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MAY/JUNE 2005

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

1½ hours

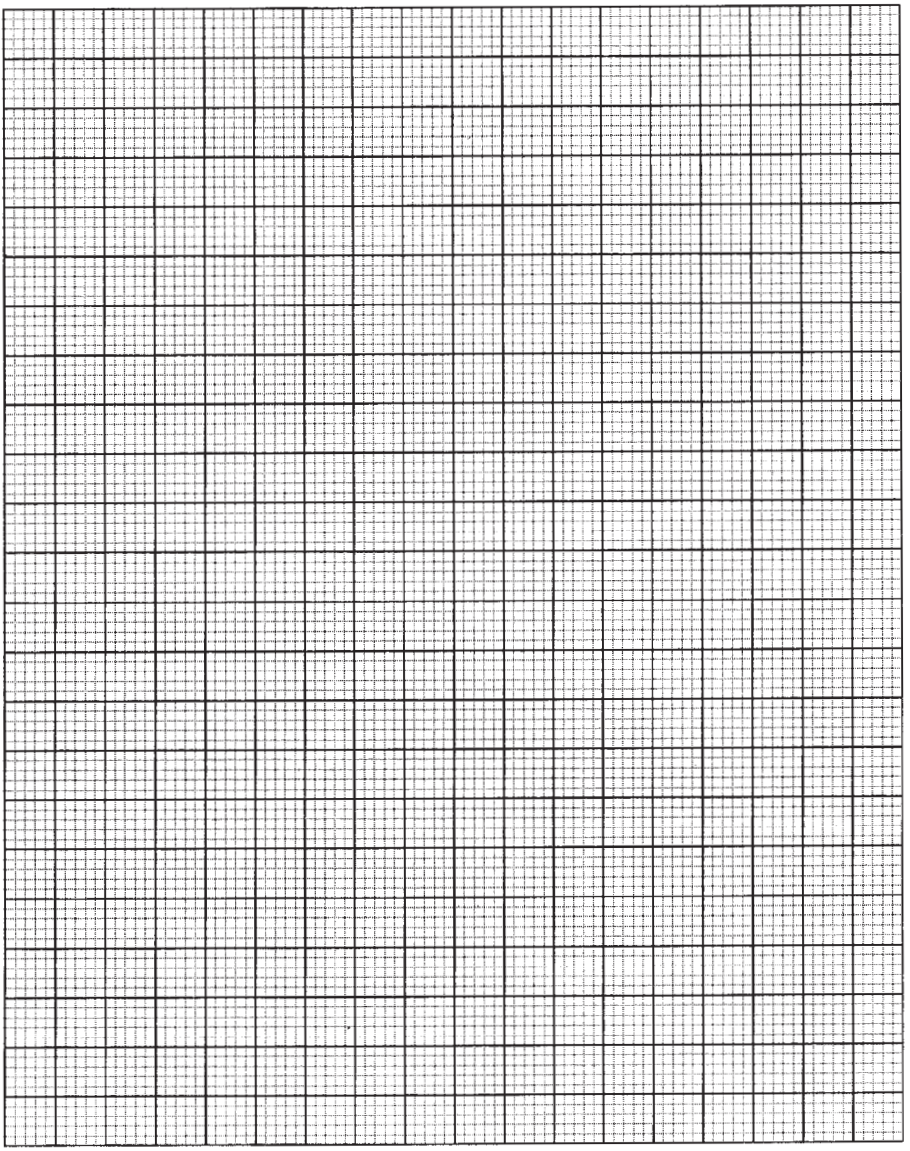
READ THE FOLLOWING DIRECTIONS CAREFULLY

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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Graph paper for Question 1.



1. You are to spend no more than $\frac{1}{2}$ hour on this question.

In this question you will find the refractive index of a rectangular block of glass.

A student was given this experiment as a CXC SBA activity and produced the following results.

Angle of incidence i/degrees	Angle of refraction r/degrees	Sin $\hat{i}$	Sin $\hat{r}$
10.0	6.0		
20.0	12.0		
30.0	18.0		
40.0	24.0		
50.0	30.0		
60.0	36.0		

(a) Complete the table above. **(4 marks)**

(b) Plot a graph of Sin $\hat{i}$ against Sin $\hat{r}$ on the graph paper provided on page 2. **(10 marks)**

(c) Find the slope, n, of the graph.

_____

_____

_____

_____

_____

(4 marks)

(d) What does the slope, n, of the graph represent?

_____

_____

(1 mark)

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(e) Draw a labelled diagram identifying the apparatus used and angles measured by the student to obtain the results.

(6 marks)

(f) A ray of light is incident at an angle of 35°. With the aid of dotted lines use your graph to calculate the angle of refraction produced.

(5 marks)

Total 30 marks

MECHANICS

2. (a) (i) State the principle of conservation of energy.

_____

_____

(2 marks)

(ii) Define the term 'potential energy'.

_____

_____

(1 mark)

(iii) Give ONE example of a body possessing potential energy.

_____

_____

(1 mark)

(iv) Define the term 'kinetic energy'.

_____

_____

(1 mark)

(v) Give ONE example of a body possessing kinetic energy.

_____

_____

(1 mark)

(b) At a football match between two college teams, the referee ordered a free kick. The ball of mass 1.5 kg was placed at rest. The kick was about to be taken by an eager footballer.

What was the potential energy of the ball just before the kick was taken?

_____

_____

(1 mark)

(c) The footballer kicked the ball and it was caught by the opposing goalkeeper, 4 metres above the ground. The ball was travelling at 10 m s^{-1}.

(i) Calculate the potential energy of the ball just before it was caught.

(3 marks)

(ii) Calculate the kinetic energy of the ball just before it was caught.

(3 marks)

(iii) After the ball was caught, what was the kinetic energy converted into?

(2 marks)

Total 15 marks

3. (a) Define the 'heat capacity of a substance' and state its SI unit.

(3 marks)

(b) Name the THREE modes of heat transfer.

(3 marks)

(c) A well-insulated hot water tank is used to supply hot water to a residential dwelling house. The immersion heating element inside the tank has a power rating of 2200 W and the tank contains 125 kg of water at 28°C. Calculate

(i) the heat energy supplied by the heating element in 2 hours

(3 marks)

(ii) the heat energy supplied to the water, given that its temperature increases to 58°C

(3 marks)

[specific heat capacity of water is 4200 J kg^{-1} K^{-1}]

(iii) the heat capacity of the tank, assuming that the tank and the water reach the same final temperature of 58°C.

(3 marks)

Total 15 marks

4. (a) Explain what is meant by the term 'magnetic field'.

_____

_____

(2 marks)

(b) TWO bar magnets are close to each other so that their magnetic fields interact. Sketch the field pattern for the TWO arrangements shown below.

(i)



(ii)



(4 marks)

(c) In Figure 1 below the primary of the transformer is connected to a battery and a switch while the secondary is connected to a centre-zero galvanometer.

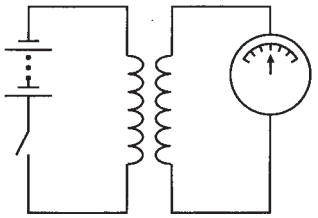


Figure 1

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(i) Describe what would be observed on the galvanometer when the switch is closed.

(2 marks)

(ii) Explain your answer.

(3 marks)

(iii) Describe what would be observed on the galvanometer if the switch is subsequently opened.

(2 marks)

(iv) Deduce what would be observed on the galvanometer if the battery were replaced by a **low frequency** a.c. supply.

(1 mark)

(v) How would these observations be affected if the number of turns on the transformer secondary were significantly increased?

(1 mark)

Total 15 marks

5. (a) Identify the logic gates described in the first column of the table below and hence complete the table by writing in the names and logic symbols in the appropriate columns.

DESCRIPTION	NAME	SYMBOL
Output is always **low** except when **both** inputs are **high**.		
Output is always **high** except when **both** inputs are **low**.		
Output is always **high** except when **both** inputs are **high**.		

(6 marks)

(b) Figure 2 shows a logic circuit.

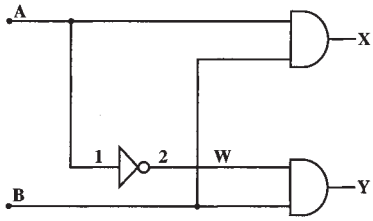


Figure 2

Examine the logic circuit shown in Figure 2 and complete the TRUTH TABLE below:

A	B	W	X	Y
0	0			
0	1			
1	0			
1	0			

(6 marks)

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(c) The logic circuit of Figure 2 is incorporated into the electrical system of a car as shown in Figure 3 below, and switches S1 and S2 are operated according to the table below.

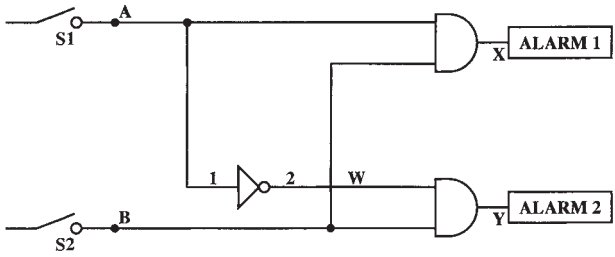


Figure 3

	ENGINE ON	ENGINE OFF	DOOR OPEN	DOOR CLOSED
SWITCH S1	ON	OFF	ANY STATE	ANY STATE
SWITCH S2	ANY STATE	ANY STATE	ON	OFF

Explain what happen if:

(i) the DOOR is OPEN and the ENGINE is OFF.

_____

_____

(2 marks)

(ii) the DOOR is OPEN and the ENGINE is ON.

_____

_____

(1 mark)

Total 15 marks

END OF TEST