UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

PHYSICS **0625/33**

Paper 3 Extended **October/November 2012**

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.
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 **12** printed pages.

1 A brick is dropped from the top of a very tall building as it is being constructed.

For Examiner's Use

Fig. 1.1 is the speed / time graph for the brick as it falls to the ground.

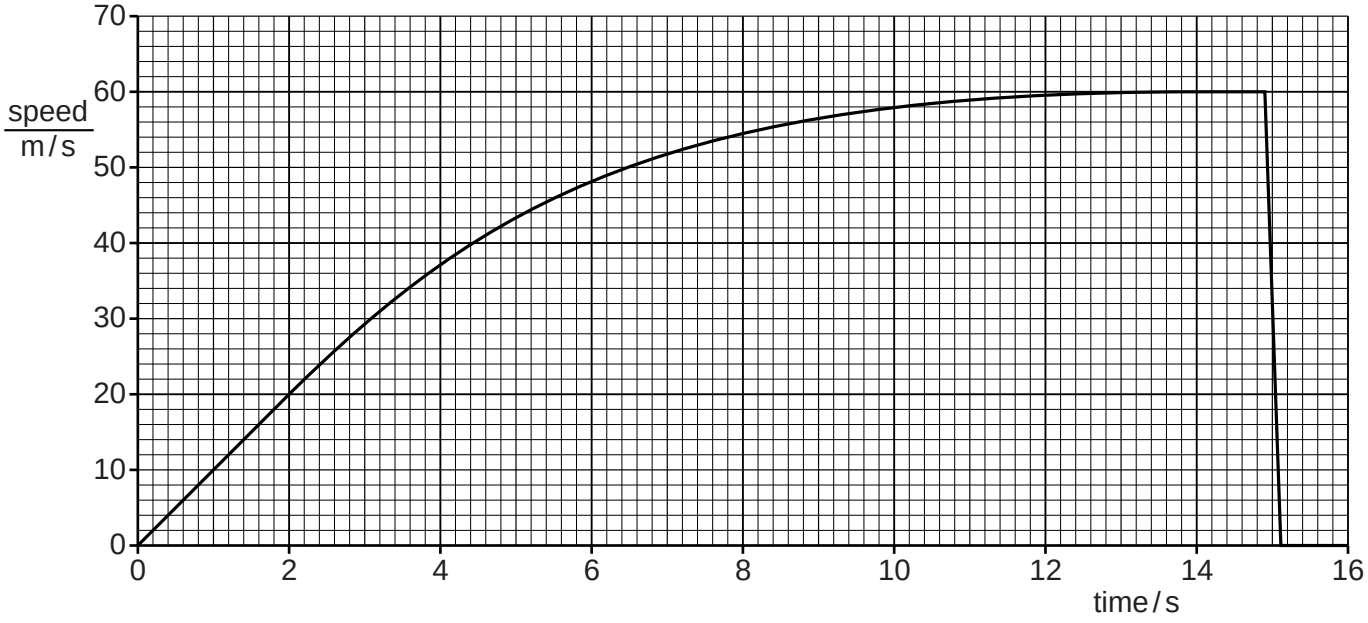

Fig. 1.1

(a) State a time at which the acceleration of the brick is

(i) zero,

time = ... [1]

(ii) constant but not zero,

time = ... [1]

(iii) not constant.

time = ... [1]

(b) Explain in terms of the forces acting on the brick why, between 0 and 14.0 s, its speed varies in the way shown by the graph.

.....

.....

.....

.....

..... [4]

(c) State the direction of the resultant force acting on the brick at time 15.0 s.

..... [1]

[Total: 8]

2 A bucket is full of oil. The total mass of the bucket of oil is 5.4 kg and the gravitational field strength is 10 N / kg.

For Examiner's Use

(a) Calculate the total weight of the bucket of oil.

weight = ... [1]

(b) The bucket of oil is hung from a spring of unstretched length 20 cm. The limit of proportionality of the spring is not exceeded and its length increases to 35 cm.

(i) State what is meant by the *limit of proportionality*.

.....

..... [1]

(ii) The oil is poured into a measuring tank. The empty bucket stretches the spring to a length of 25 cm.

Calculate

1. the force that stretches the spring to a length of 25 cm,

force = ... [3]

2. the mass of the oil in the measuring tank.

mass = ... [2]

(iii) The volume of the oil in the measuring tank is 0.0045 m^3. Calculate the density of the oil.

density = ... [2]

(c) Explain, in terms of their molecules, why the density of the oil is greater than that of air.

.....

..... [1]

[Total: 10]

3 Fig. 3.1 shows an aeroplane of mass 3.4×10^5 kg accelerating uniformly from rest along a runway.

For Examiner's Use

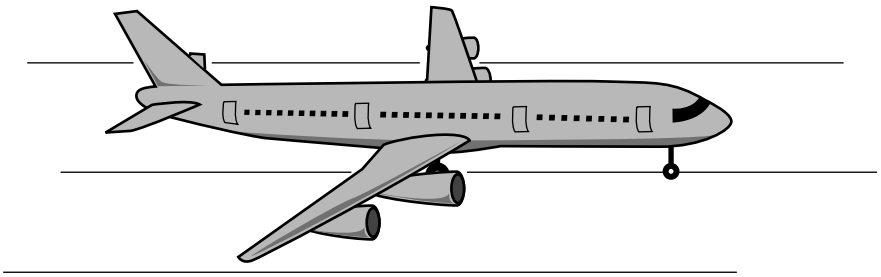

Fig. 3.1

After 26 s it reaches a speed of 65 m/s.

(a) Calculate

(i) the acceleration of the aeroplane,

acceleration = ... [2]

(ii) the resultant force on the aeroplane.

force = ... [2]

(b) Just after taking off, the aeroplane continues to accelerate as it gains height.

(i) State **two** forms of energy that increase during this time.

1. .....

2. ..... [2]

(ii) State **one** form of energy that decreases during this time.

..... [1]

(iii) State why the total energy of the aeroplane decreases during this time.

.....

..... [1]

(c) When the aeroplane reaches its maximum height, it starts to follow a curved path at a constant speed.

State the direction of the resultant force on the aeroplane.

..... [1]

[Total: 9]

For Examiner's Use

4 A diver is at a depth of 25 m beneath the surface of a lake. He carries a cylinder of high-pressure air on his back.

(a) (i) Explain how the air molecules exert a pressure on the inside surface of the cylinder.

.....

.....

.....

..... [3]

(ii) The diver gradually uses up the air in the cylinder. Explain why the pressure falls.

.....

.....

..... [1]

(b) The density of the water in the lake is 1000 kg / m^3 and the atmospheric pressure at the surface is 1.0×10^5 Pa.

Calculate the total pressure 25 m beneath the surface of the lake.

total pressure = ... [3]

[Total: 7]

For Examiner's Use

5 The water in a copper hot-water tank is heated during the night. During the day, the water cools as thermal energy (heat) passes from the water to the air surrounding the tank.

(a) (i) Describe the process by which the thermal energy is transferred from the hot water to the air.

.....

.....

.....

.....

..... [3]

(ii) State why the rate at which thermal energy passes into the air decreases as the water temperature falls.

.....

..... [1]

(b) The manufacturer of the hot-water tank says that when the outside surface is polished regularly and kept bright and shiny, the hot water will cool more slowly.

Describe, with the aid of a diagram, an experiment that shows whether a container with a bright and shiny surface is better at keeping its contents warm than one with a dull and dark surface.

.....

.....

.....

.....

.....

..... [4]

[Total: 8]

6 A laser produces a ray of blue light of wavelength 4.0×10^{-7} m (0.000 000 40 m).

For Examiner's Use

(a) (i) State the speed of light in a vacuum.

speed = ... [1]

(ii) Calculate the frequency of the light produced by the laser.

frequency = ... [2]

(b) The ray of blue light passes from air into a glass block. Fig. 6.1 shows the ray making an angle of 35° with the side of the block.

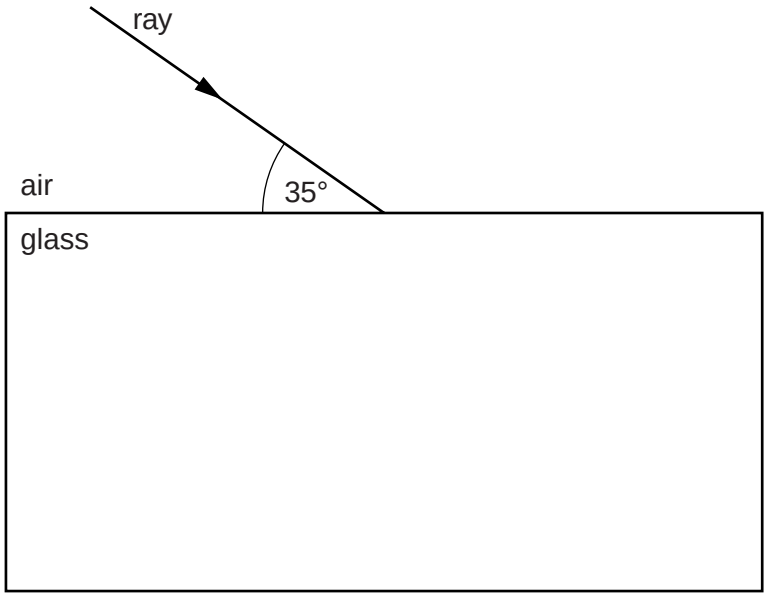

Fig. 6.1

(i) State the angle of incidence of the ray of blue light on the glass.

angle of incidence = ... [1]

(ii) Glass has a refractive index of 1.5.

Calculate the angle of refraction of the light in the glass.

angle of refraction = ... [2]

[Total: 6]

7 A converging lens has a focal length of 7.0 cm. An object of height 2.0 cm is placed 3.0 cm from the centre of the lens. Fig. 7.1 is a full-scale grid that shows the arrangement of the object, the lens and the two principal foci (focal points).

For Examiner's Use

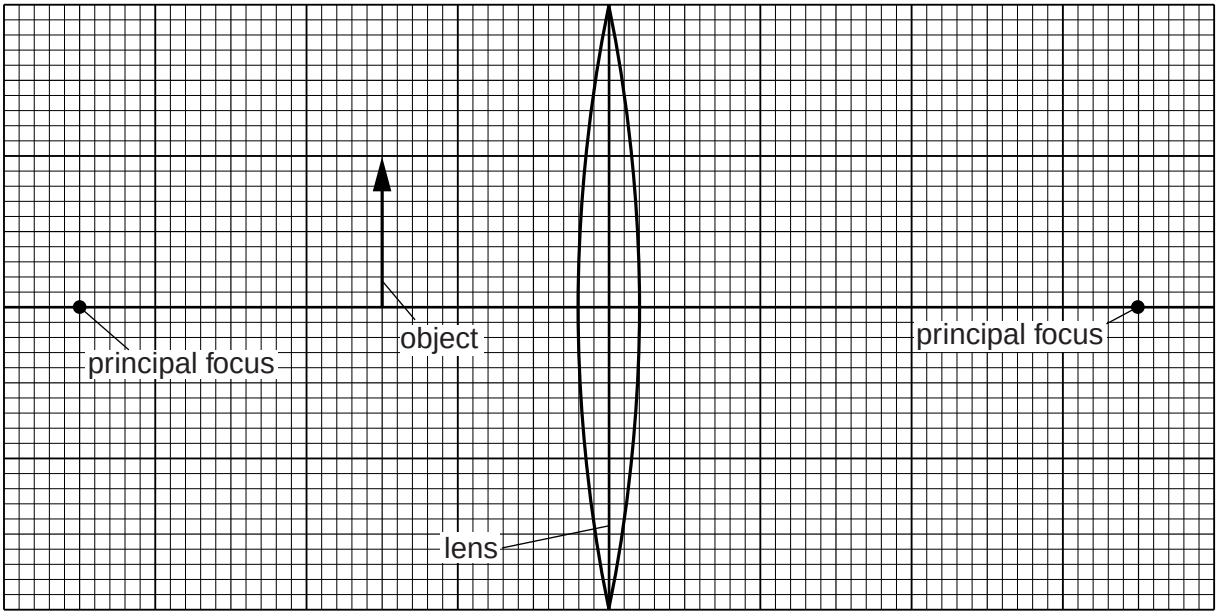

Fig. 7.1

(a) (i) By drawing on Fig. 7.1, show how the lens forms an image of the object. [3]

(ii) State **two** features of the image.

1. .....

2. .....

[2]

(b) (i) Determine the height of the image.

height = ... [1]

(ii) State the name of one device where a lens is used in the way shown in Fig. 7.1.

..... [1]

[Total: 7]

8 An electric heater is connected to a 230V mains supply. The heater circuit includes two resistors R_1 and R_2, and two switches S_1 and S_2. Fig. 8.1 is the circuit diagram.

For Examiner's Use

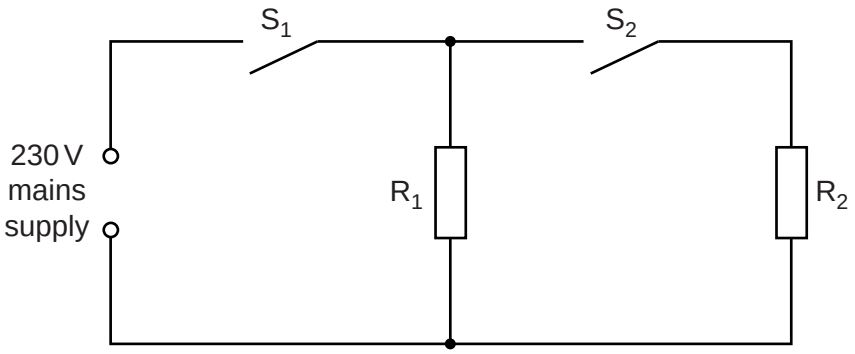

Fig. 8.1

The resistance of R_1 is 46 Ω and the resistance of R_2 is also 46 Ω.

Switch S_1 is closed and switch S_2 remains open.

(a) Calculate

(i) the current from the mains supply,

current = ... [2]

(ii) the power dissipated in the heater.

power = ... [2]

(b) Switch S_2 is now closed.

State the current in R_2.

current = ... [1]

[Total: 5]

For Examiner's Use

9 **(a)** A very sensitive, centre-zero voltmeter is connected to the two terminals of a solenoid (long coil). Fig. 9.1 shows the S pole of a cylindrical magnet being inserted into the solenoid.

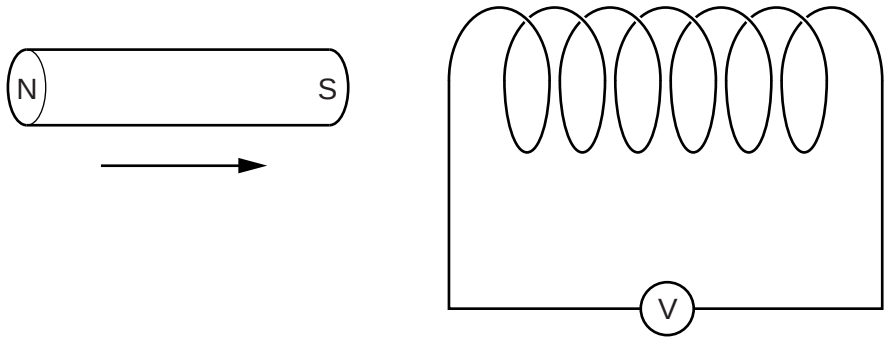

Fig. 9.1

As the magnet is inserted into the left-hand end of the solenoid, the needle of the voltmeter deflects.

(i) Explain why the needle deflects as the magnet is inserted.

.....

..... [2]

(ii) State and explain the effect of inserting the magnet more slowly.

.....

..... [2]

(iii) State what is observed when the magnet is withdrawn from the left-hand end of the solenoid.

..... [1]

(b) A transformer consists of a primary coil and a secondary coil on an iron core. An alternating voltage is connected to the primary coil.

Describe and explain the operation of the transformer.

.....

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.....

.....

..... [4]

[Total: 9]

10 A warning bell is fitted in a photographic dark room. In the dark, the bell is silent but in bright light, it rings. Two circuits linked by a relay R control the bell B. Fig. 10.1 is the circuit diagram for the arrangement.

For Examiner's Use

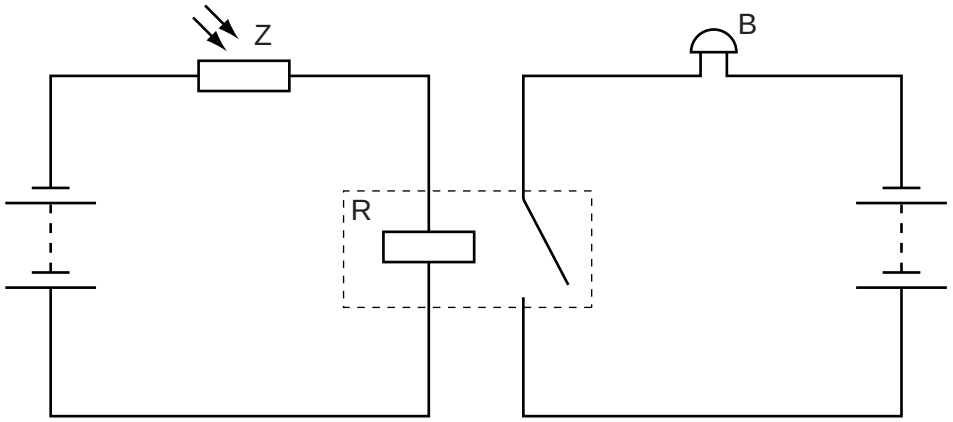

Fig. 10.1

(a) (i) State the name of component Z.

..... [1]

(ii) Explain why B rings in bright light.

.....

.....

.....

.....

.....

.....

..... [4]

(b) A change is made to one of the circuits so that B starts to ring when the temperature in the room rises.

State the change made.

.....

..... [1]

[Total: 6]

11 The isotope thorium-234 is radioactive. It emits β-particles as it decays.

For Examiner's Use

(a) The incomplete nuclide equation represents the decay of thorium-234 to an isotope of protactinium (Pa).

Complete the equation.

$$^{234}_{90}\text{Th} \longrightarrow \overset{.....}{\underset{.....}{\text{Pa}}} + \overset{.....}{\underset{.....}{\beta}}$$

[3]

(b) Fig. 11.1 shows a beam of β-particles from a sample of thorium-234 passing into the electric field between two charged plates in a vacuum.

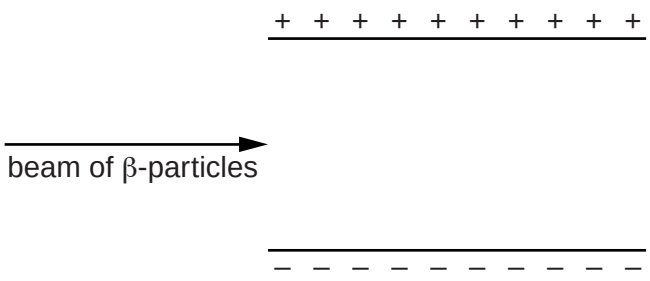

Fig. 11.1

(i) By drawing on Fig. 11.1, show how the β-particles move as they pass between the plates. [1]

(ii) Explain why the β-particles move in this way.

.....

..... [1]

[Total: 5]