BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

PHYSICS **0571/03**

Paper 3 **October/November 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
300 mm ruler

READ THESE INSTRUCTIONS FIRST

Write your candidate name, Centre number and candidate number in the spaces provided at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.
You may lose marks if you do not show your working or if you do not use appropriate units.
Do not use staples, paper clips, highlighters, glue or correction fluid.
The number of marks is given in brackets [ ] at the end of each question or part question.
Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = 10 m/s^2).

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
TOTAL	

This document consists of **15** printed pages and **1** blank page.

[Turn over

For Examiner's Use

1 Fig. 1.1 shows a pendulum bob swinging from A to C.

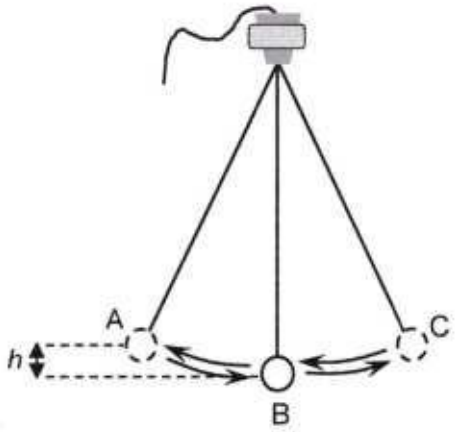

Fig. 1.1

(a) State the energy change as the pendulum swings from A to B.

..... → ..... [1]

(b) The bob has a mass 0.010 kg. The maximum kinetic energy of the bob is 0.0032 J.

Calculate

(i) the maximum velocity of the bob,

maximum velocity = ... [2]

(ii) the change in height *h* of the bob as it moves from A to B.

change in height *h* = ... [2]

(c) What is the assumption made in answering **(b)(ii)**?

.....

..... [1]

(d) Explain why eventually the bob comes to rest.

.....

..... [1]

For Examiner's Use

2 Fig. 2.1 shows a speed-time graph for the motion of a parachutist.

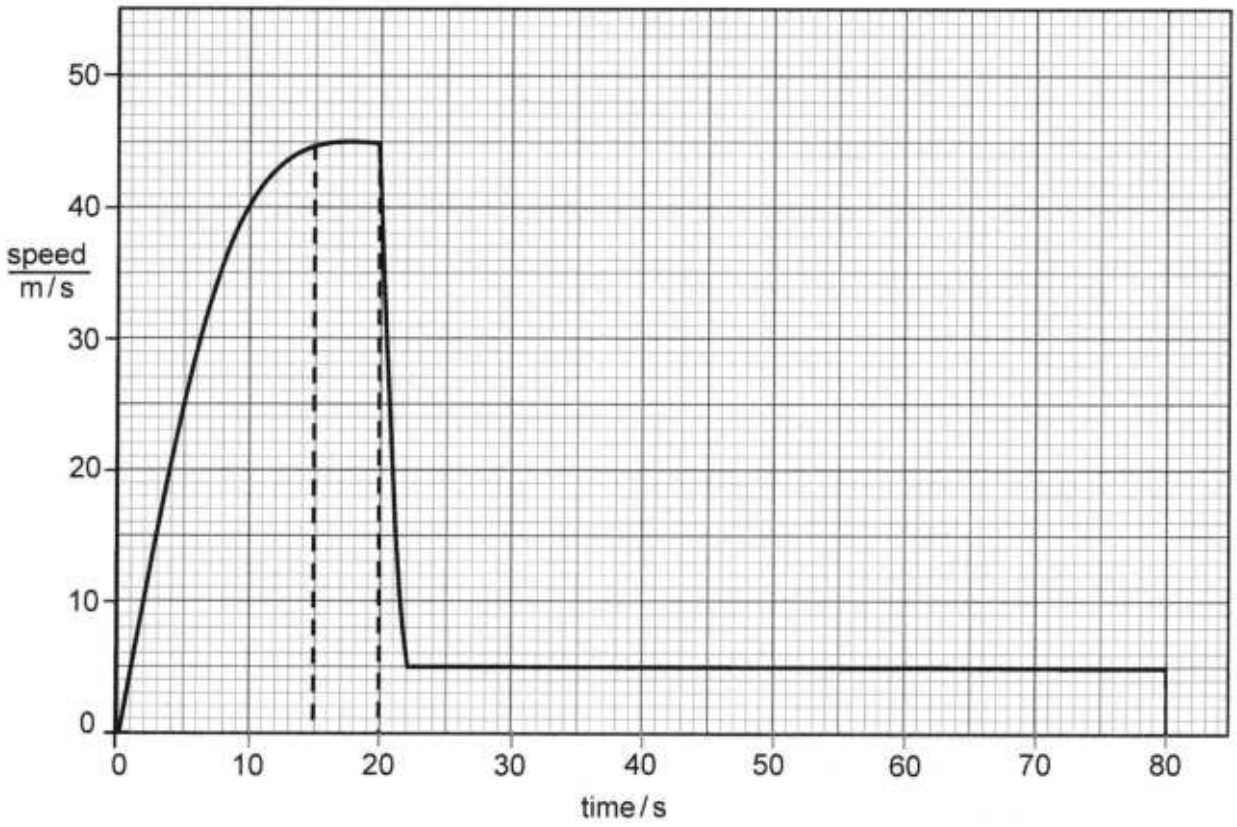

Fig. 2.1

(a) How long does it take the parachutist to reach the ground?

..... [1]

(b) Describe the acceleration of the parachutist in the first 20 s.

.....

..... [2]

(c) The parachutist is pulled down by their weight. Air resistance acts upwards.

State how these forces compare in the first 20 s.

0 – 15 s .....

15 – 20 s .....

[2]

(d) Explain why the speed of the parachutist decreases from 45 m/s to 5 m/s after 20 s.

.....

.....

..... [1]

3 Thermometers P and Q are filled with mercury and alcohol respectively.
Table 3.1 shows the melting points and boiling points of the liquids used in the thermometers.

Table 3.1

thermometer	liquid	melting point / °C	boiling point / °C
P	mercury	–39	357
Q	alcohol	–115	78

(a) (i) Define the term *boiling point*.

.....

..... [1]

(ii) Suggest a reason why thermometer Q is not suitable to measure the boiling point of pure water at sea level.

.....

.....

..... [2]

(b) Fig. 3.1 shows three liquid-in-glass thermometers R, S and T.
All the thermometers contain the same type of liquid.
The thermometers are drawn to scale.

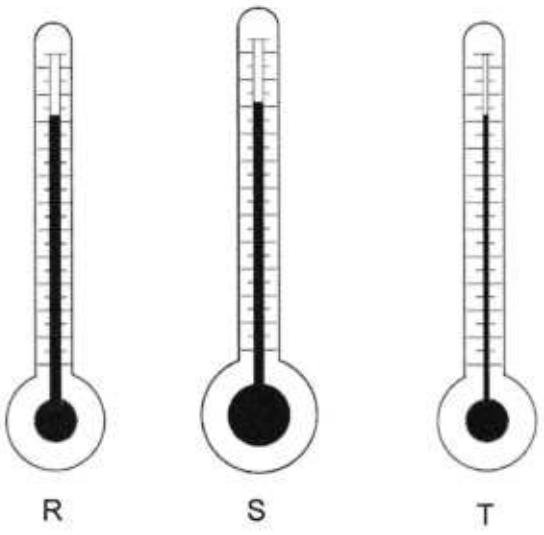

Fig. 3.1

(i) Which thermometer measures the widest range of temperature?
Justify your answer.

thermometer .....

justification .....

.....
[2]

For Examiner's Use

(ii) Give **two** advantages of a thermocouple thermometer.

1 .....

.....

2 .....

.....

[2]

For Examiner's Use

4 **(a)** Define the term *heat capacity*.

.....

..... [1]

(b) An electrical heater supplies 1.2 kW to heat some ice.
The ice, initially at 0 °C, melts and changes to water at 100 °C in a time of 30 minutes.

Calculate

(i) the amount of thermal energy supplied to the ice and water in 30 minutes,

thermal energy = ... [2]

(ii) The mass of the heated ice.
The specific latent heat of fusion of ice is 330 J/g.
The specific heat capacity of water is 4.2 J/g °C.

mass = ... [2]

(c) Explain why the electrical energy input to the heater is not equal to the energy supplied to the ice and water.

.....

..... [1]

For Examiner's Use

5 **(a)** A thin converging lens is used as a magnifying glass to form images.

State **two** characteristics of the image formed by the lens.

1 .....

2 .....

[2]

(b) Fig. 5.1 shows a simple camera used to take a picture of an object placed in front of the camera.

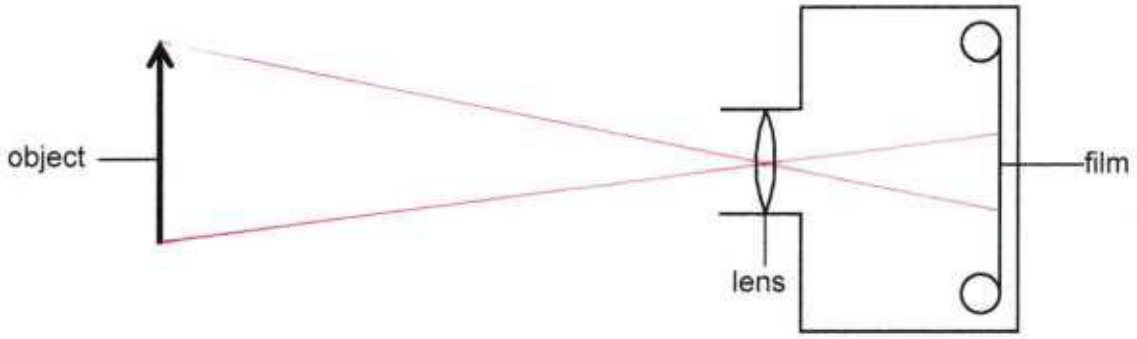

Fig. 5.1

(i) On Fig. 5.1, draw **two** rays from the object to the film to show the image formed by the camera. [1]

(ii) On Fig. 5.1, draw the image to show how it appears on the film. [1]

(iii) Use the diagram in Fig. 5.1 to calculate the magnification of the camera lens.

magnification = ... [2]

For Examiner's Use

6 Optical fibres are used to transmit light by total internal reflection, as shown in Fig. 6.1.

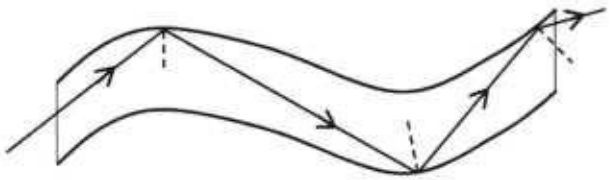

Fig. 6.1

(a) State **one** condition that makes it possible for total internal reflection to take place in the optical fibre.

.....

..... [1]

(b) Explain how mirages are formed. You may draw a diagram if you wish.

.....

.....

.....

.....

.....

..... [4]

For Examiner's Use

7 **(a)** A glass rod is rubbed with a cloth. The rod becomes positively charged.

What is the charge on the cloth after rubbing the rod? Explain your answer.

charge .....

explanation .....

[1]

(b) Explain why the glass retains the charge at the region where it was rubbed.

.....

..... [1]

(c) An uncharged metal coated sphere is suspended from a support by an insulating thread. Fig. 7.1 shows the position of the sphere when the positively charged rod is brought near it.

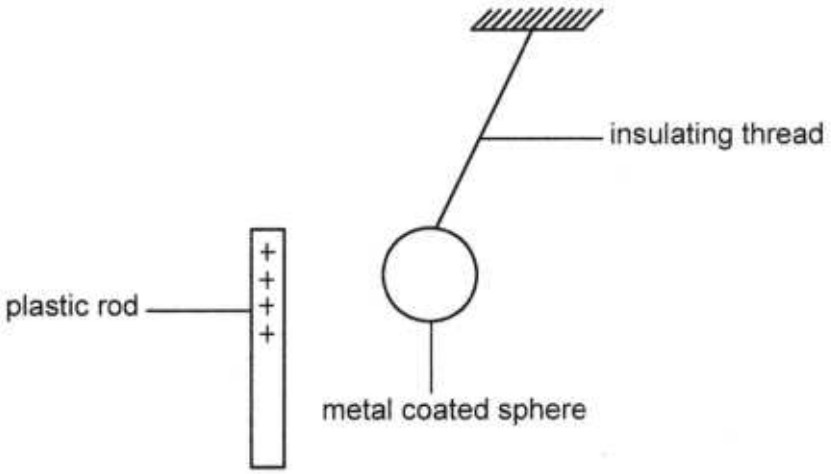

Fig. 7.1

(i) Explain why the sphere is attracted to the rod.

.....

.....

..... [2]

(ii) The sphere in Fig. 7.1 is to be negatively charged by induction using the rod.

Describe the actions needed to produce an even distribution of charge on the surface of the sphere.

.....

.....

.....

..... [2]

For Examiner's Use

8 Fig. 8.1 shows an electric circuit.

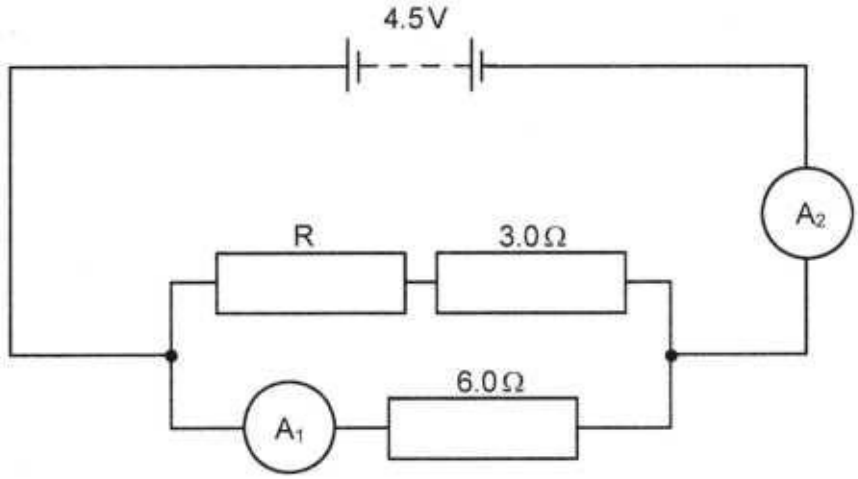

Fig. 8.1

The reading of ammeter A_2 is 0.90A.

(a) Calculate the reading of ammeter A_1.

reading = ... [2]

(b) Determine

(i) the current in the 3.0Ω resistor,

current = ... [1]

(ii) the resistance of R.

resistance = ... [2]

(c) The power supply is switched on for 300 seconds.

Calculate the energy it transfers during the time it is switched on.

energy = ... [2]

For Examiner's Use

9 Fig. 9.1 shows a steel bar with one end labelled P.

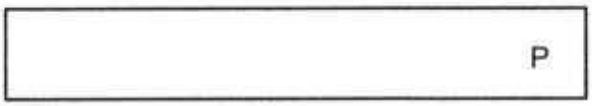

Fig. 9.1

(a) The bar is placed in a solenoid that is connected to a power supply.
End P becomes a south pole.

On Fig. 9.1, draw the solenoid and the power supply.
Mark the direction of the current in the solenoid. [2]

(b) The bar is permanently magnetised.
On Fig. 9.2, draw the magnetic field lines created by the bar. [2]

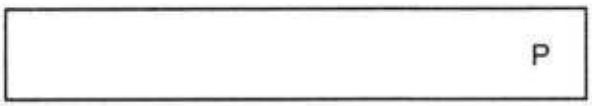

Fig. 9.2

(c) What is meant by *magnetic saturation*?

.....

..... [1]

(d) Fig. 9.3 shows two magnets, Q and R, suspended next to each other.

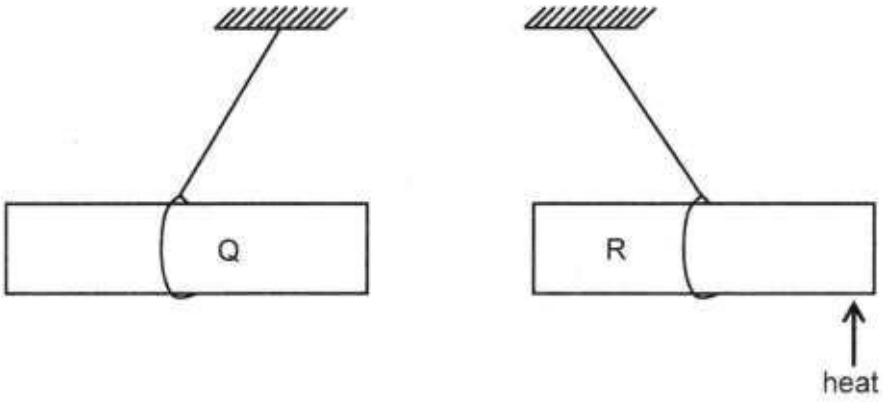

Fig. 9.3

The magnets repel each other.
Magnet R is moved away and heated until it is red hot.
After cooling, the ends of Q and R that initially repelled are placed close to each other.

State and explain what will be observed.

observation .....

explanation .....

.....

[2]

For Examiner's Use

10 Fig. 10.1 shows a temperature sensitive circuit used to operate a fire alarm.

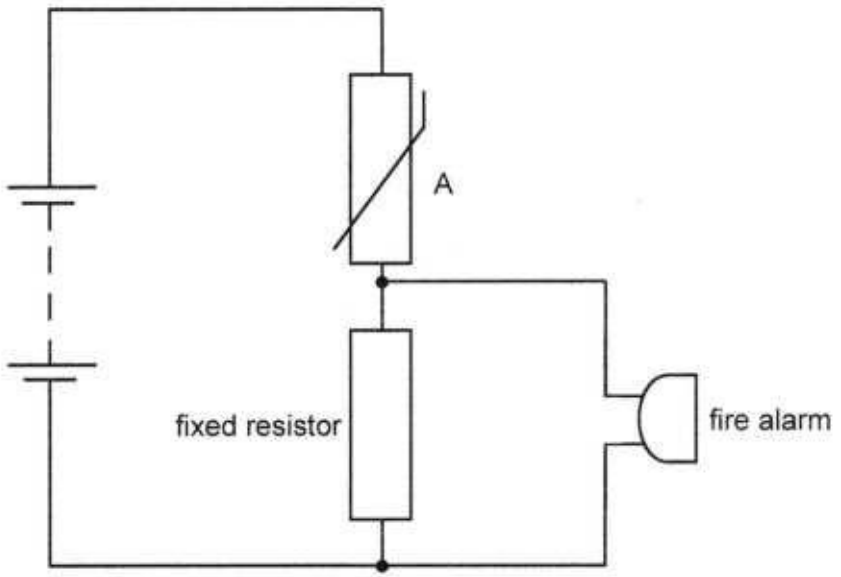

Fig. 10.1

(a) (i) State the name of the component labelled A.

..... [1]

(ii) Explain why the fire alarm sounds when there is fire.

.....

.....

.....

..... [2]

(b) The fixed resistor is replaced by a variable resistor.

Suggest **one** advantage of using the variable resistor.

.....

..... [1]

For Examiner's Use

11 (a) A radioactive isotope decays by emitting a beta particle.

State how the atomic number (proton number) and the mass number (nucleon number) of the isotope changes.

atomic number.....

mass number .....

[2]

(b) Explain why a radioisotope with a short half-life should be used as a tracer in medicine.

.....

..... [2]

(c) A radioisotope with a half-life of 30 minutes has an activity of 8000 counts per second.

How long will it take for the activity to decrease to 250 counts per second?

time taken =..... [2]

(d) The initial number of radioactive atoms of the same radioisotope is doubled.

What effect does this have on its half-life?

..... [1]