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 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.

This document consists of **20** printed pages.

1 A school athlete does a sprint training run. Fig. 1.1 shows how her speed varies with time.

For Examiner's Use

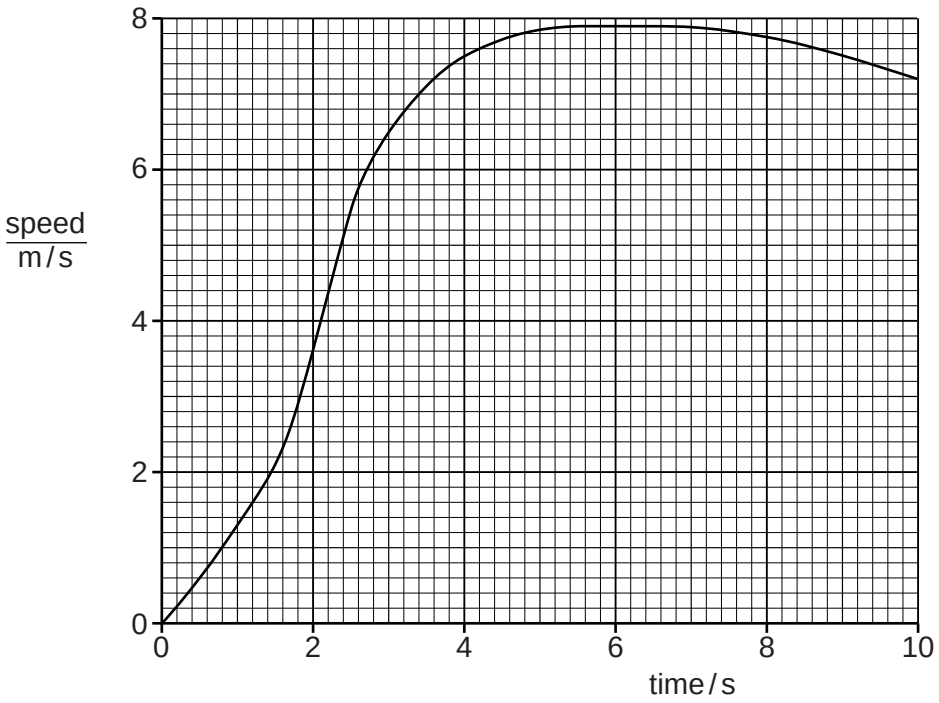

Fig. 1.1

(a) Explain how the graph in Fig. 1.1 can be used to determine the distance she runs.

.....

..... [1]

(b) Determine her maximum acceleration. Show clearly on the graph how you obtained the necessary information.

maximum acceleration = ... [4]

(c) She runs a distance of 62 m.

Calculate her average speed.

For Examiner's Use

average speed = ...[2]

[Total: 7]

2 Fig. 2.1 shows a model fire engine used by a student to take measurements of force and motion.

For Examiner's Use

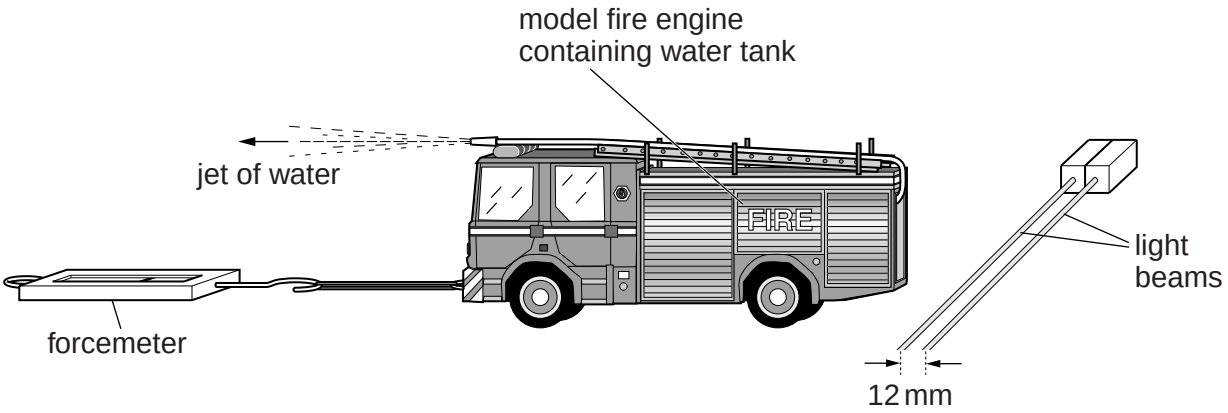

Fig. 2.1

The model projects a jet of water forwards. The forcemeter holds the model stationary. It indicates a force of 0.060 N acting on the model.

The forcemeter is now disconnected and the model accelerates to the right at 0.030 m / s^2.

(a) The back of the model breaks a pair of light beams and the time to pass between them is measured electronically. The beams are 12 mm apart and the second beam is broken 0.080 s after the first.

The student times with a stopwatch how long it takes from the release of the model until the beams are cut.

Calculate the time he measures.

time measured = ... [4]

(b) This experiment is carried out with the water tank in the model nearly full.

Calculate the mass of the model including the water in the tank.

For Examiner's Use

mass = ...[2]

(c) The student repeats the experiment with the same force but with the water tank nearly empty.

State and explain how the acceleration will compare to that of the first experiment.

.....

.....

.....

.....

.....[2]

[Total: 8]

3 **(a)** **(i)** State one similarity and one difference between vector and scalar quantities.

similarity .....

difference .....[2]

(ii) Give an example of each quantity.

vector quantity .....

scalar quantity .....[2]

(b) Fig. 3.1 is an overhead view of two tractors pulling a tree trunk.

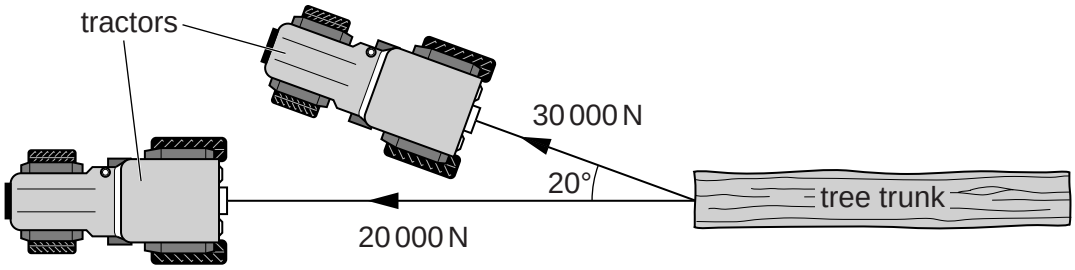

Fig. 3.1

The force exerted by each tractor is indicated in the diagram.

In the space below, carefully draw a scale diagram to determine the resultant force on the tree trunk. State the scale you use.
Write down the magnitude of the resultant force **and** the angle between the resultant force and one of the original forces.

magnitude of resultant force = ...

direction of resultant force = ...
[4]

[Total: 8]

4 Fig. 4.1 shows a small, closed, transparent chamber containing smoke.

For Examiner's Use

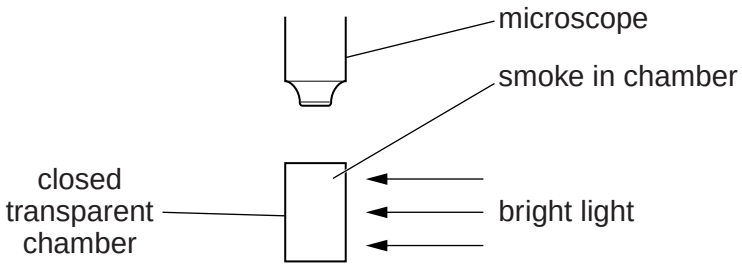

Fig. 4.1

The chamber is brightly lit and observed through a microscope. The smoke particles are seen as very small, bright dots.

(a) Describe the movement of the dots.

.....

.....

.....

..... [2]

(b) Explain, in terms of molecules, how this movement is caused.

.....

.....

.....

..... [2]

(c) Describe what is seen as the smoke particles move towards and away from the observer.

.....

.....

.....

..... [1]

[Total: 5]

5 Fig. 5.1 shows two identical metal cans, open at the top, used in an experiment on thermal energy. The outside of can A is polished and the outside of can B is painted black.

For Examiner's Use

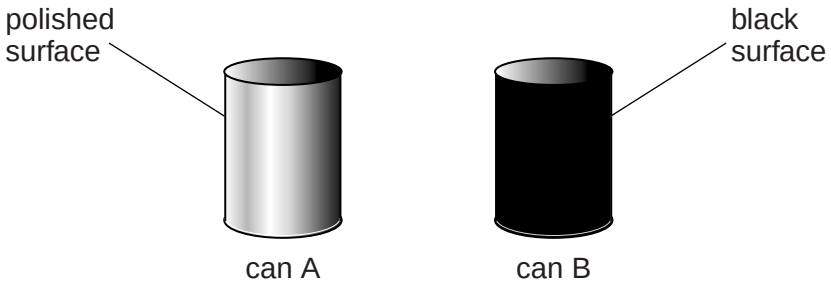

Fig. 5.1

(a) The cans are heated to the same temperature. Predict and explain the relative rates of loss of thermal energy by infra-red radiation from the two cans.

.....

.....

.....

.....[2]

(b) **(i)** A student is provided with the two cans, a supply of hot water and two thermometers.

Describe the experiment he should carry out to test your answer to **(a)**.

.....

.....

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.....

.....

.....[4]

(ii) Another student is given the same equipment but finds two polystyrene tiles. Fig. 5.2 shows the tiles alongside the cans.

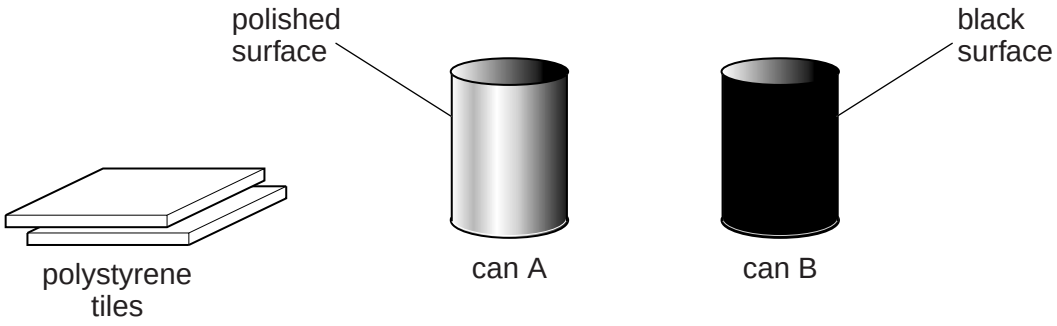

Fig. 5.2

State how she could use the tiles to improve the experiment, and explain why this is effective.

.....

.....

.....

.....[2]

(c) The two cans are now filled with cold water and placed equal distances from a strong source of infra-red radiation.

State and explain which can of water heats up more quickly.

.....

.....

.....

.....[2]

[Total: 10]

6 **(a)** Draw a straight line from each wave to the most appropriate speed on the right.

For Examiner's Use

wave	speed
	15 m/s (1.5 × 10 m/s)
	300 m/s (3×10^2 m/s)
light in air	1500 m/s (1.5×10^3 m/s)
sound in air	1 500 000 m/s (1.5×10^6 m/s)
sound in water	300 000 000 m/s (3×10^8 m/s)
	1 500 000 000 m/s (1.5×10^9 m/s)

[3]

(b) Fig. 6.1 shows a railway-line testing-team checking a continuous rail of length 120 m. The diagram is not to scale.

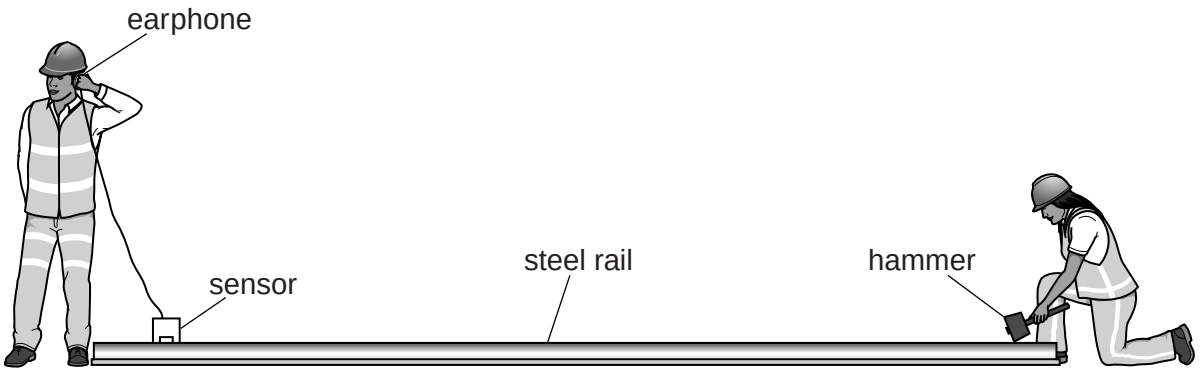

Fig. 6.1 (not to scale)

One tester strikes one end of the rail with a hammer. The other tester hears the sound transmitted through the air and transmitted through the rail. He hears the two sounds at different times.

For Examiner's Use

The speed of sound in steel is 5000 m / s.

Calculate the time difference, using your value from **(a)** for the speed of sound in air.

time difference = ...[4]

[Total: 7]

7 **(a)** Fig. 7.1 shows a ray diagram of a converging lens forming the image I of the object O.

For Examiner's Use

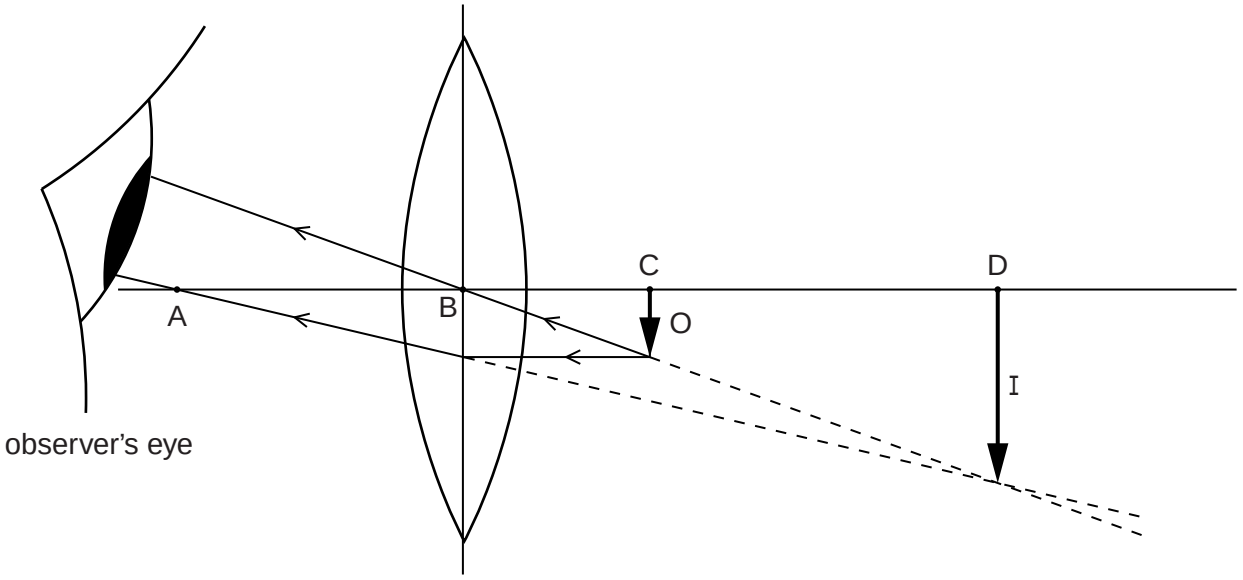

Fig. 7.1

(i) Put a tick in **two** boxes in the following list to describe the image formed by the lens in Fig. 7.1.

description	place **two** ticks in this column
real	
virtual	
magnified (enlarged)	
same size	
diminished (smaller)	

(ii) Which length, on Fig. 7.1, is the focal length of the lens?
Circle one of the lengths below.

AB BC BD CD

[3]

(b) In this question, you will apply the laws of reflection for a plane mirror to a curved mirror.

For Examiner's Use

This mirror is shown in Fig. 7.2. The normal at any point on this mirror is the line from that point to the point C.

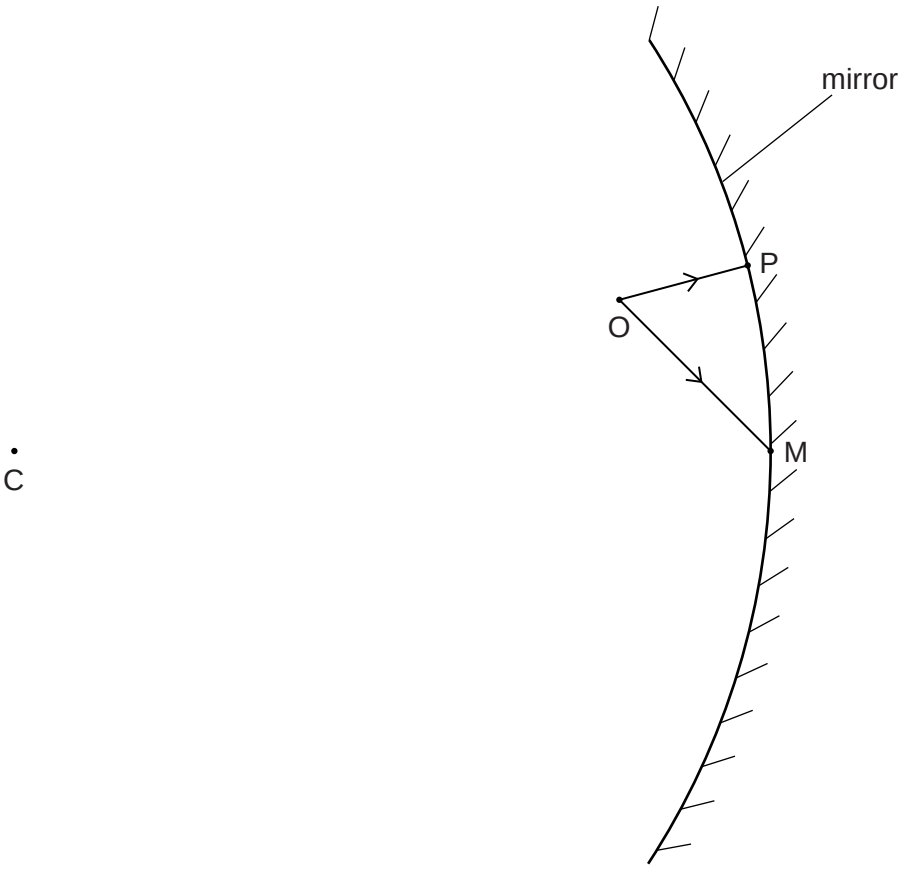

Fig. 7.2

Two rays have been drawn from the object O.

On Fig. 7.2,

(i) draw the normal to the mirror at M, [1]

(ii) draw the ray reflected from M, [1]

(iii) draw the ray reflected from P, [1]

(iv) extend the reflected rays back to the right of the mirror and locate the image. Label this image I. [2]

[Total: 8]

8 **(a)** A piece of wire has a resistance of 0.45 Ω.

For Examiner's Use

Calculate the resistance of another piece of wire of the same material with a third of the length and half the cross-sectional area.

resistance = ... [3]

(b) Fig. 8.1 shows a circuit with three resistors, a power supply and four voltmeters.

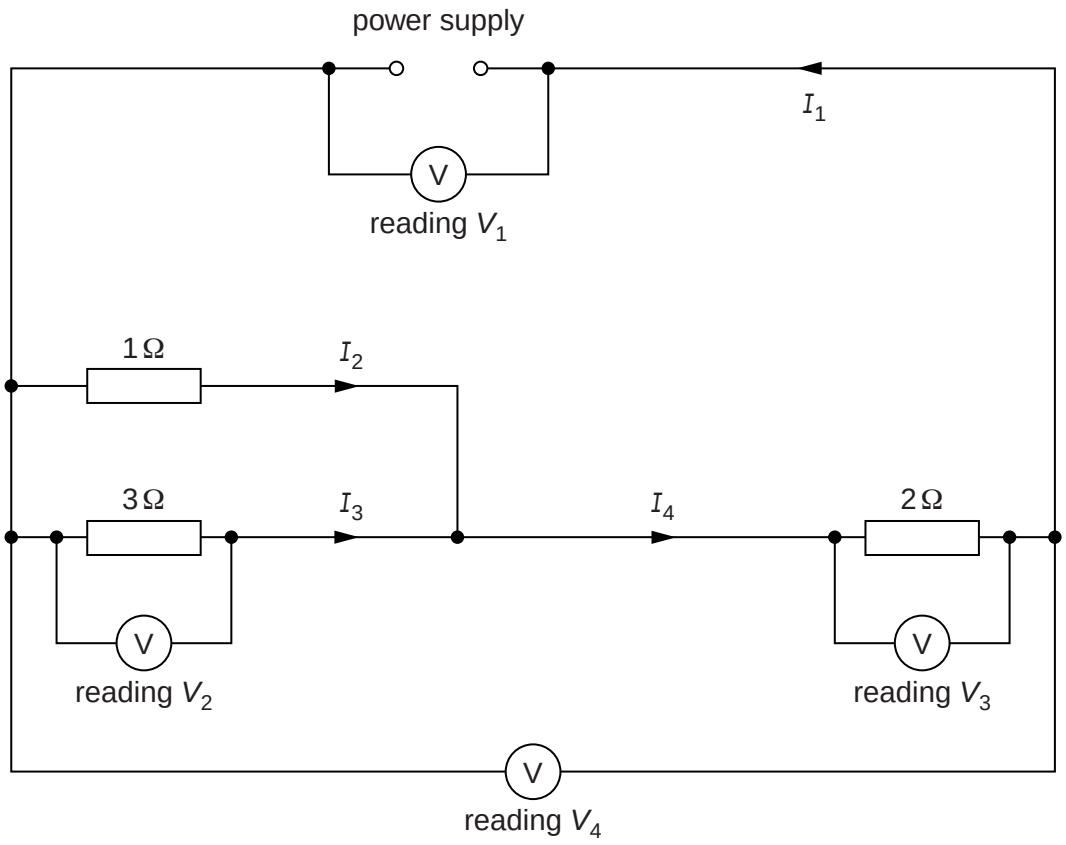

Fig. 8.1

(i) Calculate the combined resistance of the three resistors.

For Examiner's Use

resistance = ... [3]

(ii) Write down **two** relationships for the currents in the circuit.

[2]

(iii) Write down **two** relationships for the voltmeter readings in the circuit.

[2]

[Total: 10]

9 **(a)** An electrical safety expert is inspecting a laundry. The main workroom has a very hot and damp atmosphere.

The safety expert recommends that normal domestic light switches, as shown in Fig. 9.1, are replaced.

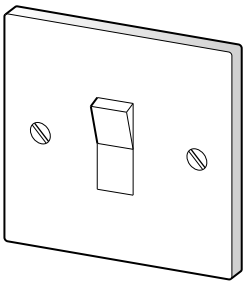

Fig. 9.1

(i) Explain why this recommendation is made.

.....

.....

.....

.....[2]

(ii) Suggest how the lights should be switched on and off.

.....

.....

.....

.....[1]

(b) Fig. 9.2 shows an aircraft being refuelled through a rubber hose.

For Examiner's Use

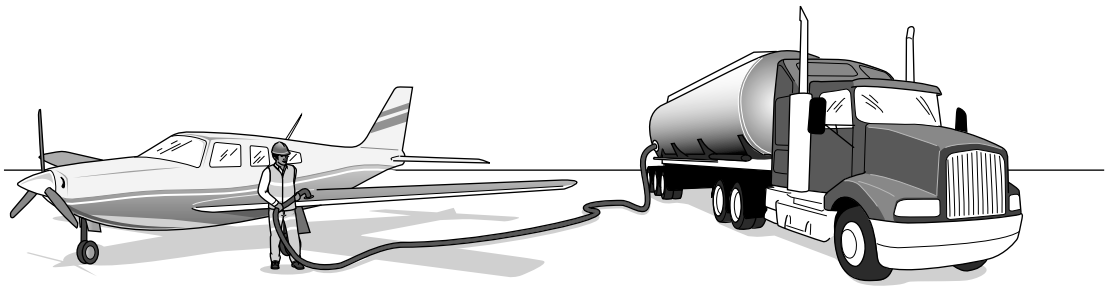

Fig. 9.2

(i) Suggest how fuel flowing through the hose can cause a large build-up of electric charge on the aircraft.

.....

.....

.....

.....[2]

(ii) The aircraft is refuelled on a particular day when the tyres and wheels are wet.

Explain why there will be no large build-up of charge in this case.

.....

.....

.....

.....[1]

[Total: 6]

10 (a) (i) Fig. 10.1 shows the symbol for a logic gate.

For Examiner's Use

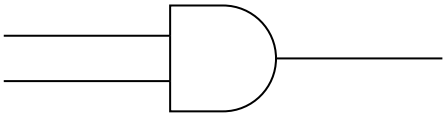

Fig. 10.1

Name this logic gate.

.....

(ii) Draw the symbol for a NOR gate.

[2]

(b) (i) The two inputs of a NAND gate are both low (logic level 0).

Write down the output state.

.....

(ii) One input of a NAND gate is low (logic level 0) and the other input is high (logic level 1).

Write down the output state.

..... [2]

(c) A logic gate contains a number of components.

Circle **one** of the following that is contained in a logic gate.

thermistor transformer transistor transmitter [1]

[Total: 5]

11 Strontium-90 is a radioactive isotope that emits β-particles as it decays. The nuclear equation below shows this decay.

For Examiner's Use

$$^{90}_{38}\text{Sr} \longrightarrow {}^{a}_{b}\text{X} + {}^{0}_{-1}\text{e}$$

(a) Calculate

(i) the value of *a*,

a = ...

(ii) the value of *b*.

b = ...
[2]

(b) **(i)** Tick the element from the list below that is produced by this decay.

element	proton number	place **one** tick in this column
selenium	34	
bromine	35	
krypton	36	
rubidium	37	
strontium	38	
yttrium	39	
zirconium	40	
niobium	41	
molybdenum	42	

[1]

(ii) The isotope $^{a}_{b}\text{X}$ is also radioactive and undergoes β-decay.

State the name of the element that is produced by this decay.

.....[1]

Question 11 continues on the next page.

(c) Three nuclei are represented as

$$^{83}_{42}X \qquad ^{209}_{83}Y \qquad ^{84}_{42}Z$$

State and explain which nuclei are isotopes of the same element.

.....

.....

.....

.....[2]

[Total: 6]

For Examiner's Use