UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

1136975068

PHYSICS **0625/31**

Paper 3 Extended **October/November 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.

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

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For Examiner's Use

1 **(a)** State Hooke's law.

.....

..... [1]

(b) Fig. 1.1 shows a graph of the stretching force *F* acting on a spring against the extension *x* of the spring.

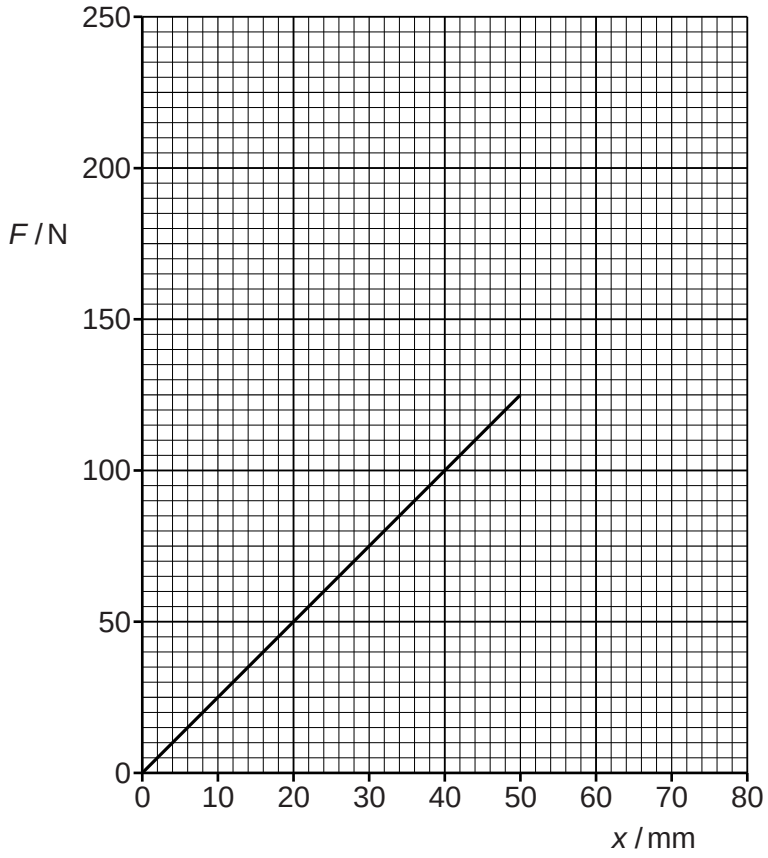


Fig. 1.1

(i) State the features of the graph that show that the spring obeys Hooke's law.

.....

..... [1]

(ii) Calculate *k*, the force per unit extension of the spring.

k = ...[3]

(iii) The limit of proportionality of the spring is reached at an extension of 50 mm.

Continue the graph in Fig. 1.1 to suggest how the spring behaves when the stretching force is increased to values above 125 N. [1]

(iv) Another spring has a smaller value of k. This spring obeys Hooke's law for extensions up to 80 mm.

On the grid of Fig. 1.1, draw a possible line of the variation of F with x for this spring. [1]

[Total: 7]

For Examiner's Use

2 A train has a total mass of 7.5×10^5 kg.

For Examiner's Use

(a) The train accelerates from rest at a constant rate along a straight, horizontal track. It reaches a speed of 24 m/s in 60 s.

Calculate

(i) the train's acceleration,

acceleration = ... [2]

(ii) the resultant force acting on the train.

force = ... [2]

(b) The train now travels with a constant speed of 24 m/s along a straight, horizontal track. The total force opposing the motion due to friction and air resistance is 7.2×10^4 N.

(i) By considering the work done by the train's engine in 1.0 s, calculate its output power.

power = ... [2]

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(ii) The train begins to travel up a slope.

Explain why the power of the train's engine must be increased to maintain the speed of 24 m / s.

.....

.....

.....

.....

..... [3]

[Total: 9]

For Examiner's Use

For Examiner's Use

3 (a) (i) Write down the names of **three** man-made devices in everyday use that depend, for their action, upon the moments of forces.

1. .....

2. .....

3. .....

[2]

(ii) Fig. 3.1 shows a uniform rod AB acted upon by three equal forces *F*.

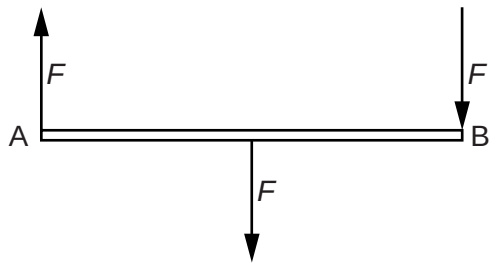


Fig. 3.1

State **two** reasons why the rod is **not** in equilibrium.

1. .....

2. .....

[2]

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(b) Fig. 3.2 shows a uniform rod PQ, supported at its centre and held in a horizontal position. The length of PQ is 1.00 m.

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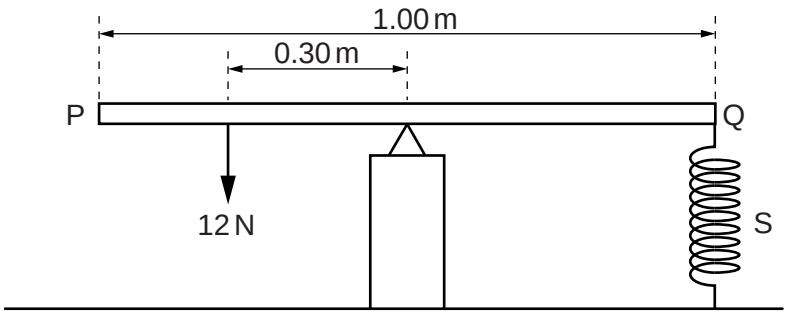


Fig. 3.2

A force of 12 N acts at a distance of 0.30 m from the support. A spring S, fixed at its lower end, is attached to the rod at Q.

(i) Calculate the force exerted on PQ by the spring.

force = ... [2]

(ii) Explain why it is not necessary to know the weight of PQ.

.....

..... [1]

[Total: 7]

For Examiner's Use

4 **(a)** State the energy changes that take place when

(i) a cyclist rides down a hill without pedalling,

.....

.....

(ii) a cyclist pedals up a hill at a constant speed.

.....

.....

[3]

(b) A car of mass 940 kg is travelling at 16 m/s.

(i) Calculate the kinetic energy of the car.

kinetic energy = ... [2]

(ii) The car is brought to rest by applying the brakes.

The total mass of the brakes is 4.5 kg. The average specific heat capacity of the brake material is 520 J/(kg °C).

Calculate the rise in temperature of the brakes. Assume there is no loss of thermal energy from the brakes.

rise in temperature = ... [3]

[Total: 8]

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5 One side of a copper sheet is highly polished and the other side is painted matt black.

The copper sheet is very hot and placed in a vertical position, as shown as in Fig. 5.1.

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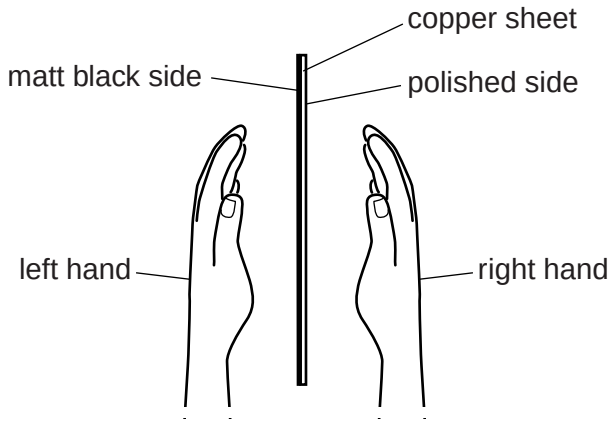


Fig. 5.1

A student places her hands at equal distances from the sheet, as shown in Fig. 5.1.

(a) Explain

(i) why her hands are not heated by **convection**,

.....

..... [1]

(ii) why her hands are not heated by **conduction**.

.....

..... [1]

(b) State and explain which hand gets hotter.

.....

.....

..... [2]

(c) It is suggested that one side of the copper sheet cools to a lower temperature than the other side.

Explain why this does not happen.

.....

.....

..... [2]

[Total: 6]

For Examiner's Use

6 **(a)** Complete the following statements by writing appropriate words in the spaces.

The pressure of a gas in a sealed container is caused by the collisions of

..... with the container wall.

An increase in the temperature of the gas increases the pressure because the

..... of the ..... increases.

The force on the wall due to the gas is the pressure multiplied by the .....

of the wall. [2]

(b) A mountaineer takes a plastic bottle containing some water to the top of a mountain. He removes the cap from the bottle, drinks all the water and then replaces the cap, as shown in Fig. 6.1.

On returning to the base of the mountain, he finds that the bottle has collapsed to a much smaller volume, as shown in Fig. 6.2.

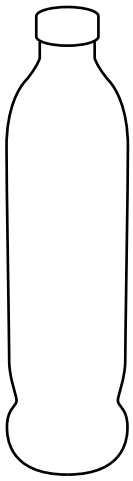


Fig. 6.1

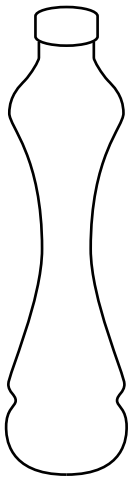


Fig. 6.2

(i) Explain why the bottle collapsed.

.....

.....

.....

..... [2]

(ii) At the top of the mountain the atmospheric pressure was 4.8×10^4 Pa and the volume of the bottle was 250 cm^3.

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Calculate the volume of the bottle at the base of the mountain where the pressure of the air inside the bottle is 9.2×10^4 Pa. Assume no change of temperature.

volume = ... [3]

[Total: 7]

7 **(a)** Fig. 7.1 shows the surface of water in a tank.

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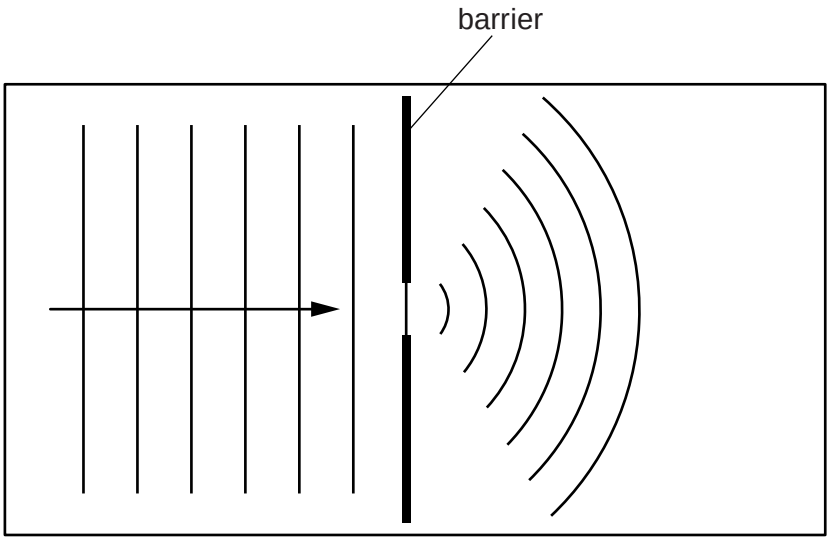


Fig. 7.1

Straight wavefronts are produced at the left-hand end of the tank and travel towards a gap in a barrier. Curved wavefronts travel away from the gap.

(i) Name the process that causes the wavefronts to spread out at the gap.

..... [1]

(ii) Suggest a cause of the reduced spacing of the wavefronts to the right of the barrier.

..... [1]

(iii) State how the pattern of wavefronts to the right of the barrier changes when the gap is made narrower.

..... [1]

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(b) Fig. 7.2 shows a wave travelling, in the direction of the arrow, along a rope.

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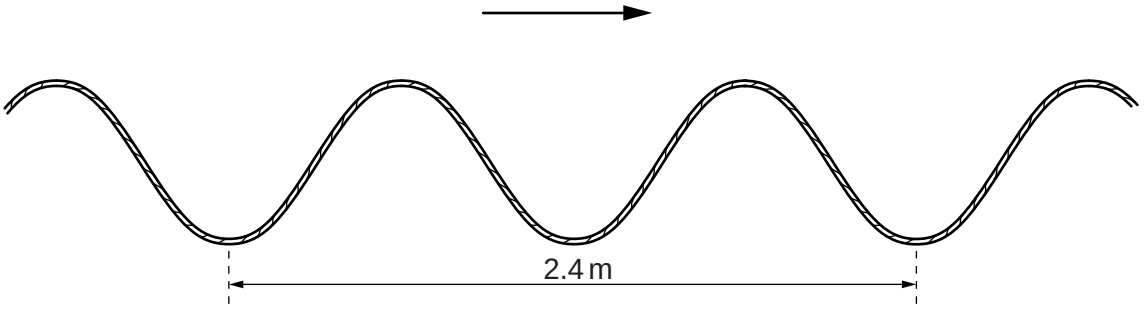


Fig. 7.2

(i) Explain why the wave shown in Fig. 7.2 is described as a *transverse* wave.

.....

..... [1]

(ii) The speed of the wave along the rope is 3.2 m / s.

Calculate the frequency of the wave.

frequency = ... [3]

[Total: 7]

For Examiner's Use

8 **(a)** Describe an experiment that shows how a magnet can be used to produce a current in a solenoid by electromagnetic induction. Sketch and label the arrangement of apparatus you would use.

.....

.....

..... [3]

(b) Fig. 8.1 represents a transformer with primary coil P and secondary coil S, wound on an iron core.

There is an alternating current in coil P.

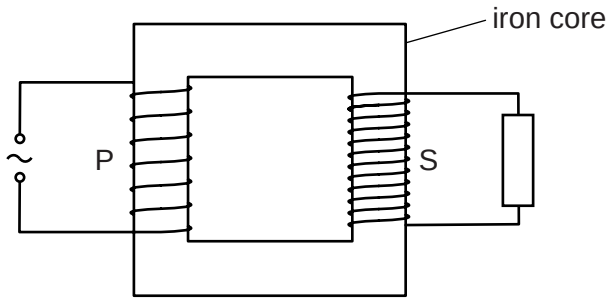


Fig. 8.1

(i) State what happens in the iron core as a result of the alternating current in P.

.....

..... [2]

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(ii) Tick the box next to the correct description of the current in S.

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- ☐ higher frequency a.c.
- ☐ same frequency a.c.
- ☐ lower frequency a.c.
- ☐ rectified d.c.
- ☐ constant d.c. [1]

(iii) Coil P has 50 turns of wire, an applied voltage of 12 V, and a current of 0.50 A. Coil S has 200 turns.

Calculate the current in S. Assume the transformer is 100 % efficient.

current = ... [3]

[Total: 9]

For Examiner's Use

9 **(a)** State the relationship between

(i) the resistance *R* and the length *L* of a wire of constant cross-sectional area,

.....

(ii) the resistance *R* and the cross-sectional area *A* of a wire of constant length.

.....
[1]

(b) A 60W filament lamp X is connected to a 230V supply, as shown in Fig. 9.1.

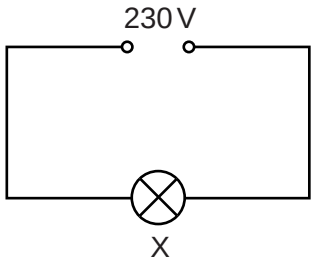


Fig. 9.1

Calculate the current in the filament.

current = ... [2]

(c) Lamp Y has a filament made of the same metal as the filament of lamp X in **(b)**.

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This filament has half the length and one-third of the cross-sectional area of the filament of X.

Lamp Y is also connected to a 230V supply.

Calculate the ratio $\frac{\text{current in filament of Y}}{\text{current in filament of X}}$. Show your working.

ratio = ... [4]

[Total: 7]

For Examiner's Use

10 **(a)** Fig. 10.1 shows an electron beam travelling, in a vacuum, towards the space between a pair of oppositely-charged parallel plates.

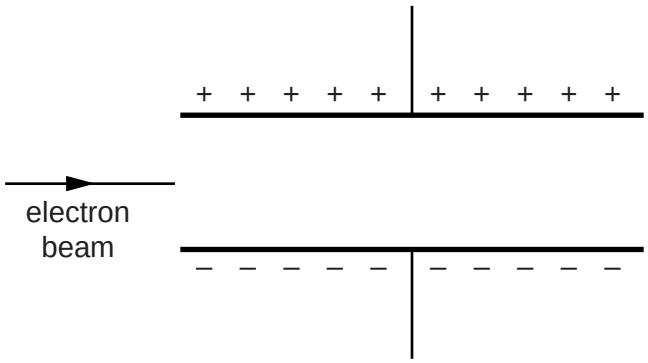


Fig. 10.1

On Fig. 10.1, draw carefully the path of the beam between the plates **and** in the space to the right of the plates. [2]

(b) The screen of a cathode-ray oscilloscope (c.r.o.) has a grid of 1 cm squares. Fig. 10.2 shows the trace of an alternating voltage on this screen.

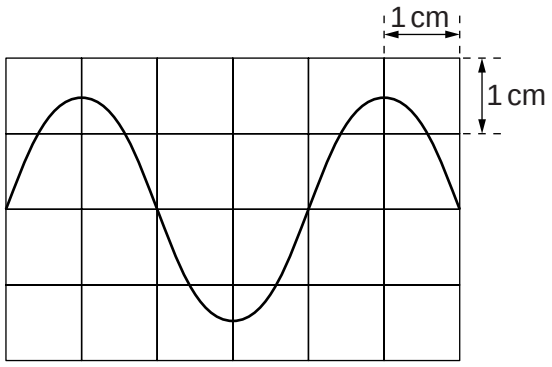


Fig. 10.2

(i) A potential difference of 5.0 V across the Y-plates of the oscilloscope moves the spot on the screen a vertical distance of 1.0 cm.

Use Fig. 10.2 to determine the maximum p.d. across the Y-plates.

maximum p.d. = ... [1]

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(ii) The spot on the screen takes 1.0 ms to move 1.0 cm horizontally.

From Fig. 10.2, determine the time for 1 cycle of the waveform on the screen, and use this time to find the frequency of the alternating voltage.

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frequency = ... [3]

[Total: 6]

For Examiner's Use

11 **(a)** Describe the action of

(i) a NOT gate,

..... [1]

(ii) a thermistor.

..... [1]

(b) Fig. 11.1 shows a circuit that switches on a warning lamp when the temperature in an oven falls below a set value.

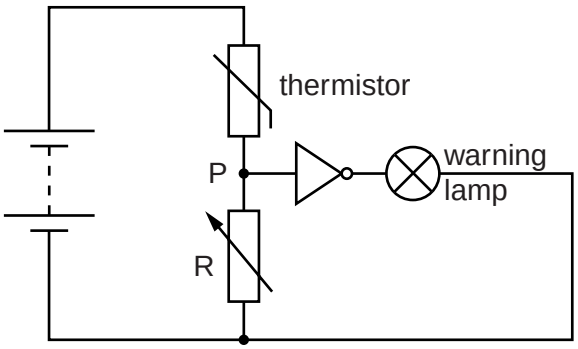


Fig. 11.1

Explain, with reference to the components in the circuit and point P,

(i) why the warning lamp is on when the temperature in the oven is below the set value,

.....

.....

.....

.....

.....

.....

..... [4]

(ii) the effect of changing the resistance of R.

.....

..... [1]

[Total: 7]

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