BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

PHYSICS **0571/03**

Paper 3 **October/November 2014**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
300 mm ruler

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name 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 10N (i.e. acceleration of free fall = 10 m/s^2).

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

This document consists of **11** printed pages and **1** blank page.

1 Fig. 1.1 shows a simple pendulum.

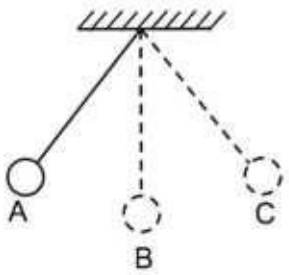

Fig. 1.1

(a) Define an *oscillation*.

.....

..... [1]

(b) The pendulum takes 8.0 s to make 20 oscillations.
Determine the period of the pendulum.

period = ... [1]

(c) A stopwatch was used to time a few oscillations to determine the period of the pendulum.
The time recorded by the stopwatch is as shown in Fig. 1.2.

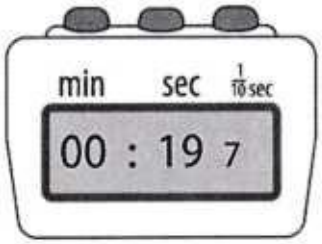

Fig. 1.2

(i) What is the time shown by the stopwatch?

time = ... [1]

(ii) Write down the accuracy of the stopwatch.

accuracy = ... [1]

(iii) Explain why it is important to measure the time for several oscillations when determining the period.

.....

..... [1]

2 Fig. 2.1 shows a conveyor belt that is driven by an electric motor.

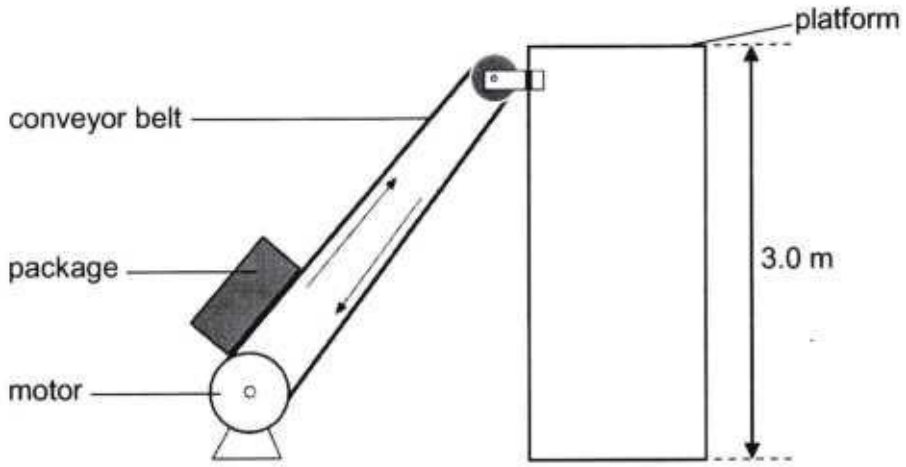

Fig. 2.1

(a) State the main energy change taking place as the package is raised to the top of the platform at constant speed.

→

..... [1]

(b) The belt is used to lift a package to a raised platform. The package takes 10 seconds to reach the top of the platform. The power output of the motor is 600 W. ($g = 10\,m/s^2$)

Calculate the mass of the package.

mass = ... [2]

(c) The motor is 80% efficient.

(i) Calculate the input power to the motor.

input power = ... [2]

(ii) Explain why the motor is **not** 100% efficient.

.....

..... [1]

3 Table 3.1 shows the temperature of a substance at 2 minute intervals, during heating. The substance is a solid at −42 °C.

Table 3.1

time / minutes	0	2	4	6	8	10	12	14	16	18	20
temperature / °C	−42	−39	−39	−39	−30	−15	0	16	32	48	63

(a) Define *melting point*.

.....

..... [1]

(b) What state is the substance at 0 °C? Explain how you obtained your answer.

.....

.....

..... [2]

(c) The substance has a latent heat of fusion of 11 300 J / g. It is heated by a heater rated at 3 000 W.

(i) Calculate the energy supplied by the heater in 120 seconds.

energy = ... [2]

(ii) Calculate the mass of the substance that will melt in 120 seconds.

mass = ... [2]

(iii) What assumption did you make in answering **(c)(ii)**?

.....

..... [1]

4 A fixed mass of gas, at a constant temperature of 300 K, exerts a pressure of 100 000 Pa in a syringe of volume 30 cm^3 as shown in Fig. 4.1.

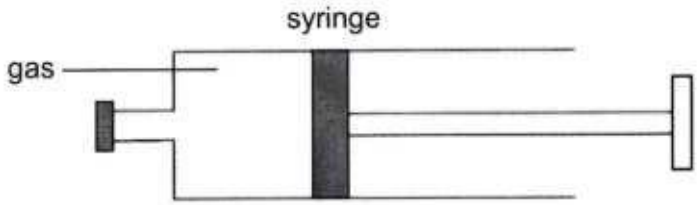

Fig. 4.1

(a) (i) The gas in the syringe is at an absolute temperature of 300 K.

Define the term *absolute temperature*.

.....

..... [1]

(ii) Convert 300 K to degrees celsius.

.....°C [1]

(iii) State and explain the effect of increasing the temperature of the gas when the volume is kept constant.

.....

.....

..... [2]

(b) The volume of the gas in the syringe is reduced by one quarter. The temperature of the gas remains constant.

Calculate the new pressure exerted by the gas.

pressure = ... [3]

For Examiner's Use

5 (a) Fig. 5.1 shows a thin lens used to produce a virtual image of an object.
The principal focus of the lens is marked F and the position which is twice the focal length is marked 2F. The virtual image is shown on Fig. 5.1.

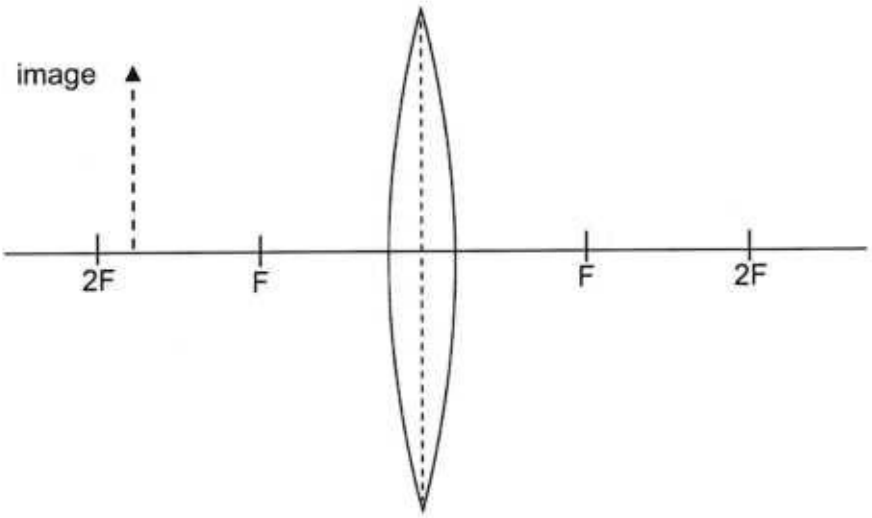

Fig. 5.1 (to scale)

(i) Name the type of lens shown in Fig. 5.1.

..... [1]

(ii) What is meant by a *virtual image*?

..... [1]

(iii) On Fig. 5.1, draw **two** rays of light to locate the position of the object.
Draw and label the object **O**. [3]

(iv) Calculate the magnification of the lens.

magnification =..... [2]

(b) State **two** characteristics of an image formed by a single lens camera.

1. .....

2. ..... [2]

For Examiner's Use

6 A radio wave is transmitted at a frequency of 972 kHz.

(a) (i) What type of waves are radio waves?

..... [1]

(ii) State the speed of radio waves.

speed = ... [1]

(iii) Calculate the wavelength of these radio waves.

wavelength =..... [2]

(b) State **one** use of radio waves.

..... [1]

For Examiner's Use

7 Fig. 7.1 shows a transformer used to charge a car battery from a 240 V alternating current supply. The transformer has 1000 turns in the primary coil and 100 turns in the secondary coil.

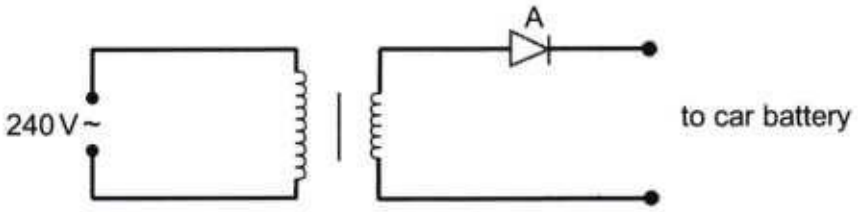

Fig. 7.1

(a) (i) Name the type of transformer shown in Fig. 7.1.

..... [1]

(ii) Name the component labelled A.

..... [1]

(iii) What is the function of the component labelled A?

.....

..... [1]

(b) The average current in the battery is 2.0 A for 3.0 hours during charging.

(i) Calculate the total charge delivered to the battery in this time.

charge =..... [3]

(ii) When the current in the primary coil is 0.20 A, the current in the secondary coil is 2.0 A.

Calculate the output voltage from the transformer.
Assume that the transformer is 100% efficient.

voltage = ... [2]

For Examiner's Use

8 Fig. 8.1 shows meter readings before and after using an electric iron for 2 hours. The cost of electricity is 60 thebe per kWh.

before ironing

after ironing

Fig. 8.1

(a) Calculate

(i) the electrical energy used in kWh,

electrical energy =..... [1]

(ii) the cost of using the electric iron for 2 hours.

cost =..... [2]

(b) The electric iron has a power rating of 2000 W.
Explain the meaning of this statement.

.....

..... [1]

(c) A 200 m long copper cable with a cross sectional area of $1.0 \times 10^{-6}\,m^2$ has a resistance of 3.6 Ω. The copper cable used to connect an electrical iron to the mains is 1.5 m long and has a cross sectional area of $2.0 \times 10^{-6}\,m^2$.

Calculate the resistance of the copper cable used to connect the iron to the mains.

resistance =..... [2]

(d) The wires used to connect sockets to the distribution board are thicker than the wires used to connect the lights.

Explain why.

.....

.....

..... [2]

For Examiner's Use

9 Fig. 9.1 shows a solenoid used to magnetise a steel rod. The ends of the rod are marked A and B. The ends of the solenoid are marked X and Y and are connected to a power supply. When there is a current in the solenoid, end B of the rod becomes a south pole.

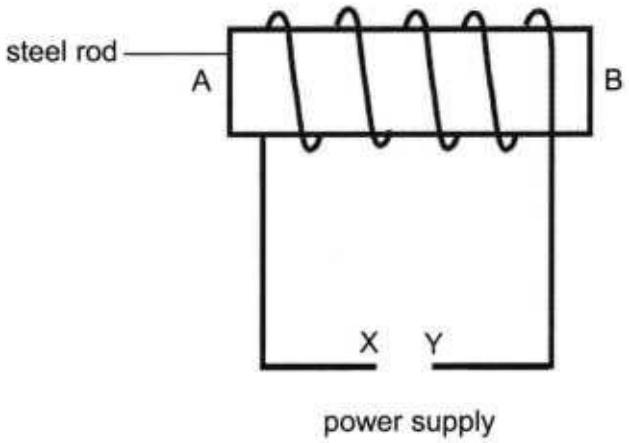

Fig. 9.1

(a) On Fig. 9.1,

(i) draw an arrow to show the direction of the current in the solenoid that makes end B a south pole, [1]

(ii) draw the symbol of the power supply connected to X and Y. [1]

(b) On Fig. 9.1, draw three lines to show the magnetic field produced by the solenoid and indicate the direction of the field with an arrow on each of the field lines. [2]

(c) Suggest **two** changes that can be made to increase the strength of the magnet produced.

1. .....

2. ..... [2]

10 (a) Uranium-235 is a radioactive material which undergoes the fission reaction shown by the equation

$$^{235}_{A}U + {}^{1}_{0}n \longrightarrow {}^{140}_{54}Xe + {}^{94}_{38}Sr + B{}^{1}_{0}n.$$

(i) What is meant by *fission*?

.....

..... [1]

(ii) Determine the numbers represented by the letters A and B in the fission reaction above.

A = ...

B = ... [2]

(b) Name another type of nuclear reaction.

..... [1]

(c) Suggest **two** disadvantages of using uranium as a source of energy.

1. .....

2. ..... [2]

(d) A radioactive substance has a half-life of 8 days. Its original activity is 800 counts per second.

What is the activity after 32 days?

activity =..... [2]