TEST CODE **01238020**

FORM TP 2006121

MAY/JUNE 2006

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

1 1/2 hours

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Attempt ALL questions.
4. The use of non-programmable calculators is allowed.
5. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

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1. A student was asked to investigate the variation in temperature of 2 kg of water initially at 30°C, when heat energy was supplied to it by an electric heater rated at 1400 W. The following measurements were taken and recorded in Table 1.

Table 1

Temperature of water, θ/°C	30.0	40.0	51.0	62.5	72.0	80.0	89.0
Heating time, t/s	0	60	120	180	240	300	360
Temperature change, $\Delta\theta = (\theta - 30)$/°C	0						
Energy supplied, Q = 1400t/J	0						

(a) Complete the table above. **(3 marks)**

(b) Plot on the graph page opposite a graph of energy supplied against temperature change. **(11 marks)**

(c) Calculate the gradient of the graph.

(6 marks)

(d) Assuming that the energy loss to the container and the surroundings is negligible, what physical quantity does this gradient represent?

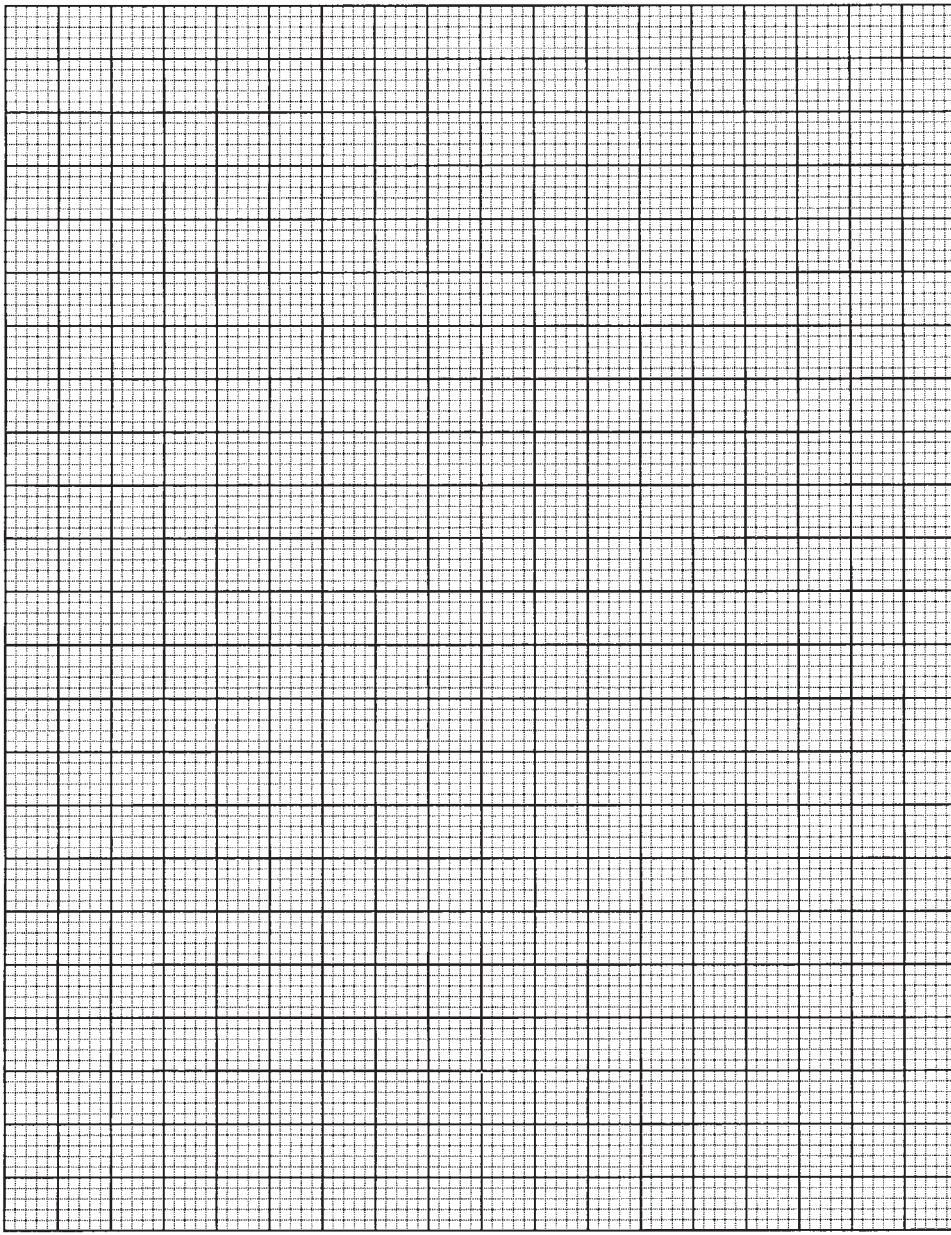
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(1 mark)

(e) Determine the value of this quantity if 1 kg of water were used and state the physical quantity this represents.

(2 marks)

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(f) Water boils at 100°C. Calculate the heat energy which must be supplied in order to completely convert the 2 kg of water to steam.

(3 marks)

(g) Distinguish between boiling and evaporation.

_____

_____

_____

_____

_____

(4 marks)

[Specific latent heat of vaporization of water = 2.3×10^6 Jkg^{-1}]

Total 30 marks

2. (a) Explain what is meant by 'electrical resistance'.

_____

_____

_____

(2 marks)

(b) The circuit shown in Figure 1 shows the interconnection between electrical devices, B and C, and voltage source A.

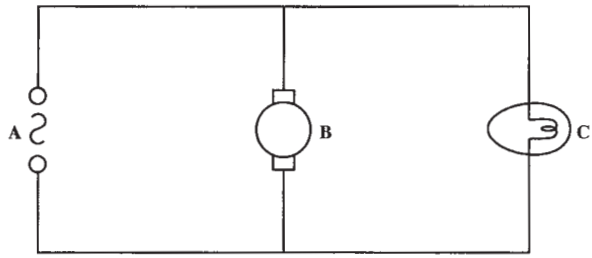


Figure 1

(i) Identify the type of connection employed in this circuit.

_____

(1 mark)

(ii) Give the meaning of the circuit symbols labelled:

B _____

C _____

(2 marks)

(iii) Name the type of voltage produced at A.

_____

(1 mark)

(c) (i) A fluorescent lamp is rated at 15W, 120V. Calculate the current which the lamp draws from the main supply.

(3 marks)

(ii) Calculate the resistance of this lamp while it is lit.

(3 marks)

(iii) When the lamp is lit, 4 W of the energy supplied is lost as heat. Calculate the efficiency of the lamp.

(3 marks)

Total 15 marks

3. (a) Figure 2 shows successive stages in the generation of a transverse wave on a stretched slinky spring.

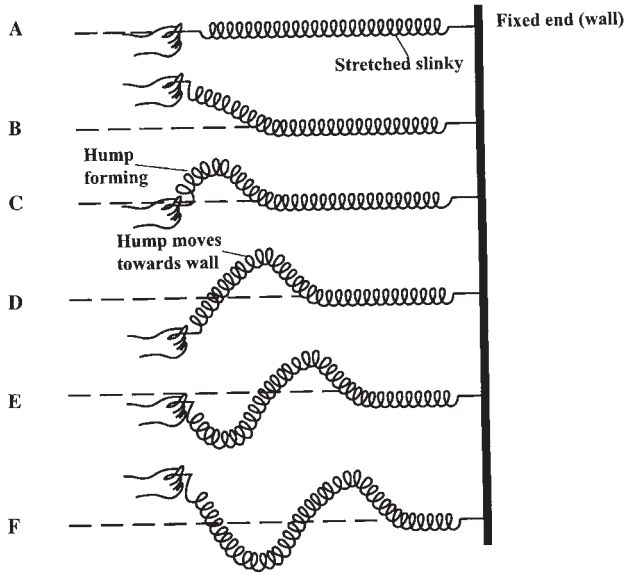


Figure 2

(i) Indicate on Figure 2F by appropriately labelling

a) the position of a crest
b) the position of a trough. **(2 marks)**

(ii) Draw labelled arrows on Figure 2E to show

a) the direction of the wave
b) the direction of hand movement needed to produce this wave.
(3 marks)

(iii) Indicate on Figure 2A the direction of hand movement needed to produce a longitudinal wave. **(1 mark)**

(b) In a classroom demonstration a student uses a slinky spring to generate waves of frequency 5 Hz with 0.65 metres separation between successive crests. Determine the speed of these waves.

(3 marks)

(c) (i) Deduce whether the velocity of a sound wave will increase, decrease or remain constant when the wave travels from a denser to a less dense medium, given that the frequency remains constant and the wavelength decreases.

_____

_____

(1 mark)

(ii) Compare the waves produced on the slinky spring in part (b) with a typical sound wave in terms of the motion of the particles.

Transverse wave on slinky spring _____

_____

Sound wave _____

_____

(2 marks)

(d) In Figure 3 below, a ship sends out pulses of high-frequency sound (ultrasound) which are reflected from the sea bed and received at the ship every 1.2×10^{-2} seconds.

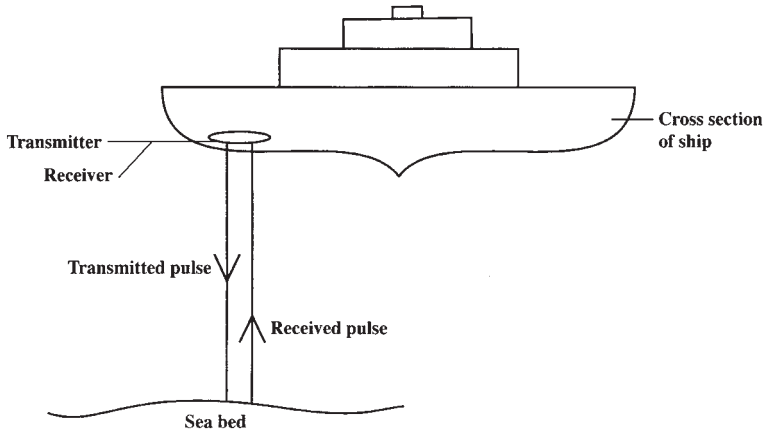


Figure 3

Calculate the depth of the sea bed below the transmitter.

(Speed of sound in sea water = 1 500 m s^{-1})

(3 marks)

Total 15 marks

4. (a) Define 'the moment of a force'.

_____

_____

(3 marks)

(b) State the principle of moments.

_____

_____

_____

(3 marks)

(c) A cyclist hangs his bicycle with the rear wheel in contact with the ground and the handle attached to a light string as shown in Figure 4. The entire assembly is in equilibrium.

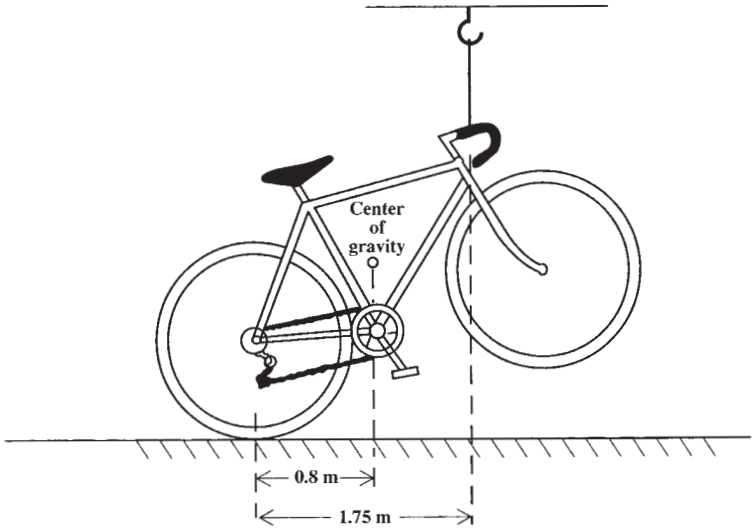


Figure 4

(i) Indicate by drawing arrows on Figure 4 the forces acting on the bicycle.

(3 marks)

(ii) Write TWO equations relating these forces.

_____

_____

(3 marks)

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(iii) The bicycle has a mass of 20 kg. Use the result you obtained in Part (c) (ii) to determine the tension in the string.

[Acceleration due to gravity, $g = 10\ m\ s^{-2}$]

(3 marks)

Total 15 marks

5. (a) Complete Table 2 below showing the International Insulation Colour Code.

Table 2

Code	Live Wire	Neutral Wire	Earth Wire
International Insulation Colour			

(3 marks)

(b) Fuses are sometimes used to protect electrical equipment from excess current. Explain how a fuse works.

(3 marks)

(c) A household has the following appliances

- Heating iron rated at 1200 W, 110 V
- Television set rated at 70 W, 110 V
- Electrical fan 52 W, 110 V

(i) Calculate the total power consumed by these devices.

(1 mark)

(ii) These devices are in use for 4 hours per day. Calculate the energy consumed in kilowatt-hours in a 30-day month.

(2 marks)

(iii) Calculate the bill for the month if each unit of electricity costs 40¢.

(2 marks)

(iv) Assuming that these devices are connected in parallel across the mains supply, and are switched ON, calculate the TOTAL current drawn from the mains.

(3 marks)

(v) Fuses are available with the following current ratings: 5A, 10A, 15A, 25A. Select a suitable fuse for protecting these devices.

(1 mark)

Total 15 marks

END OF TEST