



BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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PHYSICS

0571/03

Paper 3

October/November 2015

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 13 printed pages and 3 blank pages.

- 1 Fig. 1.1 shows an electric winch used to lift the engine of a car.

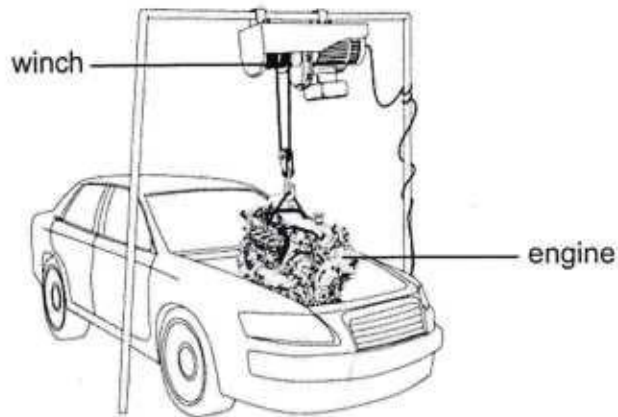


Fig. 1.1

The input power of the winch is 1800 W and it has an efficiency of 0.85.

- (a) Calculate the output power of the winch.

output power = [2]

- (b) The winch provides a lifting force of 4500 N and lifts the engine at a constant speed.

- (i) State the weight of the engine.

weight = [1]

- (ii) Calculate the work done by the winch in lifting the engine in 4.0 seconds.

work done = [2]

- (iii) Calculate the distance covered by the engine in 4.0 seconds.

distance = [2]

2 Fig. 2.1 shows a bob attached to a string. The string is attached to a support.

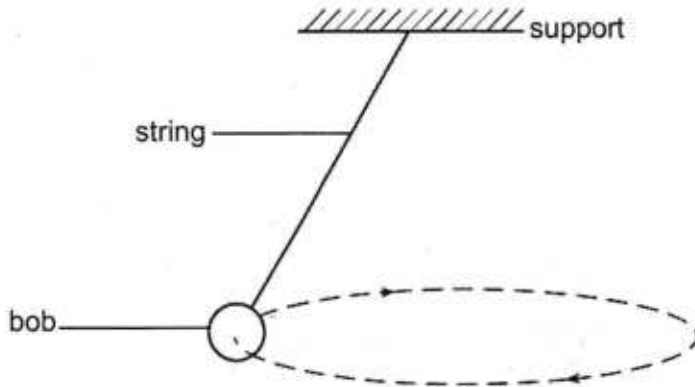


Fig. 2.1

A resultant force F acts on the bob as it moves in a circular path at constant speed.

(a) (i) State the name of force F .

..... [1]

(ii) On Fig. 1.1, draw an arrow to show the direction of force F .

[1]

(iii) Explain why no work is done by force F as the bob moves in a circular path.

.....
..... [1]

(b) The bob moves at a constant speed of 0.84 m/s and takes 1.5 s to travel in one complete circle.

(i) Calculate the distance travelled by the bob as it moves once around the circle.

distance = [2]

(ii) Determine the frequency at which the bob moves around the circular path.

frequency = [1]

(iii) Explain why the bob is accelerating even though the speed is constant.

.....
..... [1]

- 3 Fig. 3.1 shows an immersion heater and a thermometer placed in a vacuum flask containing a liquid.

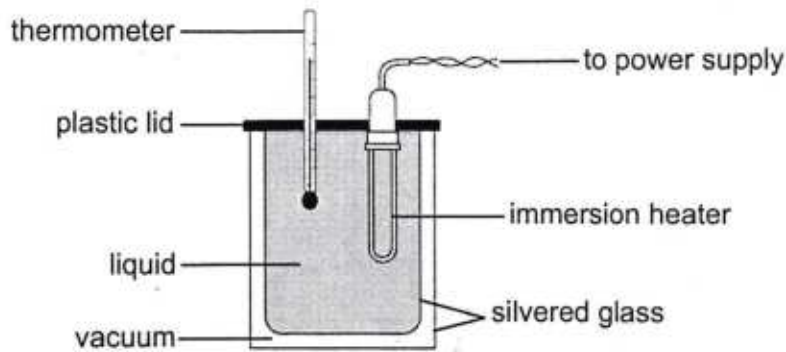


Fig. 3.1

The heater is switched on and the temperature of the liquid is recorded every minute. Table 3.1 shows the results obtained.

Table 3.1

time / minutes	0	1	2	3	4	5	6
temperature / °C	24	46	68	90	105	105	105

- (a) State the boiling point of the liquid.

boiling point = [1]

- (b) The information in Table 3.1 can be used to find the specific heat capacity of the liquid.

State **two** other quantities needed to find the specific heat capacity of the liquid.

1.....

2..... [2]

- (c) State **two** features of the vacuum flask that help to minimise heat loss from the liquid and explain how each stated feature works.

feature 1

explanation

.....

feature 2

explanation

..... [4]

4 Two rods are left in a freezer overnight. The freezer is kept at a temperature of -10°C . The rods are identical in size, but one is made of plastic and the other is made of aluminium.

(a) Explain why the temperature of the rods decreases when they are left in the freezer.

.....
..... [1]

(b) State and explain which rod feels colder when they are both touched.

rod [1]

explanation
.....
..... [2]

(c) (i) Name the **process** by which heat is transferred through the rods.

..... [1]

(ii) Describe the **method** by which heat is transferred through the rods.

.....
.....
..... [2]

- 5 Fig. 5.1 shows a ray of light striking a parallel sided rectangular glass block.

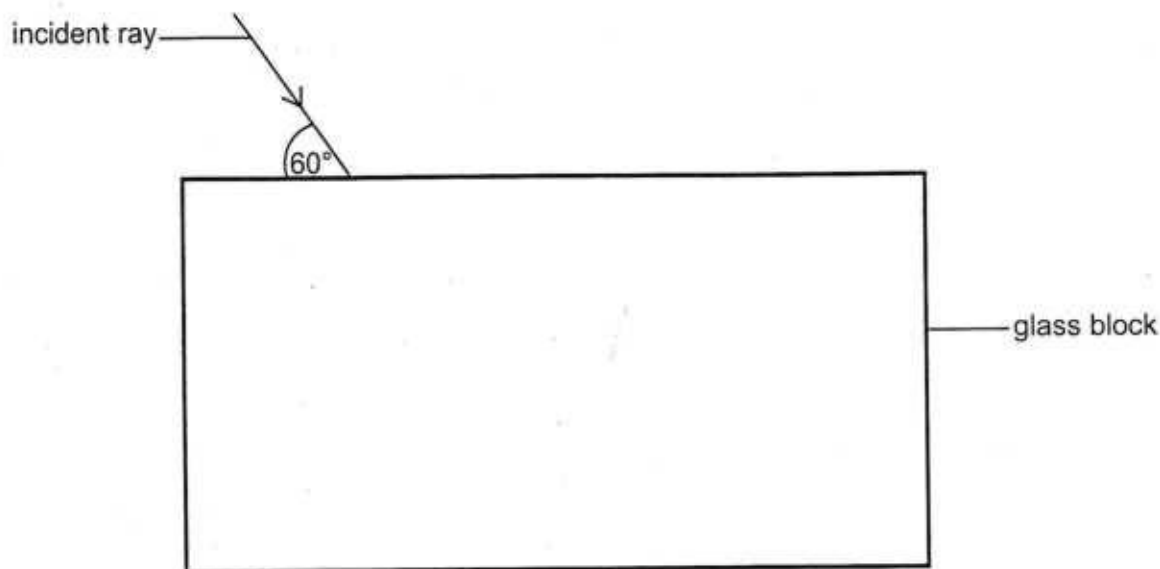


Fig. 5.1 (not to scale)

- (a) State the value of the angle of incidence.

angle of incidence = [1]

- (b) On Fig. 5.1

- (i) complete the path of the ray of light as it enters and leaves the block, [2]
 (ii) label the angle of refraction r as the ray of light enters the glass block. [1]

- (c) The refractive index of glass is 1.49.

Calculate

- (i) the angle of refraction r as the ray of light enters the glass block,

$r = \dots\dots\dots$ [2]

- (ii) the critical angle c , using the equation $n = \frac{1}{\sin c}$.

$c = \dots\dots\dots$ [1]

- (d) Fig. 5.2 shows a man looking into a dry pond which has a rock at the bottom. The man cannot see the rock when standing at position X.

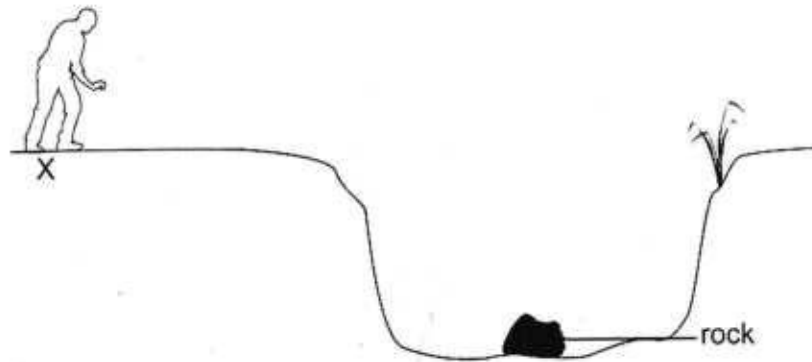


Fig. 5.2

When the pond is filled with water, as shown in Fig. 5.3, the man is able to see the rock without changing his position.

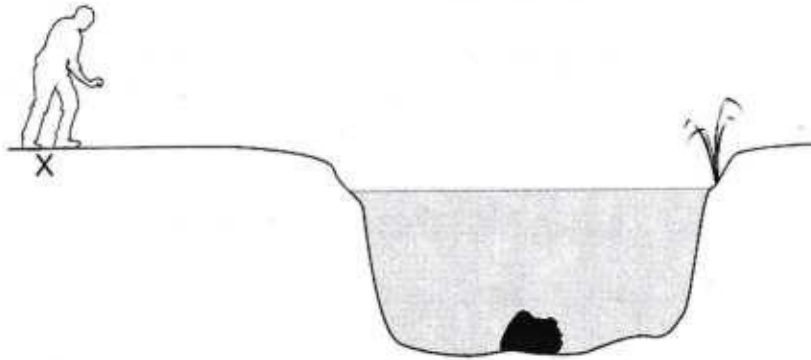


Fig. 5.3

Explain why the man

- (i) cannot see the rock at the bottom of the dry pond,

.....
 [1]

- (ii) is able to see the rock when the pond is filled with water.

.....

 [2]

6 Fig. 6.1 shows a simplified model of a fuel gauge.

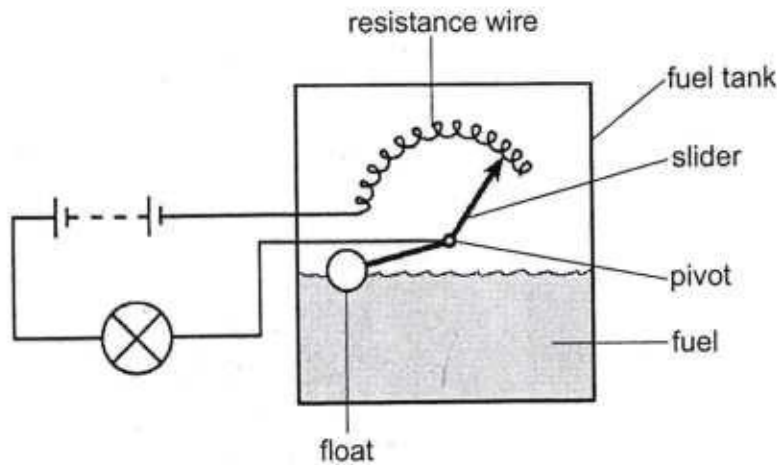


Fig. 6.1

When the fuel level falls, the float goes down and the slider rotates in an anticlockwise direction, keeping contact with the resistance wire.

(a) State how the resistance of the circuit changes as the fuel level falls.
Explain your answer.

resistance

explanation.....

[2]

(b) State and explain what is observed when the fuel tank is almost empty.

observation

explanation

[2]

7 Fig. 7.1 shows a simple model of a generator connected to a cathode-ray oscilloscope (c.r.o).

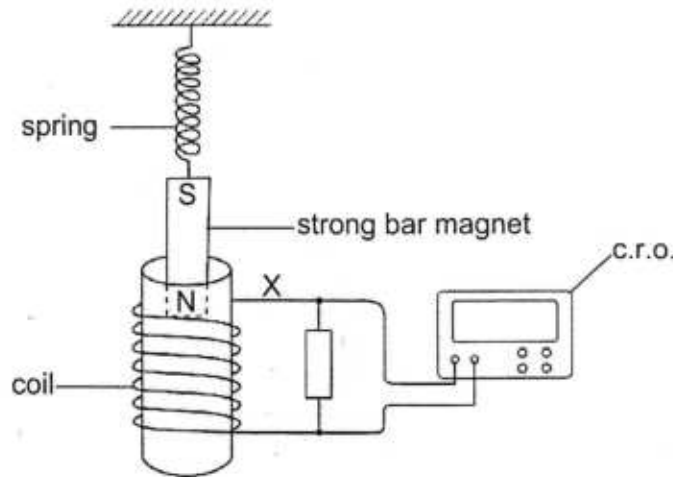


Fig. 7.1

The magnet is pushed down and then released. The magnet oscillates into, and out of, the coil causing a current in the coil.

(a) Explain why there is a current in the coil.

..... [1]

(b) On Fig. 7.1, draw an arrow to show the direction of the current in the coil when the magnet moves into the coil.

[1]

(c) State the type of current produced by the coil.

..... [1]

(d) Suggest **two** ways of increasing the current in the coil.

1

2 [2]

(e) A diode is placed in series with the coil and the resistor at point X on Fig. 7.1. On the axes shown in Fig. 7.2, sketch a graph of current against time to show how two complete cycles would be shown by the c.r.o.

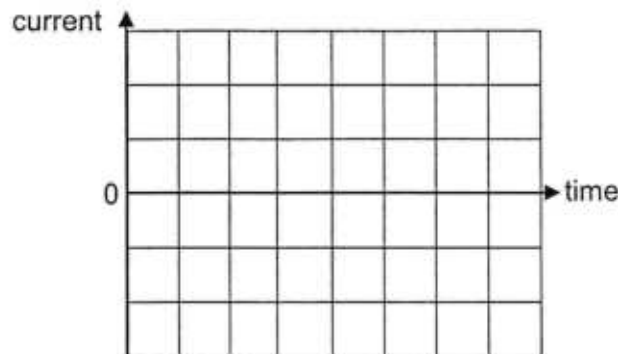


Fig. 7.2

[2]

9 Table 9.1 shows part of the colour code of resistors.

Table 9.1

number	colour	tolerance
0	black	gold $\pm 5\%$
1	brown	silver $\pm 10\%$
2	red	no band $\pm 20\%$
3	orange	
4	yellow	
5	green	

Fig. 9.1 shows a 20 k Ω resistor.

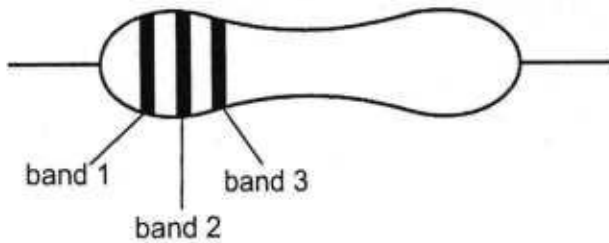


Fig. 9.1

(a) What are the colours for the three bands of the resistor?

band 1.....

band 2.....

band 3.....

[2]

(b) Determine the maximum possible resistance and the minimum possible resistance of this resistor.

maximum resistance =

minimum resistance = [2]

- (c) Fig. 9.2 shows a $20\ \Omega$ resistor connected in series with a variable resistor.

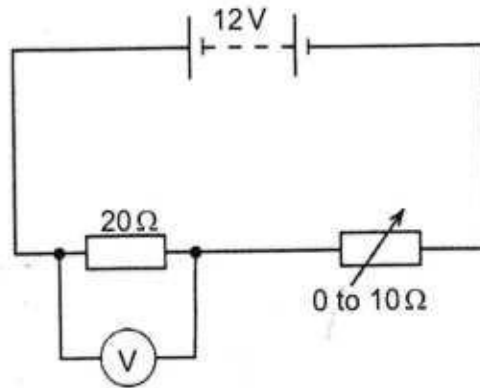


Fig. 9.2

The resistance of the variable resistor can be varied from 0 to $10\ \Omega$.
The variable resistor is adjusted until the voltmeter gives the smallest reading across the $20\ \Omega$ resistor.

- (i) Calculate the current in the circuit.

current = [2]

- (ii) Determine the voltmeter reading.

reading = [1]

- 10 (a) A technician uses a radioactive isotope to find a leak in a pipe that supplies oxygen to a laboratory. To find the leak, the technician injects a gas that contains a radioactive isotope into the pipes. The radioactive isotope emits gamma radiation.

(i) Describe how the technician is able to find the leak using this method.

.....

 [3]

(ii) Explain why isotopes emitting alpha particles are **not** suitable for the purpose.

..... [1]

- (b) A source contains strontium-90, which has a half-life of 28 years.

(i) Calculate the time taken for the activity of the source to fall to one quarter of its original value.

time = [1]

(ii) Strontium-90 (${}^{90}_{38}\text{Sr}$) decays to form yttrium-90 (${}^{90}_{39}\text{Y}$).

Complete the equation to determine the radiation given out by strontium.

