UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

PHYSICS **0625/32**

Paper 3 Extended **October/November 2009**

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 soft pencil for any diagrams, graphs or rough working.
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.

This document consists of **16** printed pages.

1 A weight attached to one end of a short length of string is swinging from side to side. The highest points in the swing are A and B, as shown in Fig. 1.1.

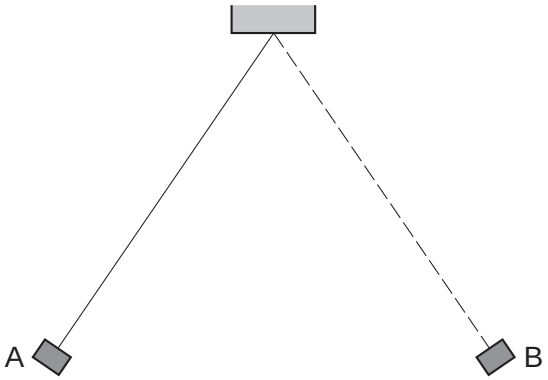

Fig. 1.1

(a) With reference to Fig. 1.1, state what is meant by the amplitude of the oscillations.

..... [2]

(b) Describe how the amplitude of the oscillations could be measured.

.....

.....

.....

.....

..... [3]

[Total: 5]

2 The list below gives the approximate densities of various metals.

gold	19 g / cm^3
lead	11 g / cm^3
copper	9 g / cm^3
iron	8 g / cm^3

At an antiques market, a collector buys what is advertised as a small ancient gold statue. When the collector tests it in the laboratory, he finds its mass is 600 g and its volume is 65 cm^3.

(a) In the space below, describe how the volume of the statue could be measured. You may draw diagrams if you wish.

[3]

(b) Use the figures given above to decide whether the statue was really made of gold. Show your working.

Was the statue made of gold? (Tick one box.)

yes	
no	

[3]

3 A student investigated the stretching of a spring by hanging various weights from it and measuring the corresponding extensions. The results are shown below.

weight / N	0	1	2	3	4	5
extension / mm	0	21	40	51	82	103

(a) On Fig. 3.1, plot the points from these results. Do not draw a line through the points yet. [2]

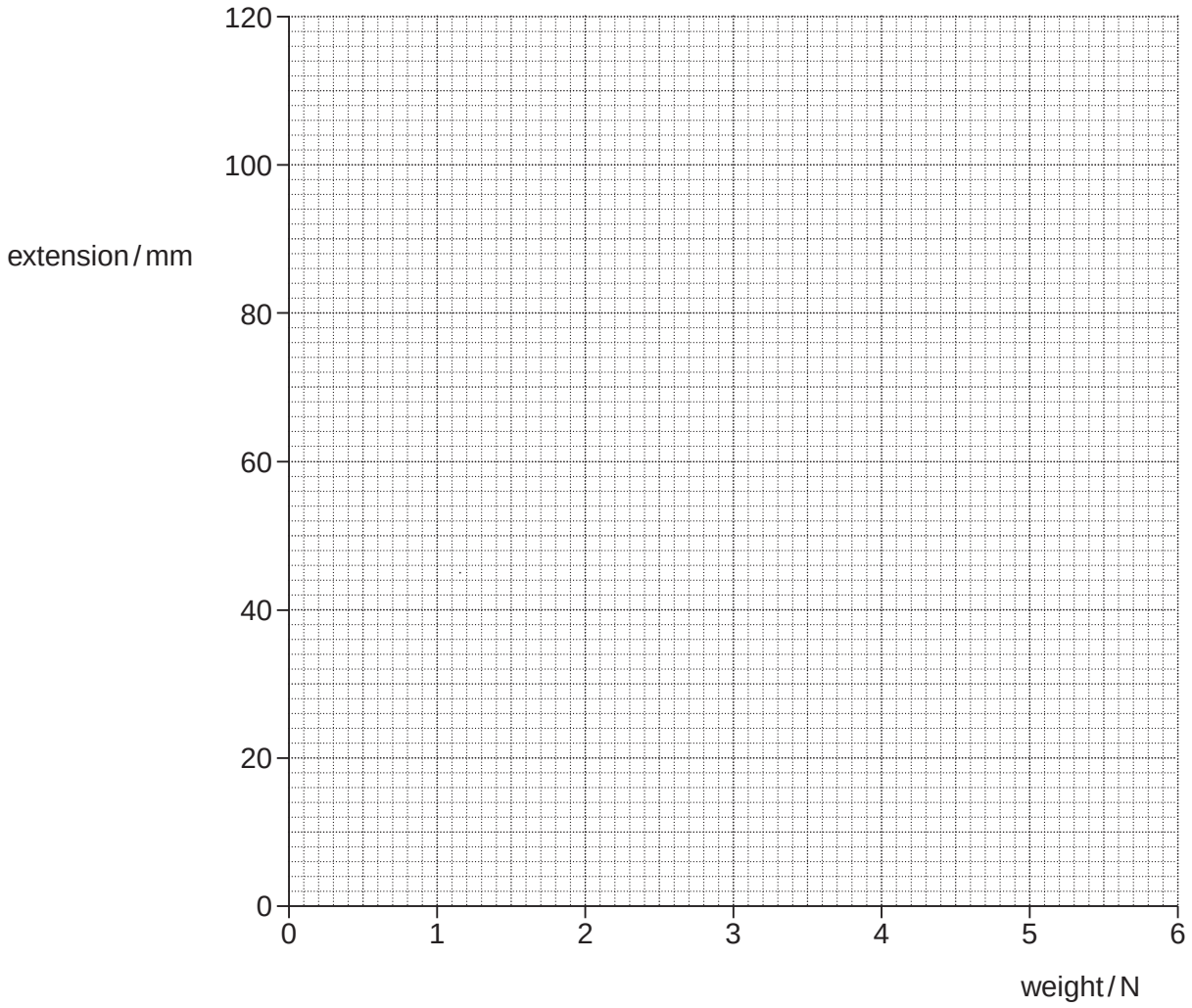

Fig. 3.1

(b) The student appears to have made an error in recording one of the results.

Which result is this?

..... [1]

(c) Ignoring the incorrect result, draw the best straight line through the remaining points.

[1]

(d) State and explain whether this spring is obeying Hooke's Law.

.....

.....

.....

.....

..... [2]

(e) Describe how the graph might be shaped if the student continued to add several more weights to the spring.

.....

.....

.....

..... [1]

(f) The student estimates that if he hangs a 45 N load on the spring, the extension will be 920 mm.

Explain why this estimate may be unrealistic.

.....

.....

.....

..... [1]

[Total: 8]

4 Fig. 4.1 illustrates an object on a string being whirled anticlockwise in a vertical circle.

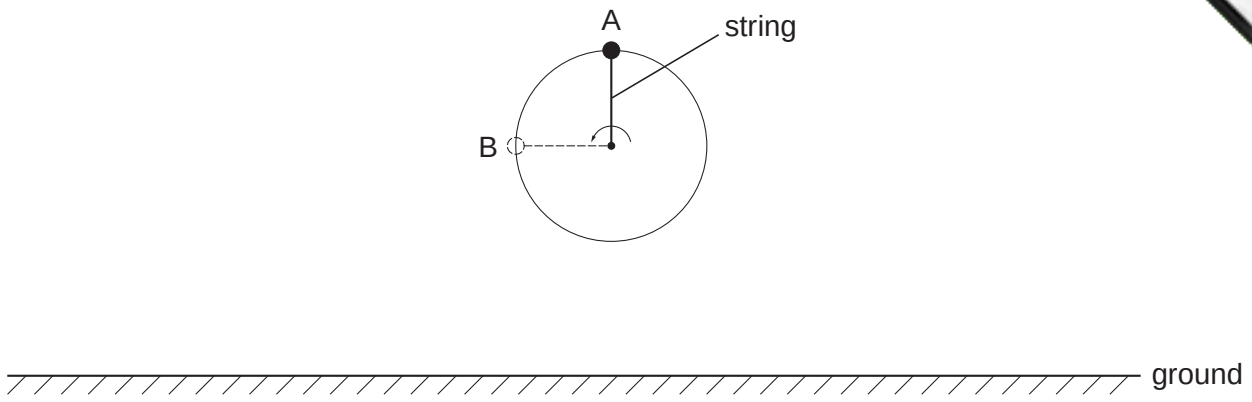

Fig. 4.1

The lowest point of the circle is a small distance above the ground. The diagram shows the object at the top A of the circle, and at B, when it is at the same height as the centre of the circle.

(a) On Fig. 4.1, mark clearly

(i) the force of the string on the object

1. at A,

2. at B. [2]

(ii) the path the object would take until it hit the ground, if the string broke

1. at A,

2. at B. [3]

(b) The mass of the object is 0.05 kg. At A, the tension in the string is 3.6 N.

(i) Calculate the weight of the object.

weight = ... [1]

(ii) Calculate the total force on the object at A.

total force = ... [2]

[Total: 8]

5 A farmer uses an electric pump to raise water from a river in order to fill the irrigation ch... that keep the soil in his fields moist.

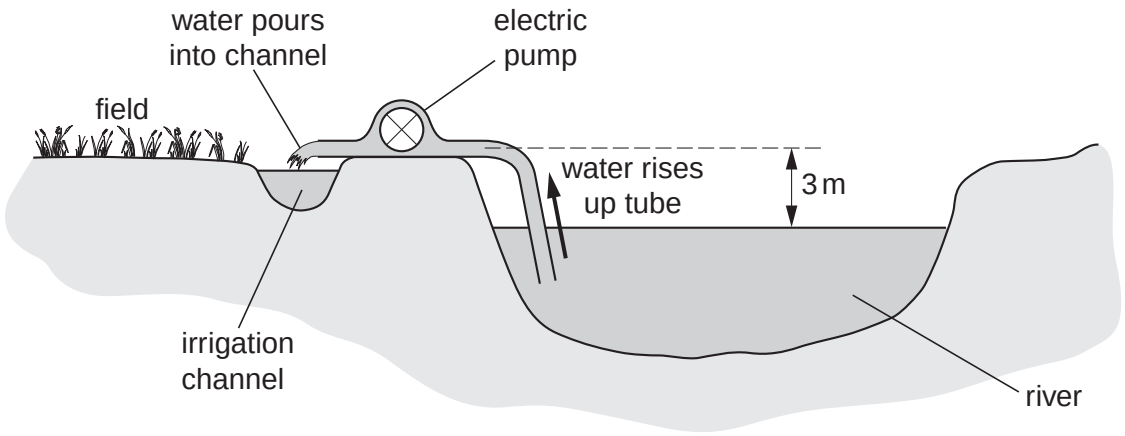

Fig. 5.1

Every minute, the pump raises 12 kg of water through a vertical height of 3 m.

(a) Calculate the increase in the gravitational potential energy of 12 kg of water when it is raised 3 m.

increase in gravitational potential energy = ... [3]

(b) Calculate the useful power output of the pump as it raises the water.

power = ... [3]

[Total: 6]

6 A vertical cylinder has a smooth well-fitting piston in it. Weights can be added to or re… from a tray on the top of the piston.

(a) Weights are added to the tray, as shown in Fig. 6.1.

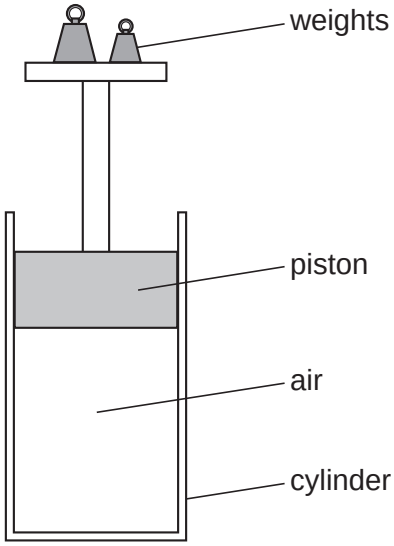

Fig. 6.1

(i) State what happens to the pressure of the air in the cylinder as a result of adding these weights.

..... [1]

(ii) The initial pressure of the trapped air is 1.05×10^5 Pa. When the weights are added, the volume of the air decreases from 860 cm^3 to 645 cm^3.

The temperature of the air does not change.

Calculate the final pressure of the trapped air.

pressure = ... [3]

(iii) The area of the piston is 5.0×10^{-3} m^2.

Calculate the weight that is added to the piston.

weight added = ... [4]

(b) The weights are kept as shown in Fig. 6.1. The temperature of the air in the cyl... increased.

(i) State what happens to the volume of the air in the cylinder as a result of this temperature rise.

..... [1]

(ii) State how, if at all, the pressure of the air changes as the temperature changes.

..... [1]

(iii) State what must be done to prevent the volume change in **(b)(i)**.

..... [1]

(iv) The volume change in **(b)(i)** is prevented. State what happens to the pressure of the air in the cylinder.

..... [1]

[Total: 12]

7 Three wires and a meter are used to construct a thermocouple for measuring the temperature of a pipe carrying hot liquid, as shown in Fig. 7.1.

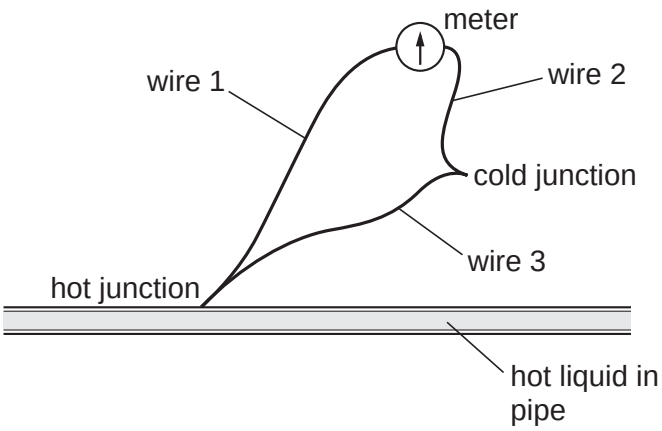

Fig. 7.1

(a) Copper wire and constantan wire are used in the construction of the thermocouple.

State which metal might be used for

wire 1 .....

wire 2 .....

wire 3 .....

[1]

(b) State what type of meter is used.

..... [1]

(c) State one particular advantage of thermocouples for measuring temperature.

..... [1]

[Total: 3]

8 Fig. 8.1 shows a thin converging lens. The two principal foci are shown.

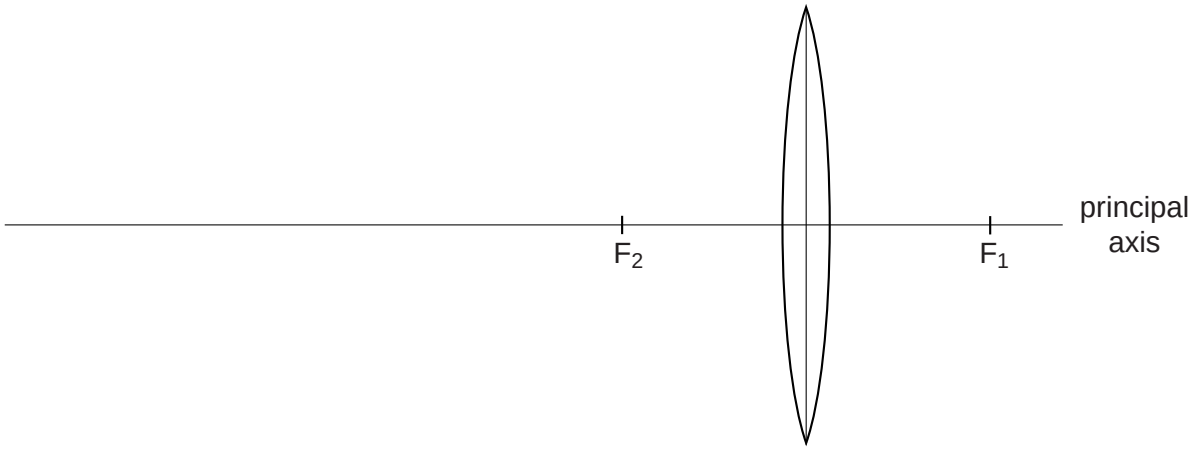

Fig. 8.1

A vertical object, 2 cm tall, is to be positioned to the left of the lens, with one end on the principal axis.

On Fig. 8.1,

(a) draw the object in a position which will produce a virtual image, labelling the object with the letter O, [1]

(b) draw two rays showing how the virtual image is formed, [2]

(c) draw in the image, labelling it with the letter I. [1]

[Total: 4]

9 **(a)** State what is meant by *specific heat capacity*.

.....

..... [2]

(b) Water has a very high specific heat capacity.

Suggest why this might be a disadvantage when using water for cooking.

.....

..... [1]

(c) Fig. 9.1 illustrates an experiment to measure the specific heat capacity of some metal.

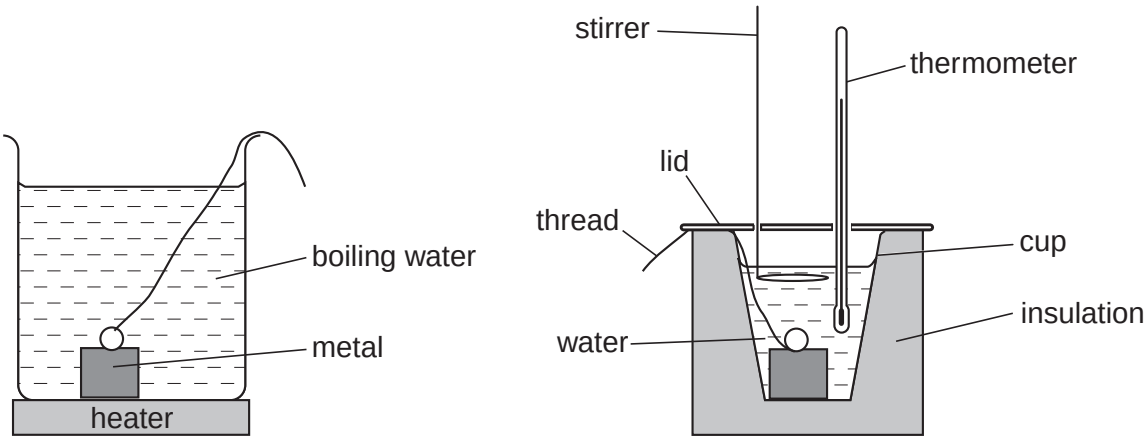

Fig. 9.1

The piece of metal is heated in boiling water until it has reached the temperature of the water. It is then transferred rapidly to some water in a well-insulated cup. A very sensitive thermometer is used to measure the initial and final temperatures of the water in the cup.

specific heat capacity of water = 4200 J / (kg K)

The readings from the experiment are as follows.

mass of metal = 0.050 kg
mass of water in cup = 0.200 kg
initial temperature of water in cup = 21.1 °C
final temperature of water in cup = 22.9 °C

(i) Calculate the temperature rise of the water in the cup and the temperature fall of the piece of metal.

temperature rise of water = ...

temperature fall of metal = ...

[1]

(ii) Calculate the thermal energy gained by the water in the cup. State the eq[illegible] that you use.

thermal energy gained = ... [3]

(iii) Assume that only the water gained thermal energy from the piece of metal.

Making use of your answers to **(c)(i)** and **(c)(ii)**, calculate the value of the specific heat capacity of the metal. Give your answer to 3 significant figures.

specific heat capacity = ... [2]

(iv) Suggest one reason why the experiment might not have given a correct value for the specific heat capacity of the metal.

.....

..... [1]

[Total: 10]

10 Alternating current electricity is delivered at 22 000 V to a pair of transmission lines. The transmission lines carry the electricity to the customer at the receiving end, where the potential difference is *V*. This is shown in Fig. 10.1. Each transmission line has a resistance of 3 Ω.

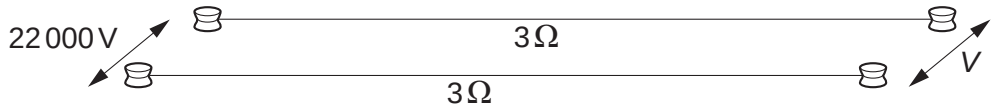

Fig. 10.1

(a) The a.c. generator actually generates at a much lower voltage than 22 000 V.

(i) Suggest how the voltage is increased to 22 000 V.

..... [1]

(ii) State one advantage of delivering electrical energy at high voltage.

..... [1]

(b) The power delivered by the generator is 55 kW. Calculate the current in the transmission lines.

current = ... [2]

(c) Calculate the rate of loss of energy from one of the 3 Ω transmission lines.

rate of energy loss = ... [2]

(d) Calculate the voltage drop across one of the transmission lines.

voltage drop = ... [2]

(e) Calculate the potential difference V at the receiving end of the transmission lines.

V = ... [2]

[Total: 10]

Question 11 is on the next page.

11 Fig. 11.1 is an electronic circuit controlling an electric heater.

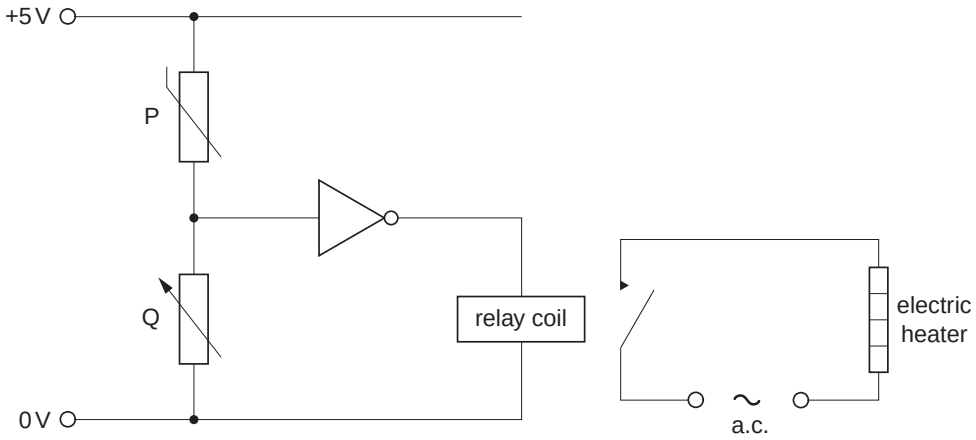

Fig. 11.1

The relay contacts close when there is a current in the relay coil.

(a) State the name of the logic gate in the circuit.

..... [1]

(b) **(i)** State the name of component P.

..... [1]

(ii) State what happens to P when its temperature falls.

..... [1]

(c) For the relay to operate, the output of the gate must be high (logic 1).

(i) What must be the input of the gate for the relay to operate?

..... [1]

(ii) State what the resistance of P must be, compared with the resistance of Q, in order to give this input to the gate.

..... [1]

(iii) Under what conditions will P have this resistance?

..... [1]

(d) Suggest why component Q is a variable resistor, rather than one with a fixed value.

..... [1]

(e) Suggest a practical use for this circuit.

..... [1]

[Total: 8]