UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

4158352429

PHYSICS **0625/31**

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 **16** printed pages.

DC (AC/SW) 49515/3

UNIVERSITY of CAMBRIDGE International Examinations

1 Fig. 1.1 shows the graph of speed *v* against time *t* for a train as it travels from one station to the next.

For Examiner's Use

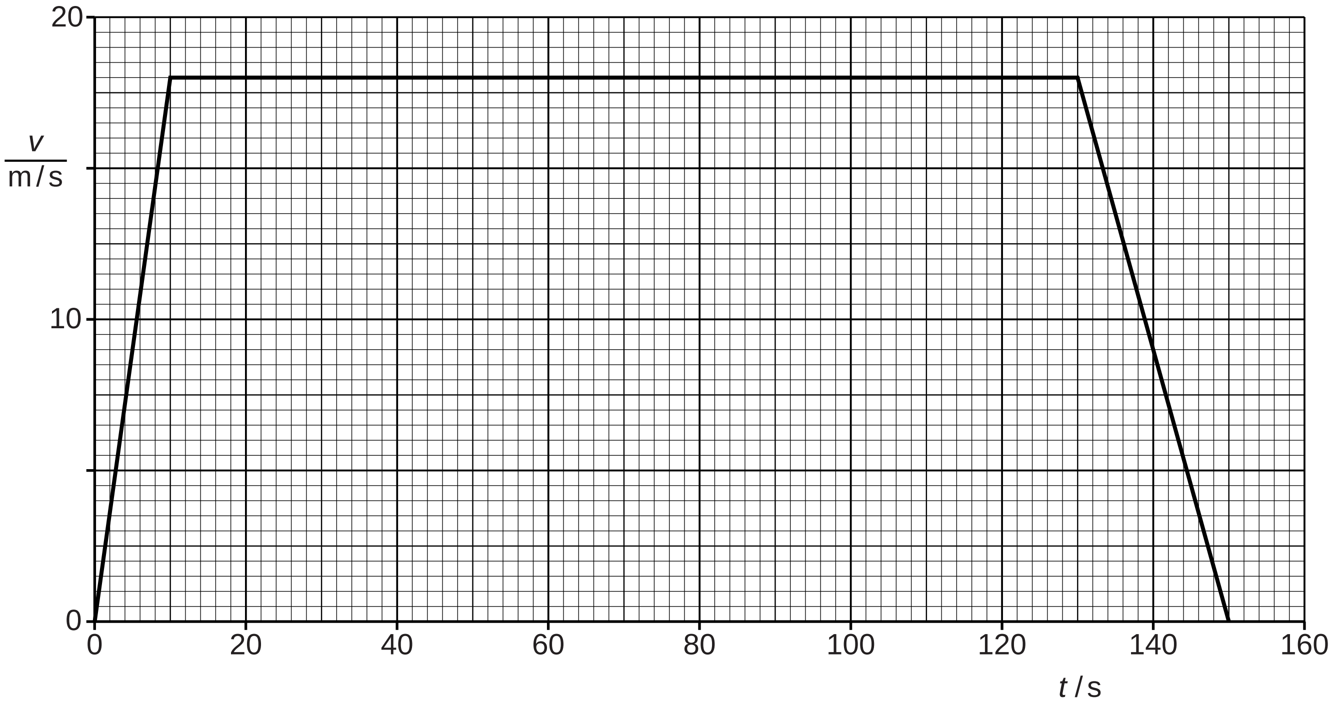

Fig. 1.1

(a) Use Fig. 1.1 to calculate

(i) the distance between the two stations,

distance = ... [4]

(ii) the acceleration of the train in the first 10 s.

acceleration = ... [2]

For Examiner's Use

(b) The mass of the train is 1.1×10^5 kg.

Calculate the resultant force acting on the train in the first 10 s.

resultant force = ... [2]

(c) The force generated by the engine of the train is called the driving force.

Write down, in words, an equation relating the driving force to any other forces acting on the train during the period t = 10 s to t = 130 s.

.... [1]

[Total: 9]

For Examiner's Use

2 **(a)** State the factors which completely describe a vector quantity.

....

.... [1]

(b) An aeroplane is flying towards the east in still air at 92 m/s. A wind starts to blow at 24 m/s towards the north.

Draw a vector diagram to find the resultant velocity of the aeroplane. Use a scale of 1.0 cm = 10 m/s.

resultant speed = ...

angle between resultant and easterly direction = ...

[5]

[Total: 6]

For Examiner's Use

3 **(a)** A stationary body is acted upon by a number of forces. State the two conditions which must apply for the body to remain at rest.

1. ....

2. ....
[2]

(b) Fig. 3.1 shows a device used for compressing crushed material.

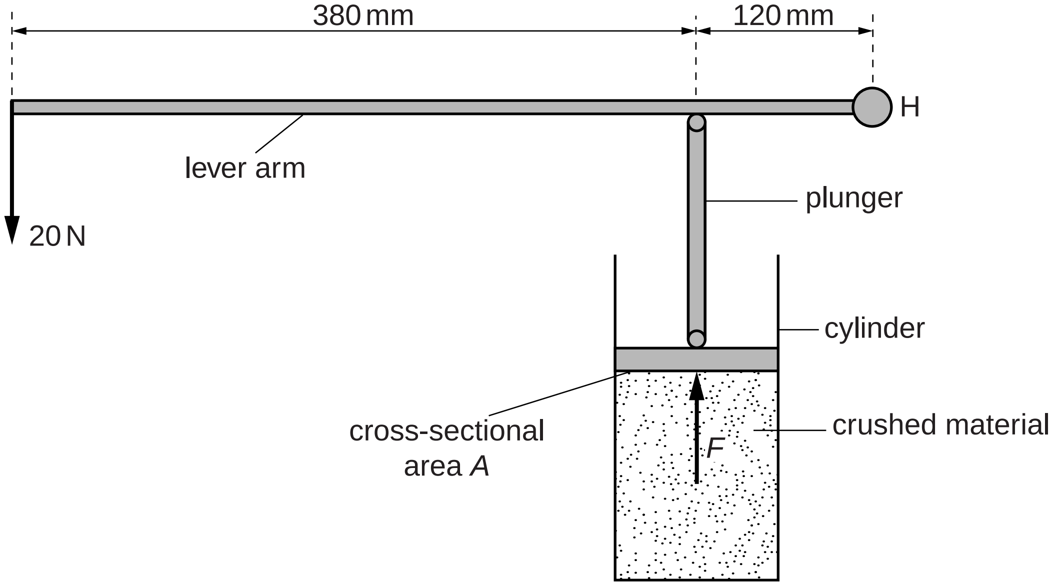

Fig. 3.1

The lever arm rotates about the hinge H at its right-hand end. A force of 20 N acts downwards on the left-hand end of the lever arm. The force *F* of the crushed material on the plunger acts upwards. Ignore the weight of the lever arm.

(i) Use the clockwise and anticlockwise moments about H to calculate the upward force *F* which the crushed material exerts on the plunger. The distances are shown on Fig. 3.1.

force *F* = ... [3]

(ii) The cross-sectional area *A* of the plunger in contact with the crushed material is 0.0036 m^2. Calculate the pressure exerted on the crushed material by the plunger.

pressure = ... [2]

[Total: 7]

For Examiner's Use

4 **(a)** State what is meant by the *centre of mass* of a body.

....

....

.... [1]

(b) Fig. 4.1 shows an athlete successfully performing a high jump.

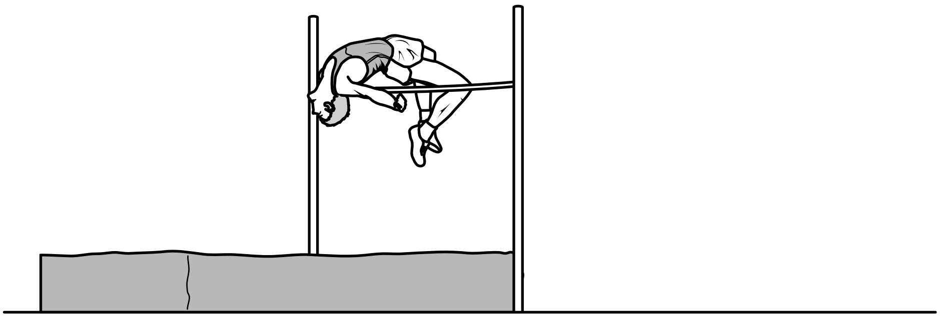

Fig. 4.1

The height of the bar above the ground is 2.0 m. The maximum increase in gravitational potential energy (g.p.e.) of the athlete during the jump is calculated using the expression g.p.e. = *mgh*.

Explain why the value of *h* used in the calculation is much less than 2.0 m.

....

....

.... [1]

For Examiner's Use

(c) Fig. 4.2 shows, in order, five stages of an athlete successfully performing a pole-vault.

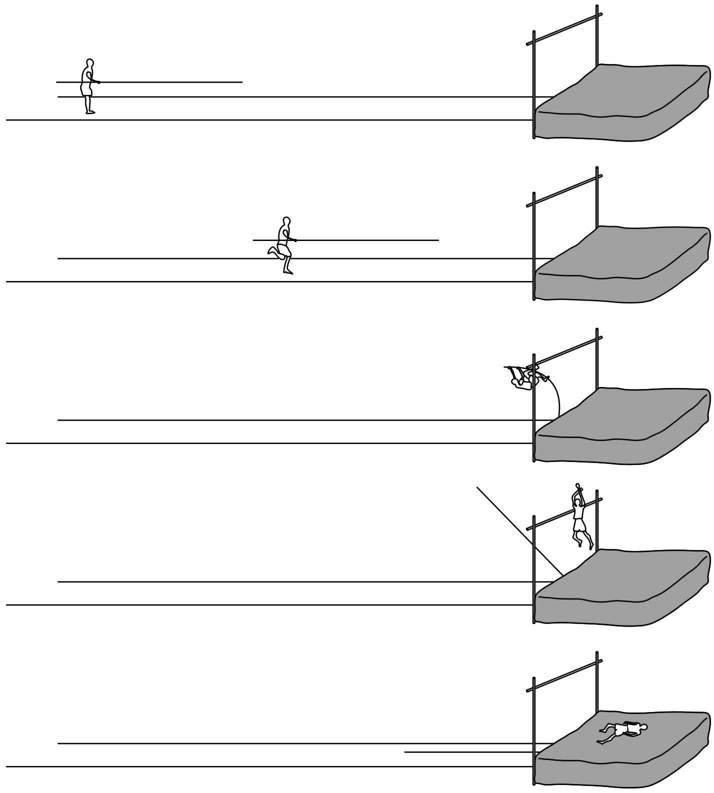

Fig. 4.2

Describe the energy changes which take place during the performance of the pole-vault, from the original stationary position of the pole-vaulter before the run-up, to the final stationary position after the vault.

....

....

....

....

....

....

....

....

....

....

.... [6]

[Total: 8]

For Examiner's Use

5 **(a)** Explain

(i) how gas molecules exert a force on a solid surface,

....

....

.... [1]

(ii) the increase in pressure of a gas when its volume is decreased at constant temperature.

....

....

....

.... [3]

(b) A cylinder of volume $5.0 \times 10^3\,cm^3$ contains air at a pressure of 8.0×10^5 Pa.

A leak develops so that air gradually escapes from the cylinder until the air in the cylinder is at atmospheric pressure. The pressure of the atmosphere is 1.0×10^5 Pa.

Calculate the volume of the escaped air, now at atmospheric pressure. Assume that the temperature stays constant.

volume = ...cm^3 [4]

[Total: 8]

For Examiner's Use

6 **(a)** Define *specific latent heat of fusion*.

....

....

.... [1]

(b) **(i)** A tray of area 0.25 m^2, filled with ice to a depth of 12 mm, is removed from a refrigerator.

Calculate the mass of ice on the tray. The density of ice is 920 kg/m^3.

mass = ... [2]

(ii) Thermal energy from the Sun is falling on the ice at a rate of 250 W/m^2. The ice absorbs 60 % of this energy.

Calculate the energy absorbed in 1.0 s by the 0.25 m^2 area of ice on the tray.

energy = ... [2]

(iii) The ice is at its melting temperature.

Calculate the time taken for all the ice to melt. The specific latent heat of fusion of ice is 3.3×10^5 J/kg.

time = ... [3]

[Total: 8]

For Examiner's Use

7 (a) Explain why a liquid cools when evaporation takes place from its surface.

....

....

.... [2]

(b) Fig. 7.1 shows five vessels each made of the same metal and containing water.

Vessels A, B, C and D are identical in size and shape. Vessel E is shallower and wider. The temperature of the air surrounding each vessel is 20 °C.

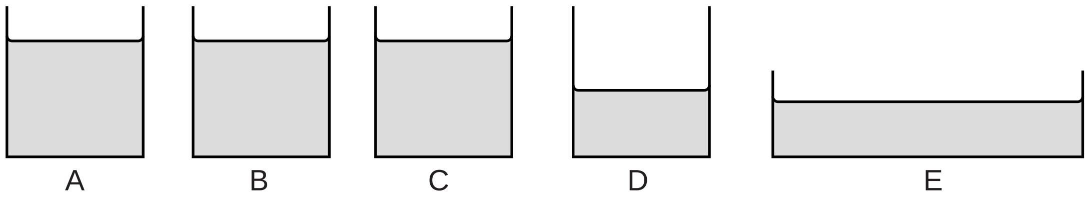

Fig. 7.1

The table shows details about each vessel and their contents.

vessel	outer surface	volume of water / cm^3	initial temperature of water / °C
A	dull	200	80
B	shiny	200	80
C	dull	200	95
D	dull	100	80
E	dull	200	80

The following questions are about the time taken for the temperature of the water in the vessels to fall by 10 °C from the initial temperature.

(i) Explain why the water in B takes longer to cool than the water in A.

....

.... [1]

(ii) Explain why the water in C cools more quickly than the water in A.

....

.... [1]

(iii) Explain why the water in D cools more quickly than the water in A.

....

.... [1]

(iv) Suggest **two** reasons why the water in E cools more quickly than the water in A.

1. ....

....

2. ....

.... [2]

[Total: 7]

For Examiner's Use

8 **(a)** A ray of light in air travels across a flat boundary into glass. The angle of incidence is 51°. The angle of refraction is 29°.

(i) In the space below, draw a labelled diagram to illustrate this information. [3]

(ii) Calculate the refractive index of the glass.

refractive index = ... [2]

(b) A ray of light in glass travels towards a flat boundary with air. The angle of incidence is 51°. This ray does not emerge into the air.

State and explain what happens to this ray.

....

....

....

.... [2]

[Total: 7]

9 Fig. 9.1 shows a thin, straight rod XY placed in the magnetic field between the poles of a magnet. The wires from the ends of XY are connected to a centre-zero voltmeter.

For Examiner's Use

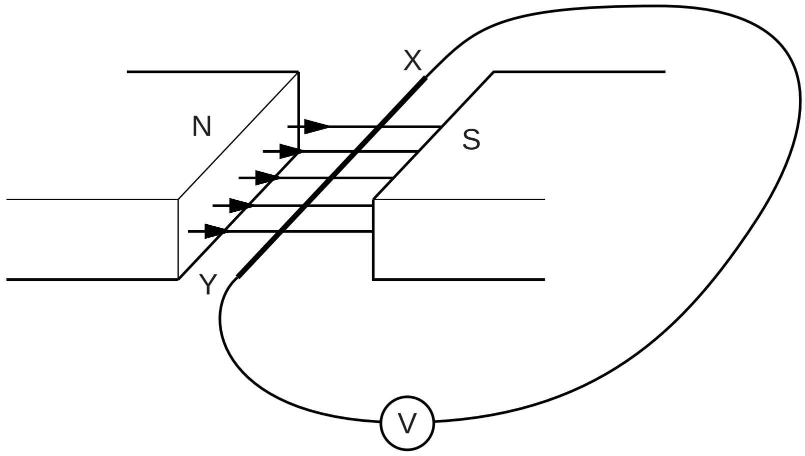

Fig. 9.1

(a) When XY is moved slowly upwards the needle of the voltmeter shows a small deflection.

(i) State how XY must be moved to produce a larger deflection in the opposite direction.

....

.... [2]

(ii) XY is now rotated about its central point by raising X and lowering Y. Explain why no deflection is observed.

....

....

.... [2]

(b) The effect of moving XY can be seen if the wires are connected to the terminals of a cathode-ray oscilloscope instead of the voltmeter.

(i) State the parts inside the oscilloscope tube to which these terminals are connected.

.... [1]

(ii) The spot on the oscilloscope screen moves up and down repeatedly. State how XY is being moved.

.... [1]

(iii) State the setting of the time-base of the oscilloscope during the process described in **(ii)**.

.... [1]

[Total: 7]

For Examiner's Use

10 (a) State the electrical quantity that has the same value for each of two resistors connected to a battery

(i) when they are in series, ...

(ii) when they are in parallel. ....
[1]

(b) Fig. 10.1 shows a circuit with a 1.2 kΩ resistor and a thermistor in series. There is no current in the voltmeter.

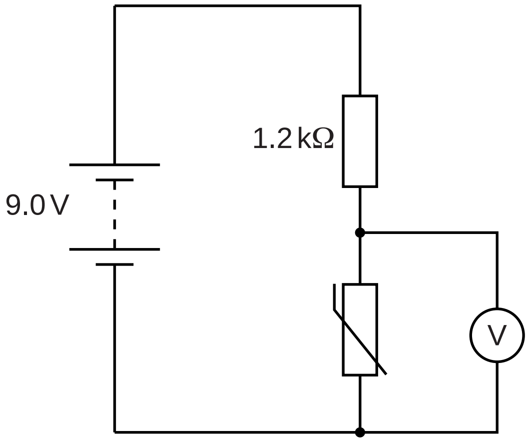

Fig. 10.1

Calculate the voltmeter reading when the resistance of the thermistor is 3.6 kΩ.

voltmeter reading = ... [3]

(c) Fig. 10.2 shows a fire-alarm circuit. The circuit is designed to close switch S and ring bell B if there is a fire.

For Examiner's Use

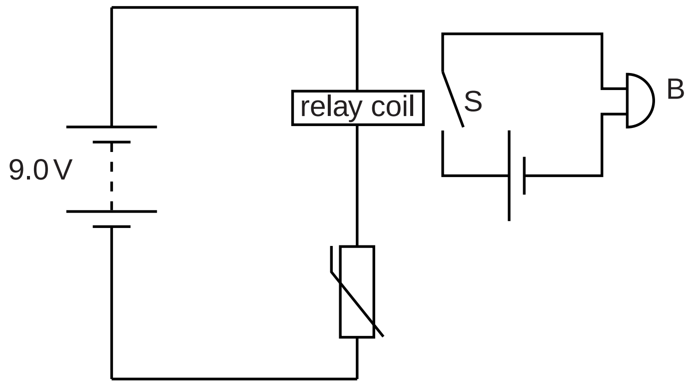

Fig. 10.2

Explain the operation of the circuit.

....

....

....

....

....

....

.... [3]

[Total: 7]

Question 11 is on the next page.

For Examiner's Use

11 (a) A radioactive source emits α-, β- and γ-radiation.

Which of these radiations

(i) has the shortest range in air, ...

(ii) has a negative charge, ...

(iii) is not deflected in a magnetic field? ....
[2]

(b) In a famous experiment, carried out in a vacuum, a very thin sheet of gold was placed in the path of alpha particles.

It was found that a large number of the alpha particles passed through the sheet with little or no deflection from their original path. A very small number of the alpha particles were reflected back towards the source.

(i) Explain, in terms of the force acting, why the direction of motion of an alpha particle changes when it comes close to the nucleus of a gold atom.

....

....

.... [2]

(ii) State **two** conclusions, about the nuclei of atoms, that were made from the results of this experiment.

1. ....

....

2. ....

....
[2]

[Total: 6]