UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

9978941325

PHYSICS **0625/31**

Paper 3 Extended **May/June 2011**

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, 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.

DC (LEO/DJ) 28843/5
© UCLES 2011

1 In a laboratory, an experiment is carried out to measure the acceleration of a trolley on a horizontal table, when pulled by a horizontal force.

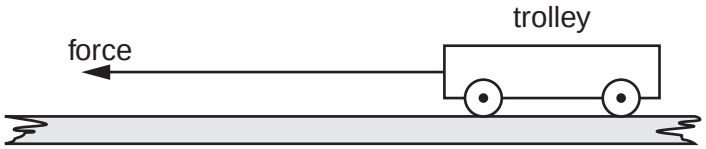


Fig. 1.1

The measurements are repeated for a series of different forces, with the results shown in the table below.

force / N	4.0	6.0	10.0	14.0
$\frac{\text{acceleration}}{\text{m/s}^2}$	0.50	0.85	1.55	2.25

(a) On Fig. 1.2, plot these points and draw the best straight line for your points. [2]

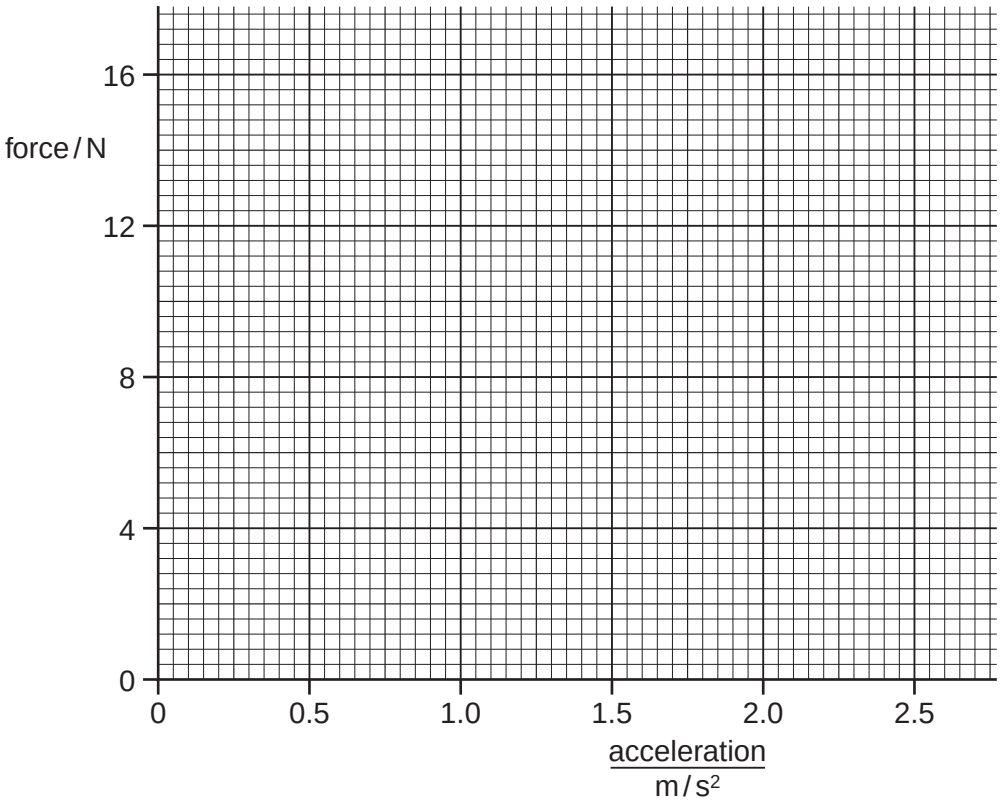


Fig. 1.2

© UCLES 2011

(b) The graph shows that below a certain force there is no acceleration.

(i) Find the value of this force. .....[1]

(ii) A force smaller than that in **(b)(i)** is applied to the stationary trolley. Suggest what happens to the trolley, if anything.

.....[1]

(c) Show that the gradient of your graph is about 5.7.

gradient = ...[1]

(d) **(i)** State the equation that links resultant force *F*, mass *m* and acceleration *a*.

[1]

(ii) Use your gradient from **(c)** to find the mass of the trolley.

mass = ...[2]

(e) On Fig. 1.3, sketch a speed / time graph for a trolley with constant acceleration.

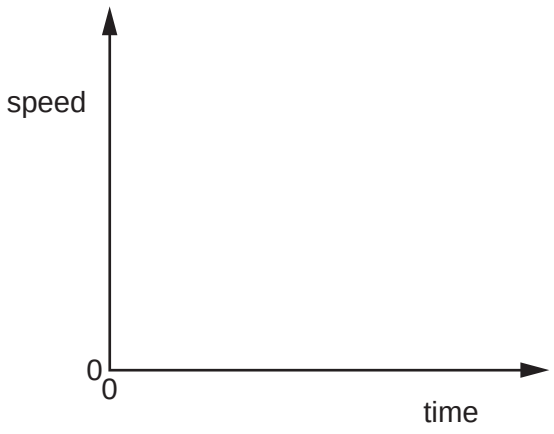


Fig. 1.3

[1]

[Total: 9]

2 Some builders decide to measure their personal power ratings using apparatus they already have on site. Fig. 2.1 shows the arrangement they use.

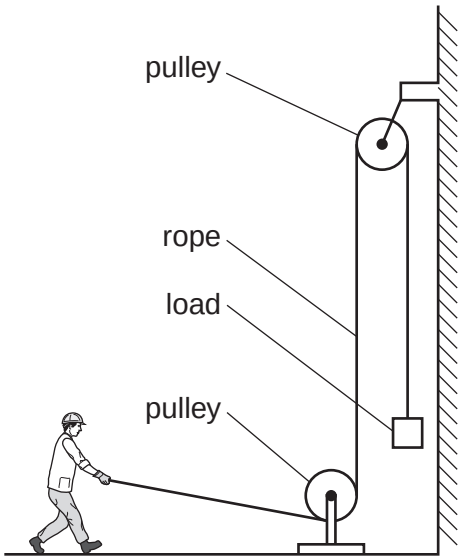


Fig. 2.1

(a) In the table below, list the three quantities they must measure in order to calculate one man's power, and the instrument they would use for each measurement.

quantity to be measured	instrument used for measurement
1.	
2.	
3.	

[3]

(b) One workman is measured as having a power of 528 W. His weight is 800 N.

He can develop the same power climbing a ladder, whose rungs are 30 cm apart.

How many rungs can he climb in 5 s?

number of rungs = ...[3]

© UCLES 2011

(c) The human body is only about 15% efficient when climbing ladders.

Calculate the actual energy used from the body of the workman in **(b)** when he climbs 20 rungs.

energy used = ...[2]

[Total: 8]

3 During a period of hot weather, the atmospheric pressure on the pond in Fig. 3.1 remains constant. Water evaporates from the pond, so that the depth *h* decreases.

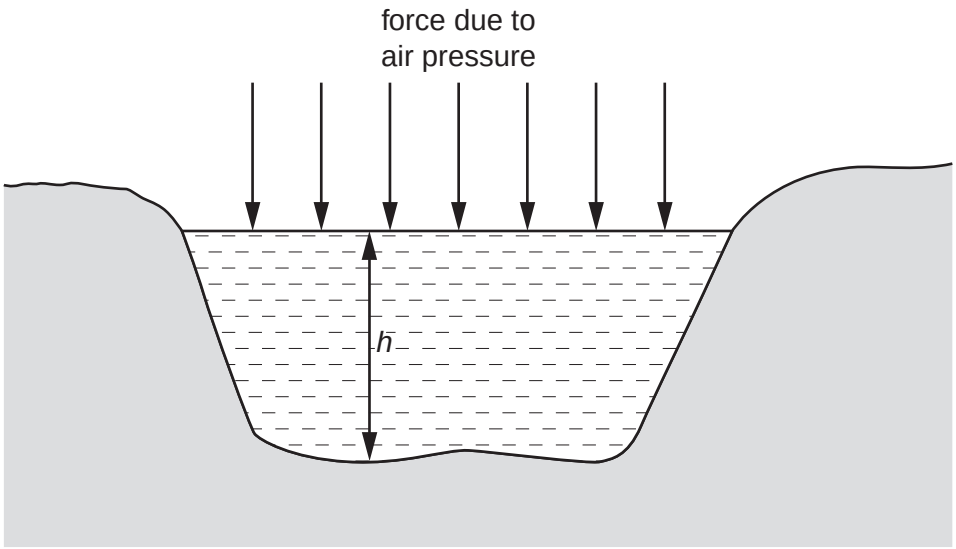


Fig. 3.1

(a) Study the diagram and state, giving your reason, what happens during this hot period to

(i) the force of the air on the surface of the pond,

.....

.....[1]

(ii) the pressure at the bottom of the pond.

.....

.....[1]

(b) On a certain day, the pond is 12 m deep.

(i) Water has a density of 1000 kg / m^3.

Calculate the pressure at the bottom of the pond due to the water.

pressure due to the water = ...[2]

© UCLES 2011

(ii) Atmospheric pressure on that day is 1.0×10^5 Pa.

Calculate the total pressure at the bottom of the pond.

total pressure = ...[1]

(iii) A bubble of gas is released from the mud at the bottom of the pond. Its initial volume is $0.5\,cm^3$.

Ignoring any temperature differences in the water, calculate the volume of the bubble as it reaches the surface.

volume = ...[2]

(iv) In fact, the temperature of the water is greater at the top than at the bottom of the pond.

Comment on the bubble volume you have calculated in **(b)(iii)**.

.....

.....

.....[1]

[Total: 8]

4 The circuit of Fig. 4.1 is set up to run a small immersion heater from a 6.0V battery.

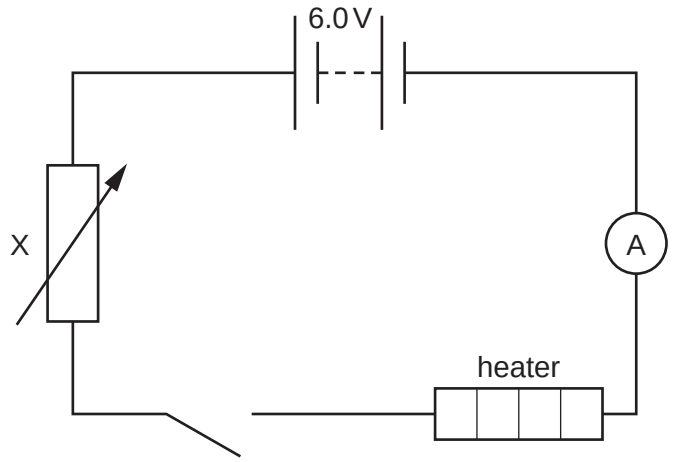


Fig. 4.1

(a) State the name and purpose of component X.

name .....

purpose .....[1]

(b) The heater is designed to work from a 3.6V supply. It has a power rating of 4.5W at this voltage.

(i) Calculate the current in the heater when it has the correct potential difference across it.

current = ...[2]

(ii) Calculate the resistance of component X if there is to be the correct potential difference across the heater. The battery and the ammeter both have zero resistance.

resistance = ...[3]

(c) Some time after the heater is switched on, the ammeter reading is seen to have decreased.

Suggest why this happens.

.....

.....[1]

© UCLES 2011

(d) As an alternative to running the heater from a battery, it is decided to construct a circuit to enable it to be operated from the a.c. mains supply.

Name the electrical component needed to

(i) reduce the potential difference from that of the mains supply down to a potential difference suitable for the heater,

.....[1]

(ii) change the current from a.c. to a current which has only one direction.

.....[1]

[Total: 9]

5 The manufacturer's label on an electric heater is as shown in Fig. 5.1.

C.I.E. Electrical Company
Suitable for use on 110 V, 60 Hz supply
1 kW/2 kW
This appliance must be earthed when in use

Fig. 5.1

(a) State what electrical quantity is represented by

(i) 110 V, ...

(ii) 60 Hz, ...

(iii) 1 kW. ..... [1]

(b) **(i)** Which part of the electric heater must be earthed?

.....[1]

(ii) Explain what the hazard might be if the heater is not earthed.

.....

.....

.....[2]

(c) The heater has two 110 V heating elements, with two switches, so that either one or both elements may be switched on.

In the space below, draw a circuit diagram showing how the heating elements and switches are connected to the mains supply.
Use the symbol ⊣□□□□⊢ for each heating element.

[2]

[Total: 6]

© UCLES 2011

6 **(a)** Six different nuclides have nucleon and proton numbers as follows:

nuclide	nucleon number	proton number
A	214	84
B	214	85
C	211	84
D	211	86
E	210	82
F	210	83

State which two nuclides are isotopes of the same element. ..... and ..... [1]

(b) Thorium-232 has a half-life of 1.4×10^{10} years.

At a particular instant, the activity of a sample of thorium-232 is 120 Bq.

(i) Calculate the time taken for the activity of this sample to fall to 15 Bq.

time taken .....[1]

(ii) Explain why, when the activity has become 15 Bq, much of the sample will no longer be thorium-232.

.....

.....

.....[1]

(iii) The sample of thorium-232 is used in an experiment in a laboratory.

Explain why its activity may be regarded as constant.

.....

.....

.....[1]

[Total: 4]

7 **(a)** The speed of light in air is known to be 3.0×10^8 m/s.

Outline how you would use a refraction experiment to deduce the speed of light in glass. You may draw a diagram if it helps to clarify your answer.

.....

.....

.....

.....

.....

.....[4]

(b) A tsunami is a giant water wave. It may be caused by an earthquake below the ocean.

Waves from a certain tsunami have a wavelength of 1.9×10^5 m and a speed of 240 m/s.

(i) Calculate the frequency of the tsunami waves.

frequency = ...[2]

© UCLES 2011

(ii) The shock wave from the earthquake travels at 2.5×10^3 m/s.

The centre of the earthquake is 6.0×10^5 m from the coast of a country.

Calculate how much warning of the arrival of the tsunami at the coast is given by the earth tremor felt at the coast.

warning time = ...[4]

[Total: 10]

8 **(a)** Fig. 8.1 shows a section of an optical fibre. It consists of a fibre of denser transparent material, coated with a layer of a less dense transparent material.

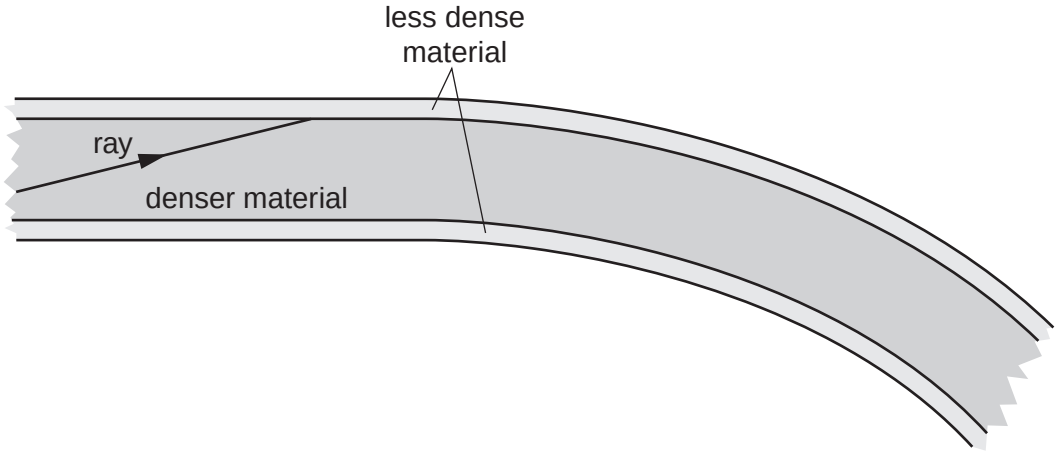


Fig. 8.1

One ray within the fibre has been started for you on Fig. 8.1.

(i) State and explain what happens to the ray already drawn, after it reaches the boundary between the materials.

.....

.....

.....[2]

(ii) On Fig. 8.1, carefully continue the ray until it reaches the end of the section of optical fibre. [1]

(b) Fibre-optic cables are sometimes used to carry out internal examinations on the human stomach.

(i) Suggest one reason why the cable is made of thousands of very thin optical fibres.

.....

.....

.....[1]

(ii) Describe briefly how the inside of the stomach is illuminated.

.....

.....

.....[1]

© UCLES 2011

(iii) Describe briefly how the light from the stomach is transferred to the detecting equipment outside the body.

.....

.....

.....[1]

[Total: 6]

9 A simple motor is made in a school laboratory. A coil of wire is mounted on an axle between the poles of a horseshoe magnet, as illustrated in Fig. 9.1.

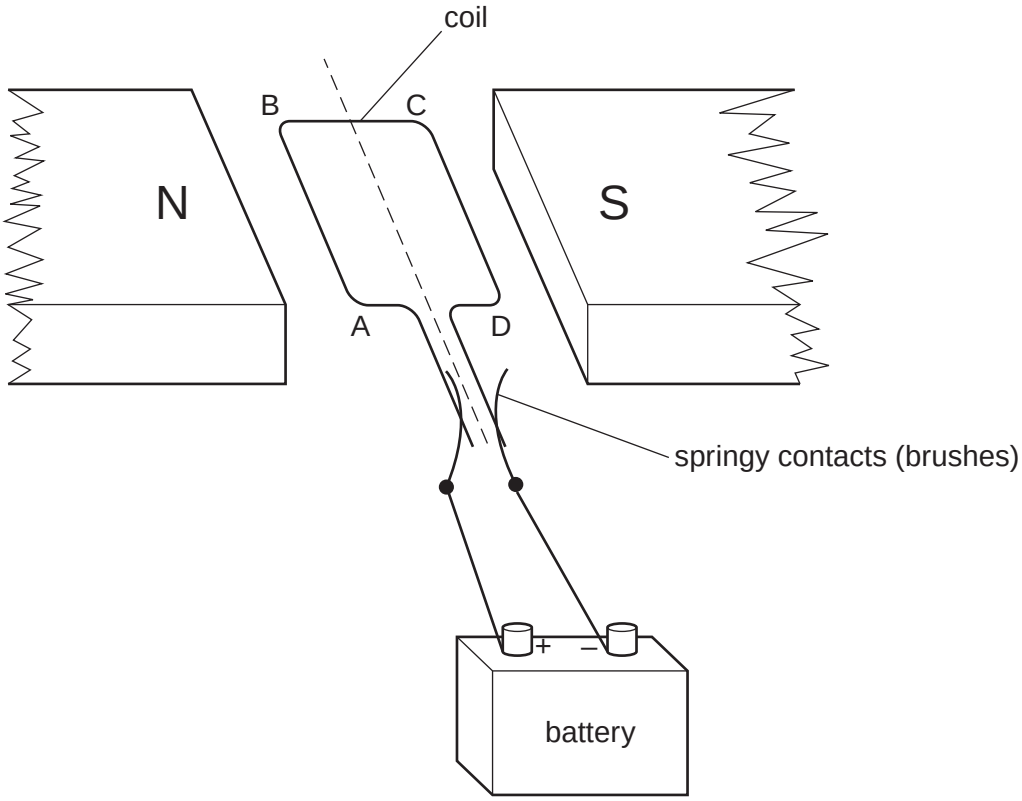


Fig. 9.1

(a) At the instant illustrated in Fig. 9.1, the coil ABCD is horizontal and the battery is connected as shown.

(i) For this position, state the direction of the force on AB and the direction of the motion of AB.

force on AB .....

direction of motion of AB .....[1]

(ii) Explain why BC does not contribute to the turning force on the coil.

.....

.....[1]

© UCLES 2011

(b) At the instant when the coil is vertical, the springy contacts do not, in fact, make contact with the ends of the coil.

Describe and explain what happens to the coil.

.....

.....

.....

.....[2]

(c) The motor in Fig. 9.1 does not rotate very quickly. The designer of a commercial motor is required to produce a faster-rotating motor.

Suggest **one** change that could be made to increase the speed of the motor.

.....

.....[1]

[Total: 5]

© UCLES 2011

[Turn over

10 **(a)** A cathode-ray oscilloscope makes use of the process known as thermionic emission.

Describe what happens during this process.

.....

.....

.....[1]

(b) In the space below, draw a **labelled** diagram of a cathode-ray oscilloscope.

Include in your diagram the tube, the cathode, the accelerating anode, the focusing anode and both X- and Y-plates. Do not attempt to show any external circuits.

[3]

(c) A cathode ray is a beam of electrons.

Suggest one way of controlling the number of electrons in the beam.

.....

.....[1]

© UCLES 2011

(d) One cathode-ray tube has 5000 V between the accelerating anode and the cathode.

The beam of electrons carries a total charge of 0.0095 C in 5.0 s.

Calculate

(i) the current caused by the beam,

current = ...[2]

(ii) the energy transferred by the beam in 20 s.

energy = ...[2]

[Total: 9]

Question 11 is on the next page.

11 A mass of 0.36 kg of a certain substance is in the solid state in a well-insulated container. The substance is heated at the rate of 1.2×10^4 J / minute.

2.0 minutes after starting the heating, the substance is all at the same temperature, and it starts to melt.

11.0 minutes after starting the heating, the substance finishes melting and the temperature starts to rise again.

(a) Calculate the specific latent heat of the substance.

specific latent heat = ...[3]

(b) (i) After 11 minutes of heating, when the temperature starts rising again, in which state is the substance?

.....[1]

(ii) Describe what happens to the molecules as thermal energy is supplied to them in this state.

.....

.....

.....

.....[2]

[Total: 6]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.