Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7032633375

PHYSICS **0625/42**

Paper 4 Theory (Extended) **February/March 2016**

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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 1.0 kg to be 10 N (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.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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

CAMBRIDGE International Examinations

[Turn over

1 A driving instructor gives a student a sudden order to stop the car in the shortest possible time.

Fig. 1.1 shows the speed-time graph of the motion of the car from the moment the order is given.

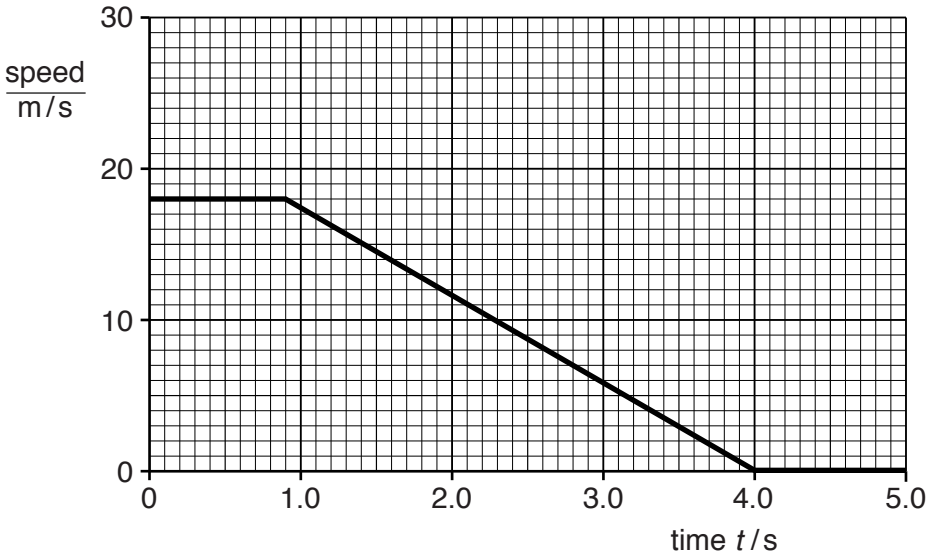


Fig. 1.1

(a) The order to stop is given at time $t = 0$ s.

(i) State the speed of the car at $t = 0$ s.

speed = ...[1]

(ii) Suggest why the car continues to travel at this speed for 0.9 s.

.....

.....[1]

(b) Calculate

(i) the deceleration of the car between $t = 0.9$ s and $t = 4.0$ s,

deceleration = ...[2]

(ii) the total distance travelled by the car from $t = 0$ s.

distance = ...[3]

(c) Describe and explain a danger to a driver of not wearing a safety belt during a sudden stop.

.....

.....

.....

.....[2]

[Total: 9]

2 Fig. 2.1 shows a hammer being used to drive a nail into a piece of wood.

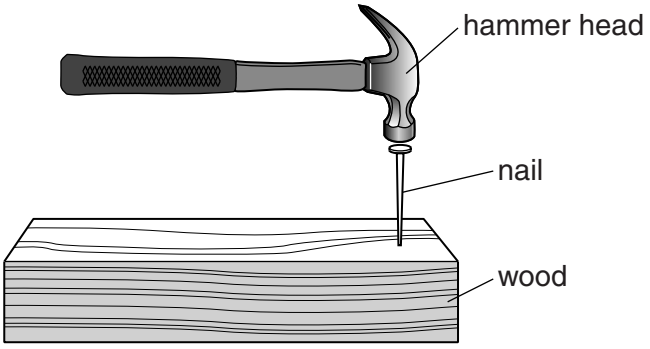


Fig. 2.1

The mass of the hammer head is 0.15 kg.
The speed of the hammer head when it hits the nail is 8.0 m/s.
The time for which the hammer head is in contact with the nail is 0.0015 s.

The hammer head stops after hitting the nail.

(a) Calculate the change in momentum of the hammer head.

change in momentum = ...[2]

(b) State the impulse given to the nail.

impulse = ...[1]

(c) Calculate the average force between the hammer and the nail.

average force = ...[2]

[Total: 5]

3 **(a)** **(i)** On Fig. 3.1, draw a graph of extension against load for a spring which obeys Hooke's law. [1]

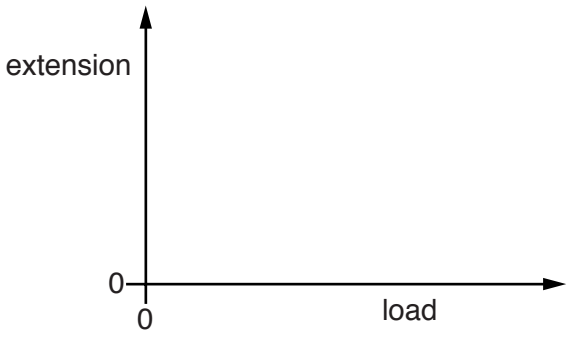


Fig. 3.1

(ii) State the word used to describe the energy stored in a spring that has been stretched or compressed.

.....[1]

(b) Fig. 3.2 shows a model train, travelling at speed *v,* approaching a buffer.

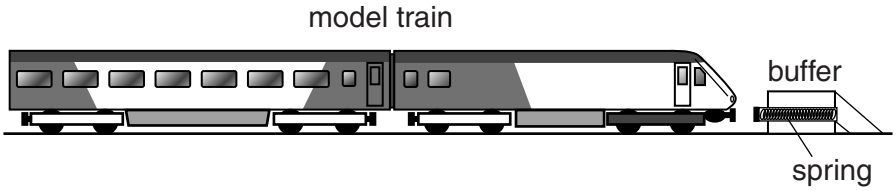


Fig. 3.2

The train, of mass 2.5 kg, is stopped by compressing a spring in the buffer. After the train has stopped, the energy stored in the spring is 0.48 J.

Calculate the initial speed *v* of the train.

v = ...[4]

[Total: 6]

4 **(a)** The source of solar energy is the Sun.

Tick the box next to those resources for which the Sun is also the source of energy.

- ☐ coal
- ☐ geothermal
- ☐ hydroelectric
- ☐ nuclear
- ☐ wind [2]

(b) Fig. 4.1 shows a solar water-heating panel on the roof of a house.

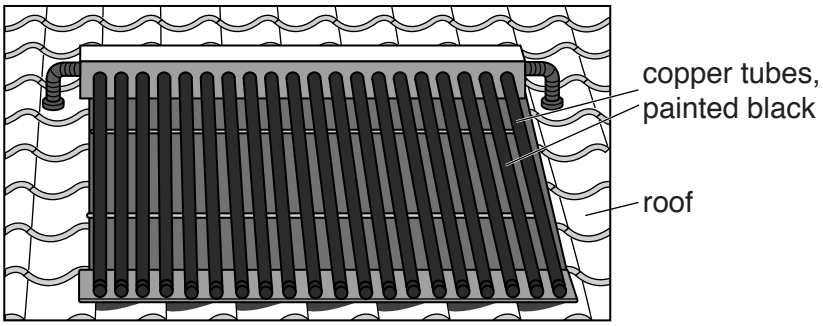


Fig. 4.1

Cold water flows into the copper tubes, which are heated by solar radiation. Hot water flows out of the tubes and is stored in a tank.

(i) Explain why the tubes are made of copper and are painted black.

.....

.....

.....[2]

(ii) In 5.0 s, 0.019 kg of water flows through the tubes. The temperature of the water increases from 20 °C to 72 °C. The specific heat capacity of water is 4200 J / (kg °C).

Calculate the thermal energy gained by the water in 5.0 s.

thermal energy = ...[3]

(iii) The efficiency of the solar panel is 70%.

Calculate the power of the solar radiation incident on the panel.

power = ...[2]

[Total: 9]

5 **(a)** A student carries out an experiment to find the relationship between the pressure p and the volume V of a fixed mass of gas. The table contains four of her sets of measurements.

p/kPa	250	500	750	1000
V/cm^3	30.0	15.2	9.8	7.6

(i) Use the data in the table to suggest the relationship between the pressure and the volume in this experiment. Explain how you reach your conclusion.

.....

.....

.....

.....[2]

(ii) State the property of the gas, apart from the mass, that remains constant during the experiment.

.....[1]

(b) A lake is 5.0 m deep. The density of the water is 1000 kg/m^3.

(i) Calculate the pressure at the bottom of the lake due to this depth of water.

pressure = ...[2]

(ii) A bubble of gas escapes from the mud at the bottom of the lake and rises to the surface.

Place one tick in each row of the table to indicate what happens to the volume, the mass and the density of the gas in the bubble. Assume that no gas or water vapour enters or leaves the bubble.

	increases	stays the same	decreases
volume of bubble			
mass of gas in bubble			
density of gas in bubble			

[2]

[Total: 7]

6 **(a)** Fig. 6.1 represents the waveform of a sound wave. The wave is travelling at constant speed.

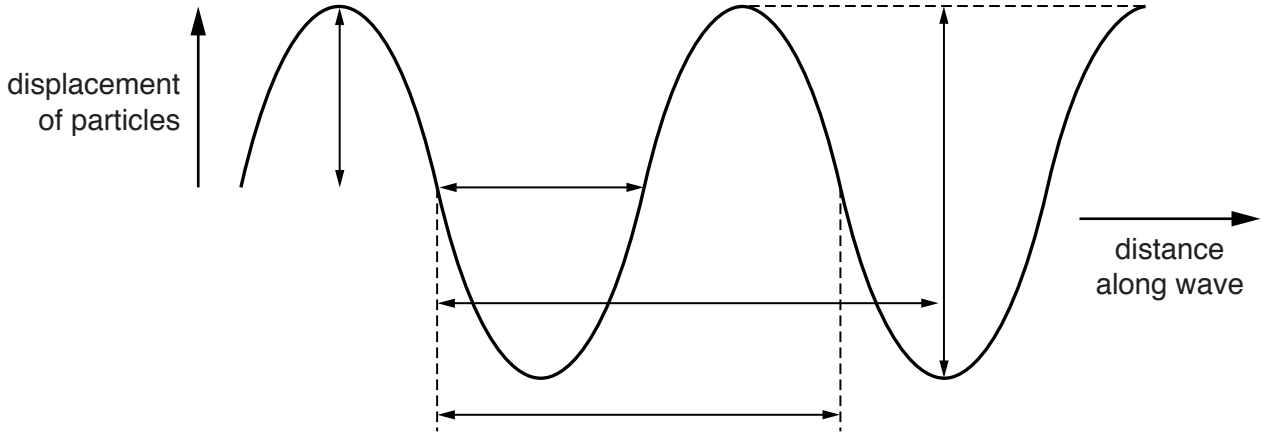


Fig. 6.1

(i) On Fig. 6.1,

1. label with the letter X the marked distance corresponding to the amplitude of the wave, [1]

2. label with the letter Y the marked distance corresponding to the wavelength of the wave. [1]

(ii) State what happens to the amplitude and the wavelength of the wave if

1. the loudness of the sound is increased at constant pitch,

amplitude .....

wavelength .....
[1]

2. the pitch of the sound is increased at constant loudness.

amplitude .....

wavelength .....
[1]

(b) A ship uses pulses of sound to measure the depth of the sea beneath the ship. A sound pulse is transmitted into the sea and the echo from the sea-bed is received after 54 ms. The speed of sound in seawater is 1500 m / s.

Calculate the depth of the sea beneath the ship.

depth = ...[3]

[Total: 7]

[Turn over

7 **(a)** Explain what is meant by

(i) *total internal reflection*,

.....

.....[1]

(ii) *critical angle*.

.....

.....[1]

(b) Fig. 7.1 shows a ray of light, travelling in air, incident on a glass prism.

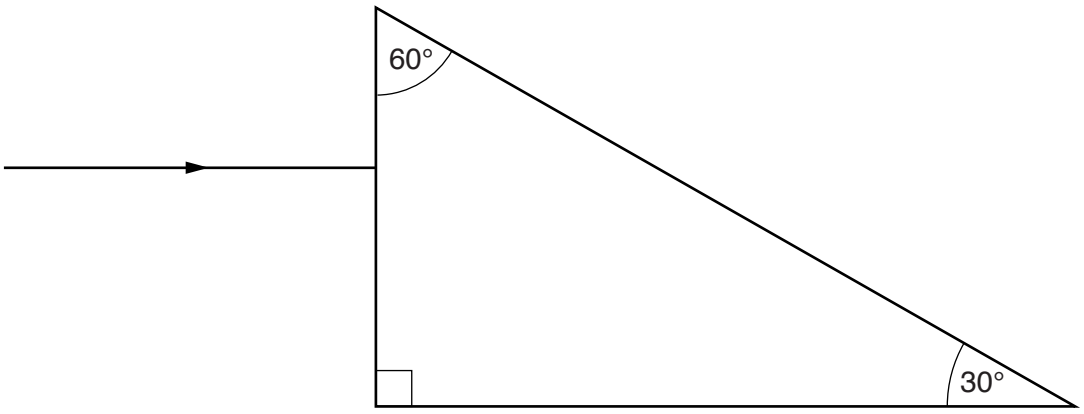


Fig. 7.1

(i) The speed of light in air is 3.0×10^8 m/s. Its speed in the glass is 2.0×10^8 m/s.

Calculate the refractive index of the glass.

refractive index = ...[2]

(ii) Show that the critical angle for the glass-air boundary is 42°.

[1]

(iii) On Fig. 7.1, draw carefully, without calculation, the continuation of the ray through the prism and into the air. [3]

[Total: 8]

8 **(a)** Fig. 8.1 shows 3 lamps and a fuse connected to a power supply.

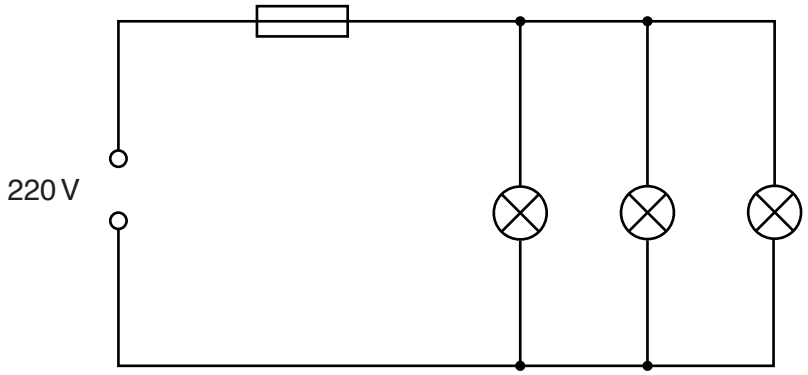


Fig. 8.1

The e.m.f. of the supply is 220 V. Each lamp is labelled 220 V, 40 W. The rating of the fuse is 2.0 A.

Calculate

(i) the current in each lamp,

current = ...[2]

(ii) the current in the fuse,

current = ...[1]

(iii) the total number of lamps, all in parallel, that could be connected without blowing the fuse.

number = ...[2]

(b) After a very long period of use, the wire filament of one of the lamps becomes thinner.

(i) Underline the effect of this change on the resistance of the filament.

resistance increases resistance remains the same resistance decreases [1]

(ii) State and explain the effect of this change on the power of the lamp.

.....

.....

.....[2]

[Total: 8]

9 (a) (i) State what is meant by the *direction* of an electric field.

.....

.....[1]

(ii) Fig. 9.1 shows a pair of oppositely-charged horizontal metal plates with the top plate positive.

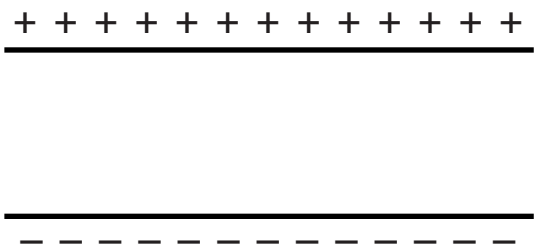


Fig. 9.1

The electric field between the plates in Fig. 9.1 is uniform.

Draw lines on Fig. 9.1 to represent this uniform field. Add arrows to these lines to show the direction of the field. [3]

(b) Fig. 9.2 shows a very small negatively-charged oil drop in the air between a pair of oppositely charged horizontal metal plates. The oil drop does not move up or down.

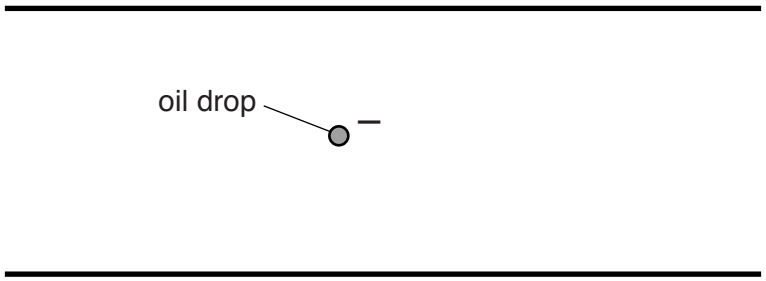


Fig. 9.2

(i) Suggest, in terms of forces, why the oil drop does not move up or down.

.....

.....[2]

(ii) Without losing any of its charge, the oil drop begins to evaporate.

State and explain what happens to the oil drop.

.....

.....[2]

[Total: 8]

10 (a) An iodine isotope $^{131}_{53}\mathrm{I}$ decays by β-emission to an isotope of xenon (Xe).

(i) State the number of each type of particle in a neutral atom of $^{131}_{53}\mathrm{I}$.

protons ..... neutrons ..... electrons ..... [2]

(ii) State the symbol, in nuclide notation, for the xenon nucleus.

.....[2]

(b) The background count rate of radioactivity in a laboratory is 30 counts / min.

A radioactive sample has a half-life of 50 minutes. The sample is placed at a fixed distance from a detector. The detector measures an initial count rate from the sample, including background, of 310 counts / min.

On Fig. 10.1, plot suitable points and draw a graph of the count rate from the sample, **corrected for background**, as it changes with time.

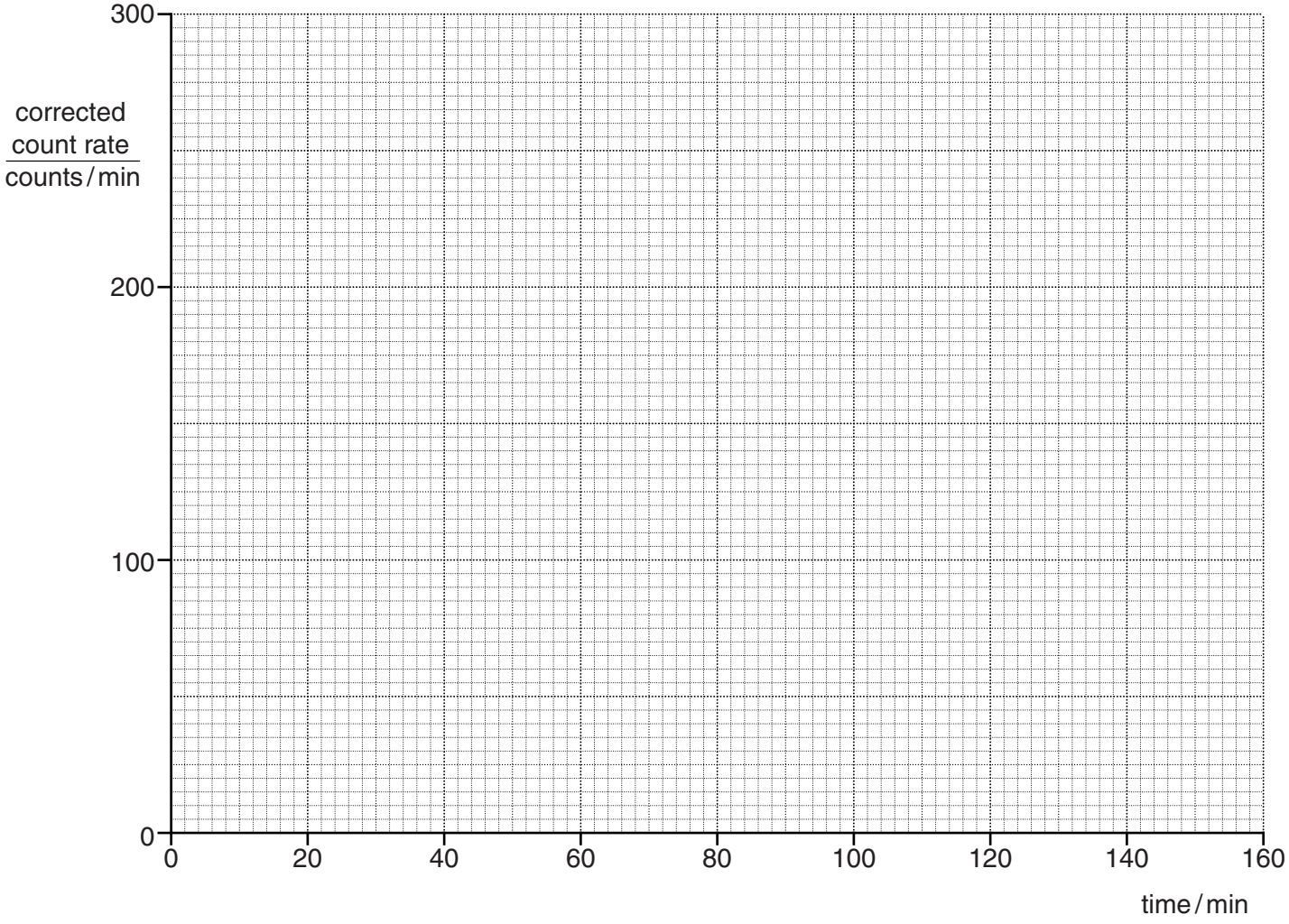
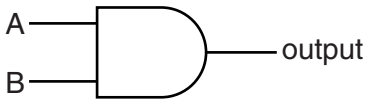


Fig. 10.1

[3]

[Total: 7]

11 (a) (i) Fig. 11.1 shows the symbol for a logic gate and its truth table.

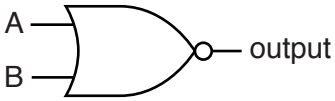


input A	input B	output
0	0	0
1	0	0
0	1	0
1	1	1

Fig. 11.1

State the name of this logic gate. .....[1]

(ii) Complete the truth table for the logic gate shown in Fig. 11.2.



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

Fig. 11.2

[2]

(b) Fig. 11.3 shows the system of logic gates used to ensure the security of the strongroom of a bank.

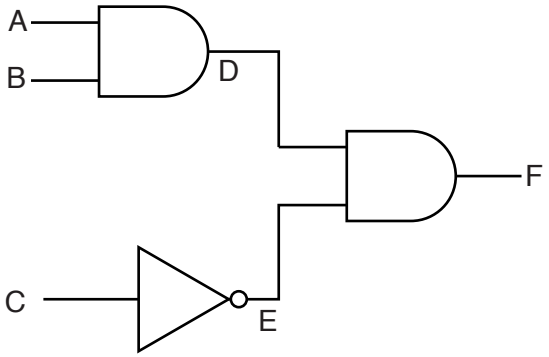


Fig. 11.3

The strongroom door will only open when the output F is logic 1.

Complete the table to show the logic states at A, B, C, D and E when the strongroom door can be opened.

input A	input B	input C	output D	output E	output F
					1

[3]

[Total: 6]