the potential difference across each lamp when lit.

potential difference = ... [1]

(ii) Calculate the current in each 12 Ω lamp when lit.

current = ... [2]

(c) Show, with reasons for your answer, which type of lamp, 4.0 Ω or 12 Ω, has the higher power.

....

....

....

.... [3]

[Total: 7]

10 (a) Fig. 10.1 shows the cross-section of a wire carrying a current into the plane of the paper.

Fig. 10.1

On Fig. 10.1, sketch the magnetic field due to the current in the wire. The detail of your sketch should suggest the variation in the strength of the field. Show the direction of the field with arrows. [3]

(b) Fig. 10.2 shows part of a model of a d.c. motor.

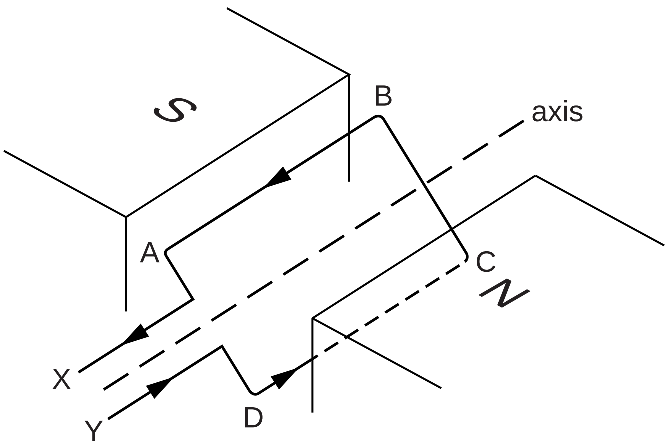

Fig. 10.2

A loop of wire ABCD is placed between the poles of a magnet. The loop is free to rotate about the axis shown. There is a current in the loop in the direction indicated by the arrows.

(i) On Fig. 10.2, draw arrows to show the directions of the forces acting on side AB and on side CD of the loop. [1]

(ii) With the loop in the position shown in Fig. 10.2, explain why the forces on AB and CD cause the loop to rotate about the axis.

....

....

....

....[1]

(iii) The ends X and Y of the loop are connected to a battery using brushes and a split-ring commutator.

State why a split-ring commutator is used.

....

....

....

....[2]

[Total: 7]

Turn over for Question 11

For Examiner's Use

For Examiner's Use

11 **(a)** Complete the following statements.

(i) An α-particle consists of ....

(ii) A β-particle consists of ....
[3]

(b) As α-particles and β-particles pass through a gas, molecules of the gas become ionised.

Explain what is meant by the *ionisation* of a gas molecule.

....

....[1]

(c) Fig. 11.1 shows a beam of α-particles and a beam of β-particles in a vacuum. The beams are about to enter a region in which a very strong magnetic field is acting. The direction of the magnetic field is into the page.

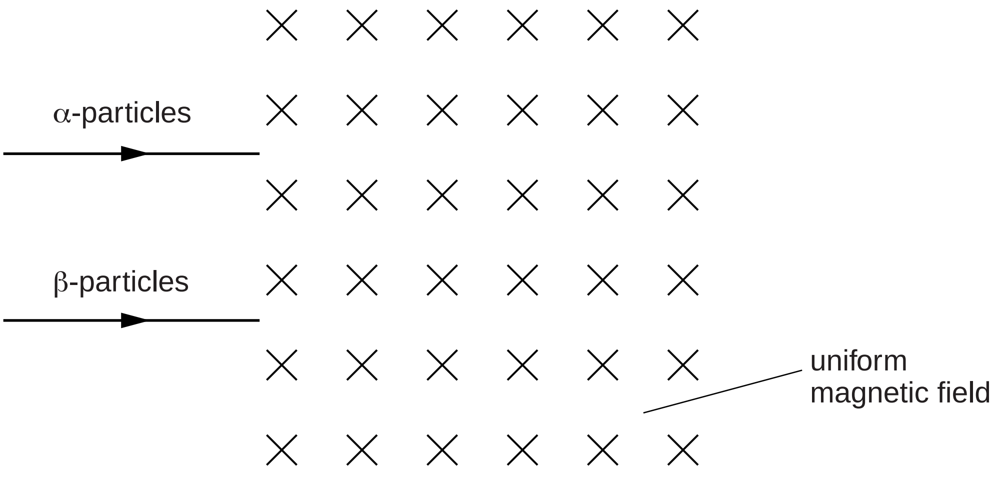

Fig. 11.1

(i) Suggest why the paths of the particles in the magnetic field are curved.

....[1]

(ii) Sketch the paths of both types of particle in the magnetic field. [3]

[Total: 8]