UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **0625/33**

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 **16** printed pages.

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1 A train is at rest in a railway station. At time $t = 0$, the train starts to move forwards with an increasing speed until it reaches its maximum speed at time $t = 48$ s.

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Fig. 1.1 is the speed-time graph for the first 48 s of the journey.

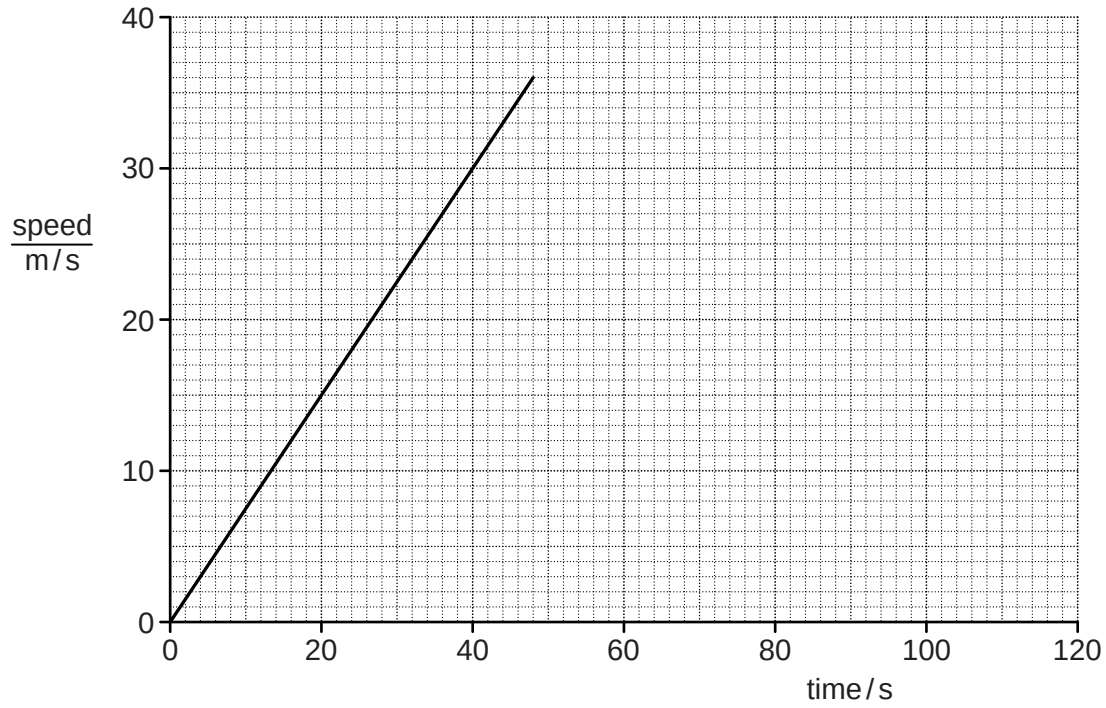


Fig. 1.1

(a) (i) State how the graph shows that, during the first 48 s of the journey, the acceleration of the train is constant.

.....

..... [1]

(ii) Calculate the acceleration of the train during the first 48 s of the journey.

acceleration = ... [2]

(b) After time $t = 48$ s, the train continues at its maximum speed for another 72 s.

(i) On Fig. 1.1, sketch the speed-time graph for the next 72 s of the journey. [1]

(ii) Determine the total distance travelled by the train in the 120 s after it starts moving.

distance = ... [3]

[Total: 7]

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2 Water is stored in a reservoir at an average vertical height of 350 m above the turbines of a hydroelectric power station.

For Examiner's Use

During a 7.0 hour period, $1.8 \times 10^6\,m^3$ of water flows down from the reservoir to the turbines.

(a) The density of water is $1000\,kg/m^3$.

For this 7.0 hour period, calculate

(i) the mass of water that flows from the reservoir to the turbines,

mass = ... [2]

(ii) the gravitational potential energy transformed as the water flows to the turbines,

energy = ... [2]

(iii) the maximum possible average output power.

power = ... [2]

(b) A hydroelectric power station generates electricity from a renewable energy source.

(i) Explain what is meant, in this context, by *renewable*.

.....

..... [1]

(ii) State two other renewable energy sources.

1. .....

2. .....
[2]

[Total: 9]

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[Turn over

3 On a windy day, a parachutist of mass 85 kg jumps from an aeroplane.

For Examiner's Use

Fig. 3.1 shows the parachutist falling through the air at a constant vertical velocity of 8.4 m/s downwards.

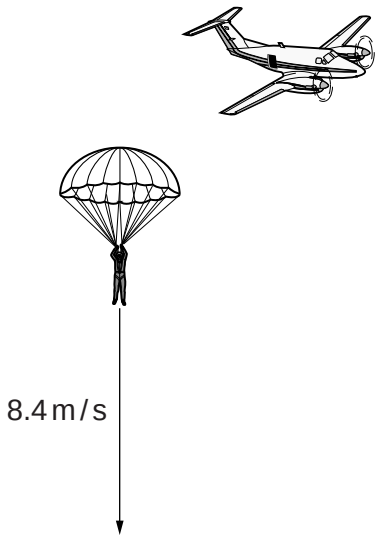


Fig. 3.1

(a) Distinguish between *speed* and *velocity*.

.....

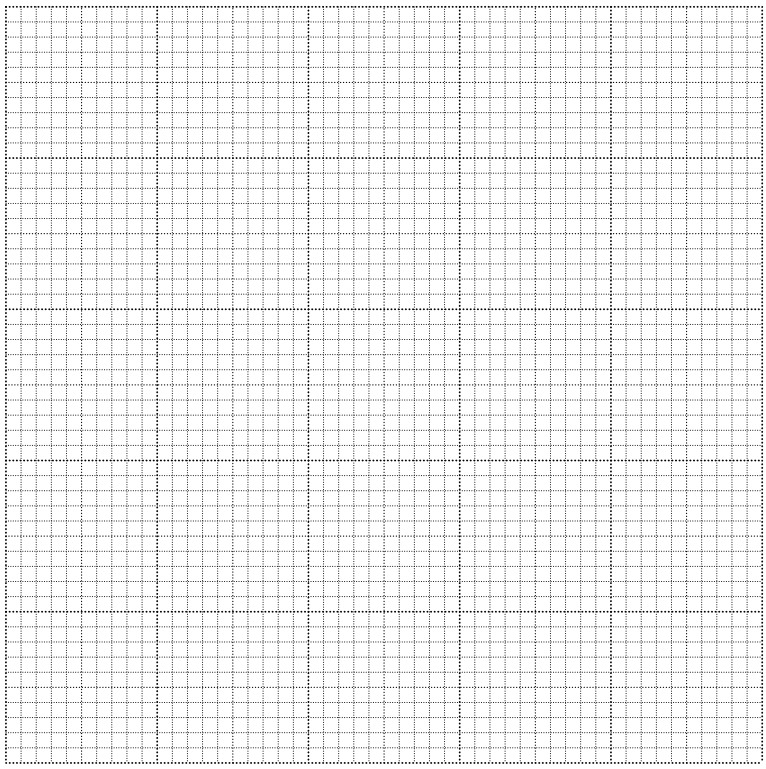
..... [1]

For Examiner's Use

(b) As the parachutist falls, the wind is moving him towards the right of the diagram, at a horizontal velocity of 6.3 m/s.

(i) On Fig. 3.1, draw an arrow to show the horizontal velocity of the parachutist. [1]

(ii) On the grid below, draw a vector diagram to determine graphically the size and direction of the resultant velocity of the parachutist.



size = ...

direction = ...
[4]

(iii) Calculate the kinetic energy of the parachutist.

kinetic energy = ... [3]

[Total: 9]

4 A large crane has a mass of 8500 kg. Fig. 4.1 shows the crane on a muddy building-site.

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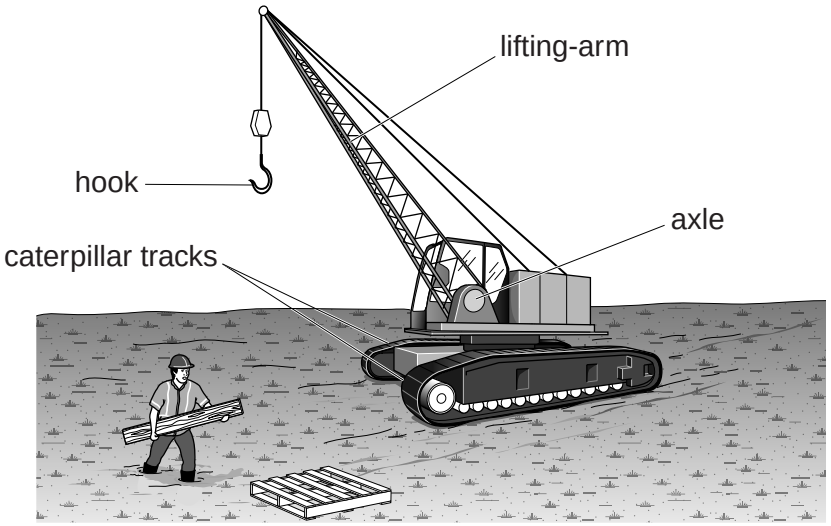


Fig. 4.1

(a) Calculate the weight of the crane.

weight = ... [1]

(b) The crane rests on two caterpillar tracks each of which has a contact area with the ground of 3.4 m^2.

(i) Calculate the pressure that the crane exerts on the ground.

pressure = ... [2]

(ii) As the crane driver walks towards the crane, he starts to sink into the mud. He lays a wide plank of wood on the mud and he walks along the plank.

Explain why he does not sink into the mud when he walks along the plank.

.....

.....

..... [2]

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(c) When the crane lifts a heavy load with its hook, the load exerts a moment on the lifting-arm about the axle.

For Examiner's Use

(i) Explain what is meant by *moment* of a force.

.....

..... [1]

(ii) Despite the moment exerted on the lifting-arm, the crane remains in equilibrium.

State the two conditions required for any object to be in equilibrium.

1. .....

2. .....
[2]

[Total: 8]

5 Fig. 5.1 shows a saucepan of boiling water on an electric hotplate.

For Examiner's Use



Fig. 5.1

As time passes, thermal energy (heat) is constantly supplied to the water but its temperature remains at 100 °C.

(a) State two ways in which boiling differs from evaporation.

1. .....

.....

2. .....

.....

[2]

(b) Explain, in terms of the water molecules, what happens to the thermal energy supplied to the water as it boils.

.....

.....

.....

..... [2]

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(c) Describe an experiment to measure the specific latent heat of steam. You may include a diagram.

For Examiner's Use

.....

.....

.....

.....

.....

..... [4]

[Total: 8]

For Examiner's Use

6 (a) (i) State two ways in which the molecular structure of a gas differs from the molecular structure of a liquid.

1. .....

2. .....

[2]

(ii) Compressibility is the ease with which a substance can be compressed.

State and explain, in terms of the forces between the molecules, how the compressibility of a gas differs from that of a liquid.

.....

.....

..... [2]

(b) Fig. 6.1 shows a weather balloon being inflated by helium from a cylinder.

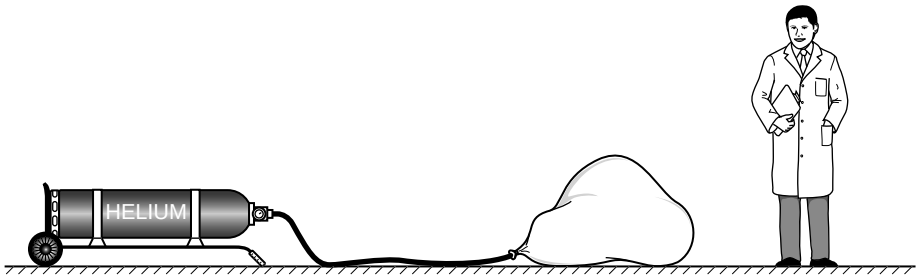


Fig. 6.1

(i) The helium that inflates the balloon had a volume of $0.035\,m^3$ at a pressure of $2.6 \times 10^6\,Pa$, inside the cylinder.

The pressure of the helium in the balloon is $1.0 \times 10^5\,Pa$ and its temperature is the same as it was when in the cylinder.

Calculate the volume occupied by the helium in the balloon.

volume = ... [3]

(ii) As the balloon rises up through the atmosphere, the temperature of the helium decreases.

State the effect of this temperature change on the helium molecules.

.....

..... [1]

[Total: 8]

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7 The frequency of the monochromatic light produced by a laser is 4.7×10^{14} Hz.

For Examiner's Use

A ray of light from the laser passes from a vacuum, where the speed of light is 3.0×10^{8} m/s, into a fibre-optic cable.

(a) State

(i) what is meant by *monochromatic*,

.....

..... [1]

(ii) the frequency of light from the laser in the fibre-optic cable.

..... [1]

(b) The speed of light in the fibre-optic cable is 2.0×10^{8} m/s.

Calculate

(i) the refractive index of the material from which fibre-optic cable is made,

refractive index = ... [2]

(ii) the wavelength of light from the laser in the fibre-optic cable.

wavelength = ... [2]

[Total: 6]

8 Fig. 8.1 shows a small, uncharged copper sphere suspended from a nylon thread, and a plastic rod being rubbed with a woollen cloth.

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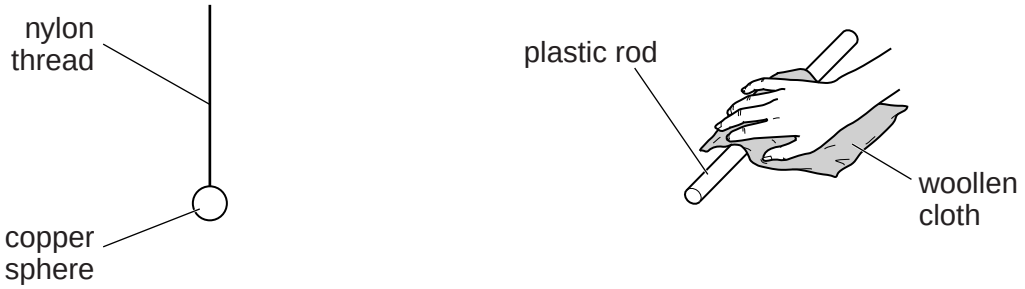


Fig. 8.1

The rod becomes negatively charged as it is rubbed.

(a) Explain, in terms of electrons, why copper is a conductor but nylon is an insulator.

.....

.....

..... [2]

(b) Describe how the negatively charged rod may be used to induce a positive charge on the copper sphere.

.....

.....

.....

..... [3]

(c) The copper sphere is given a positive charge, as shown in Fig. 8.2.



Fig. 8.2

On Fig. 8.2, draw arrows to indicate the direction and pattern of the electric field that surrounds the positively charged sphere. [2]

[Total: 7]

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9 In a laboratory experiment, the isotope uranium-238 is used as a source of α-particles.

For Examiner's Use

(a) State

(i) one feature of uranium-238 nuclei that is the same for the nuclei of other uranium isotopes,

..... [1]

(ii) one feature of uranium-238 nuclei that is different for the nuclei of other uranium isotopes.

..... [1]

(b) Fig. 9.1 shows the α-particles from the uranium source being directed at a very thin gold foil, in a vacuum.

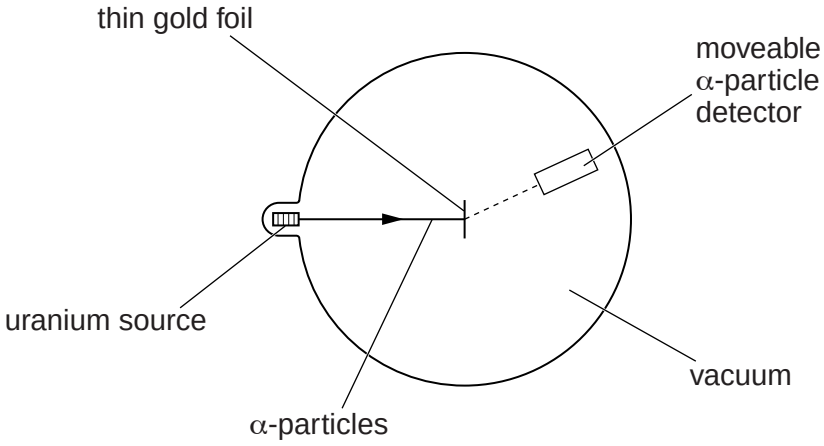


Fig. 9.1

To investigate the scattering of α-particles, a detector is moved to different positions around the very thin gold foil and measurements are recorded.

Describe the results from this scattering experiment and explain what they show about the structure of atoms.

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 6]

10 Fig. 10.1 is the symbol for a NAND gate with inputs A and B.

For Examiner's Use

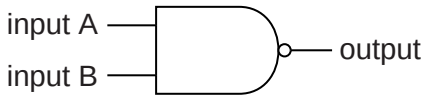


Fig. 10.1

(a) Input A and input B can be set to 1 (high) or to 0 (low).

Complete the table below to give the outputs for this NAND gate.

input A	input B	output
0	0	
0	1	
1	0	
1	1	

[1]

(b) The two inputs of the NAND gate are joined together and connected to an input C, as shown in Fig. 10.2.

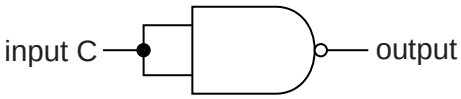


Fig. 10.2

(i) Determine the output of this NAND gate when

1. input C is set to 0,

output = ...

2. input C is set to 1.

output = ...
[1]

(ii) State the name of the logic gate that behaves in the same way as the NAND gate in Fig. 10.2.

..... [1]

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(c) A circuit combines three NAND gates.

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The inputs to the circuit are P and Q, as shown in Fig. 10.3.

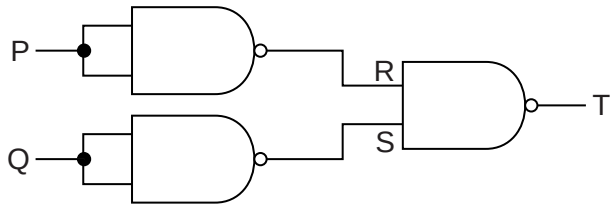


Fig. 10.3

Points R, S and T in the circuit are also labelled.

Input P is set to 0 and input Q is set to 1.

Determine the logic states (0 or 1) of points R, S and T.

point R = ...

point S = ...

point T = ...
[2]

[Total: 5]

Turn over for Question 11

11 A remote ski lodge receives 18 kW of electric power from a 120 V supply.

For Examiner's Use

(a) Calculate

(i) the current that the ski lodge draws from the supply,

current = ... [2]

(ii) the electrical energy supplied to the ski lodge in 30 minutes.

energy = ... [2]

(b) The power supply to the ski lodge is from a nearby transformer that is connected to long-distance transmission cables. The voltage of the transmission cables is very much larger than 120 V.

Explain why energy losses in the transmission cables are lower when the voltage is high.

.....

.....

.....

.....

..... [3]

[Total: 7]

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