CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

17 JANUARY 2025 (a.m.)

J 2 5 0 1 2 3 8 0 2 0

FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

TEST CODE | 0 | 1 | 2 | 3 | 8 | 0 | 2 | 0 |

SUBJECT PHYSICS – Paper 02

PROFICIENCY GENERAL

REGISTRATION NUMBER | | | | | | | | | | |

SCHOOL/CENTRE NUMBER					

NAME OF SCHOOL/CENTRE

CANDIDATE'S FULL NAME (FIRST, MIDDLE, LAST)

DATE OF BIRTH | D | D | M | M | Y | Y | Y | Y |

SIGNATURE _____

0 1 2 3 8 0 2 0 0 1

DO NOT WRITE ON THIS PAGE

FORM TP 02025026

TEST CODE **01238020**

JANUARY 2025

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions in TWO sections. Answer ALL questions.
2. Write your answers, with the appropriate units, in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. All working MUST be shown. Where appropriate, ALL formulas MUST be clearly stated as part of your working.
5. You may use a silent, non-programmable calculator to answer questions, but you should note that the use of an inappropriate number of significant figures in answers will be penalized.
6. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
7. **If you use the extra page(s), you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

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

SECTION A

Answer ALL questions.

1. (a) Complete the statement below.

Transformers can increase or decrease the _____, with a corresponding decrease or increase in _____. The basic principle behind the working of a transformer is the phenomenon of _____ between two windings linked by a common magnetic flux.

(3 marks)

786

(b) In the experimental setup shown in Figure 1, a variable AC voltage source, V_1, drives the primary winding of an **ideal** step-down transformer with a turns ratio of 3960:600. A resistor, $R = 5\ \Omega$, is connected across the secondary winding.

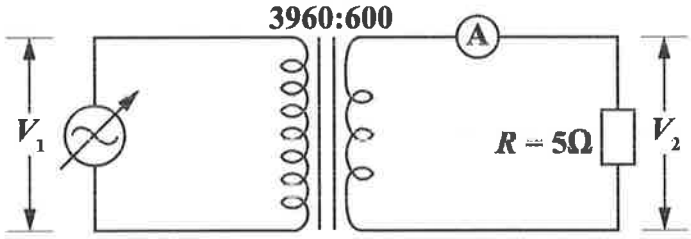

Figure 1. Diagram of a transformer

Table 1 shows the values obtained for V_2 when V_1 is varied from 0 V to 80 V.

TABLE 1: VALUES OBTAINED FOR V_2 WHEN V_1 IS VARIED

A000

V_1/V	0	10	20	30	45	60	70
V_2/V	0	1.5	3.1	4.7	6.7	9.0	10.7

Use the readings from Table 1 to plot a graph of V_2 vs V_1 on the grid **on page 5**.

GO ON TO THE NEXT PAGE

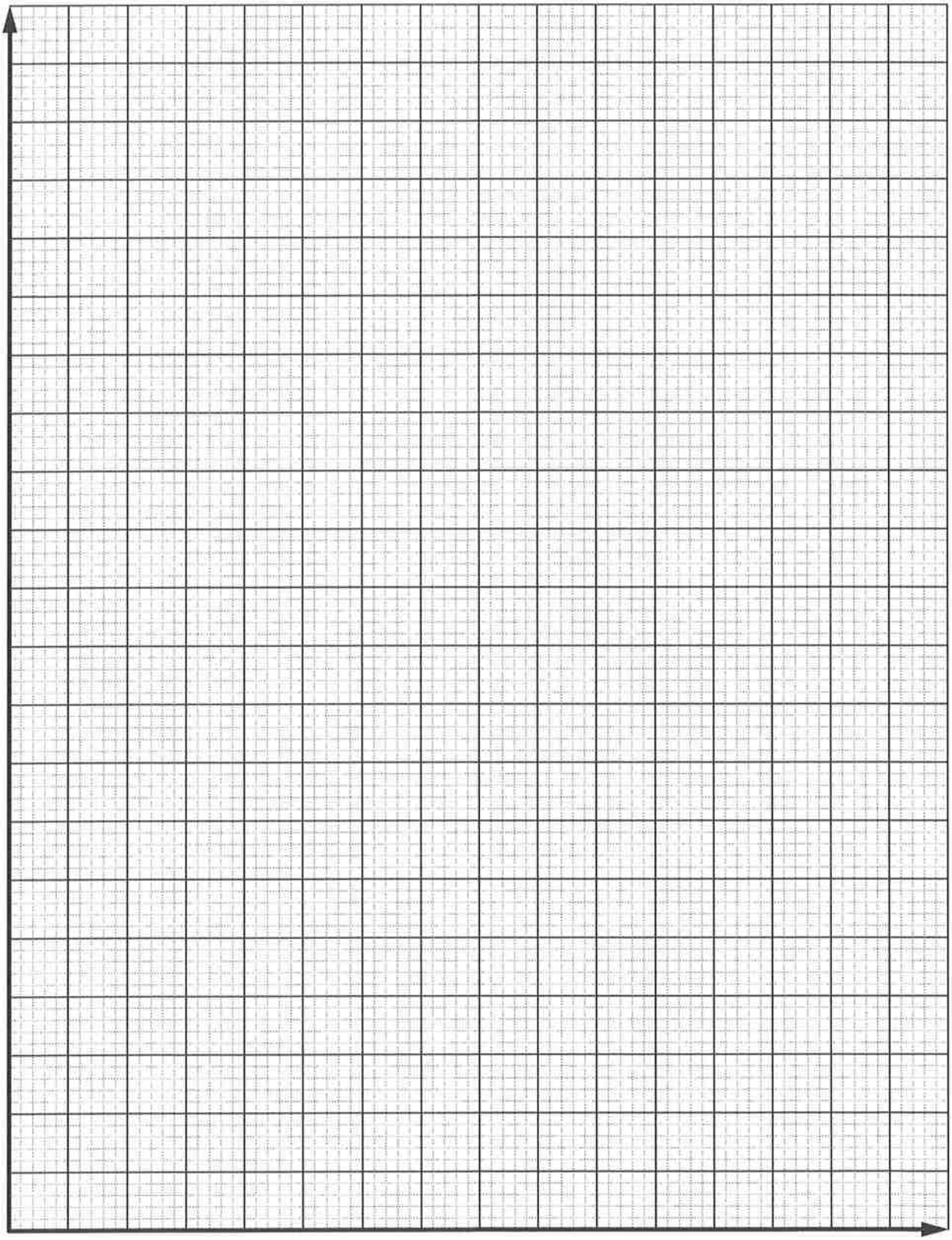

Figure 2. Graph of V_2 vs V_1

(7 marks)

GO ON TO THE NEXT PAGE

(c) Find the slope, S, of your graph.

.....

(4 marks)

(d) What does the slope of your graph represent?

.....

.....

.....

(1 mark)

(e) Use your graph to determine the value of V_2 when $V_1 = 50$ V.

$V_2 =$ _____

(1 mark)

(f) Calculate the current, I_2, in the secondary windings when $V_1 = 50$ V.

.....

(3 marks)

(g) Use the slope of your graph and the equation $I_1 = S \bullet I_2$ to determine the current, I_1, in the primary winding.

.....

(2 marks)

(h) (i) Calculate the power dissipated in the resistor, R.

.....

(3 marks)

(ii) Determine the power input to the primary windings by the source.

.....

(1 mark)

Total 25 marks

GO ON TO THE NEXT PAGE

2. (a) (i) Identify ONE alternative energy source utilized in or that is relevant to the Caribbean.

.....

.....

(1 mark)

(ii) State TWO ways in which alternative energy sources, like the one mentioned in (a) (i), are important to the Caribbean.

.....

.....

.....

.....

.....

.....

(2 marks)

(b) State the law of conservation of energy.

.....

.....

.....

.....

.....

(2 marks)

(c) A motor vehicle is travelling along a level road. What are the MAIN energy changes taking place when the vehicle comes to rest after the brakes are applied?

.....

.....

.....

(2 marks)

786

A000

(d) An elevator raises a group of 12 persons through a vertical height of 10 m in 5 s. If the average mass of the persons in the group is 55 kg, calculate

(i) the gravitational potential energy gained by the group [Use $g = 10\ ms^{-2}$]

.....

(4 marks)

(ii) the power required to raise the group.

.....

(4 marks)

Total 15 marks

3. (a) (i) The effects of thermal expansion can be observed in many everyday situations. List THREE observed examples of the effects of thermal expansion.

.....

.....

.....

.....

.....

.....

.....

.....

(3 marks)

786

(ii) Indicate whether there will be an increase or decrease in temperature in the following scenarios.

a) Samara turned on the oven to roast a breadfruit. More thermal energy enters the breadfruit than the energy that leaves the breadfruit.

.....

.....

(1 mark)

b) Aisha lights a candle during the night-time in the month of December. The windows are open and so a greater amount of cooler air enters the room than the warm air leaving the room.

A000

.....

.....

(1 mark)

(b) Identify the physical property that is being used in the following thermometers to measure temperature.

(i) A thermocouple is used to measure the temperature of an oven.

.....

.....

(1 mark)

(ii) A liquid-in-glass clinical thermometer is used to take the temperature reading of a sick child.

.....

.....

(1 mark)

(c) A weather balloon is deployed to observe and send information about the make-up of the volcanic ash plumes that were emitted from the La Soufrière volcano in St Vincent.

(i) The balloon has a volume of 28 m^3. The gas inside the balloon is heated from 176 °C to 240 °C. If the pressure inside the balloon remains constant, determine the new volume of the balloon.

.....

(3 marks)

(ii) In another situation, the volume of the balloon was kept constant and the pressure of the gas was allowed to change from its initial value of 1.00×10^5 Pa.

Calculate the new pressure if the temperature of the gas inside the balloon was heated from 176 °C to 240 °C.

786

.....

(3 marks)

(iii) Determine the percentage increase in the pressure in (c) (ii).

A000

.....

(2 marks)

Total 15 marks

SECTION B

Answer ALL questions.

4. (a) (i) State the laws of reflection.

Law 1

.....

.....

.....

.....

Law 2

.....

.....

.....

.....

(2 marks)

(ii) One property of an image formed by a plane mirror is that it is virtual. State ONE other property of the image.

.....

.....

.....

(1 mark)

(b) State Snell's law.

.....

.....

.....

.....

.....

.....

.....

.....

(3 marks)

(c) Blue and red light are incident on a Perspex block as shown in Figure 3.

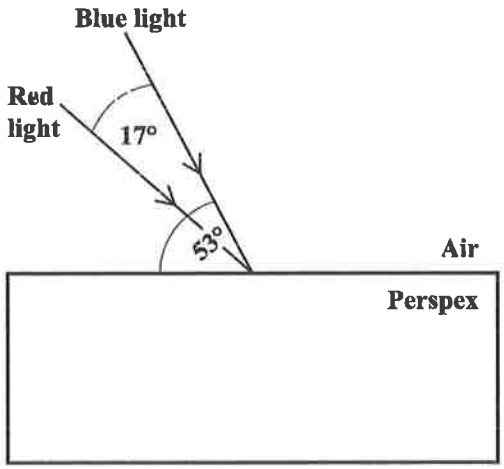

Figure 3. Diagram of Perspex block

(i) Calculate the angle of incidence for EACH colour of light.

Blue light .....

.....

Red light .....

.....

(2 marks)

(ii) Calculate the angle of refraction of the blue light, given that the refractive index for the blue light is 1.53.

.....

(4 marks)

(iii) Calculate the critical angle, *c*, for the blue light.

.....

(3 marks)

Total 15 marks

5. (a) Write the formula to show how potential difference (V), charge (Q) and energy (E) are related and state the SI unit for EACH quantity.

.....

.....

.....

.....

.....

.....

.....

(4 marks)

786

(b) A circuit that can be used to recharge a battery is shown in Figure 4.

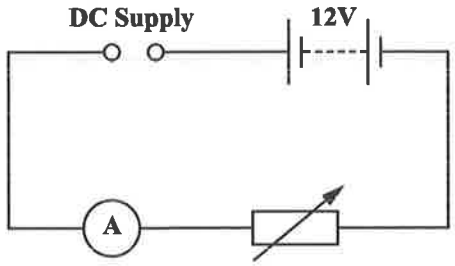

Figure 4. A Circuit that can be used to recharge a battery

(i) On the diagram, insert the polarity of the DC supply. **(1 mark)**

A000

(ii) Indicate, in the space provided below, which of the values, 6 V, 12 V or 15 V, would be MOST suitable for the DC supply.

.....

(1 mark)

(c) A compact fluorescent light bulb consumes 4.8 W of power when connected to a 120 V AC supply.

(i) Calculate the current flowing through the bulb.

.....

(3 marks)

(ii) If the bulb is connected for 5 minutes, calculate the charge passing through it.

.....

(4 marks)

(iii) Calculate the energy the bulb transfers in 5 minutes.

.....

(2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

6. (a) Radioactive materials emit nuclear radiation.

(i) List THREE main types of nuclear radiation.

.....

.....

.....

.....

(3 marks)

(ii) Identify the type of nuclear radiation which forms part of the electromagnetic spectrum.

786

.....

.....

(1 mark)

(iii) Determine the type of radiation that is

a) the most ionizing

.....

.....

(1 mark)

b) made up of electrons.

.....

A000

.....

(1 mark)

(b) Figure 5 shows a radioactive source which was placed in front of a radioactive detector. The average background count rate is 5 counts per second. With the source in place, the rate rises to 69 counts per second. After an hour, the count rate drops to 21 counts per second.

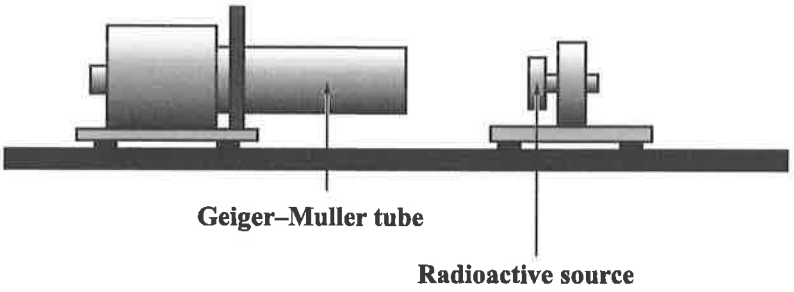

Figure 5. Side view of a radioactive detector

(i) Determine the corrected count rates for the activities of the source.

.....

(2 marks)

(ii) Calculate the half-life of the source.

.....

(3 marks)

(c) A block of lead is then placed between the source and the detector. The results of the count rates are recorded in Table 2.

TABLE 2: COUNT RATE OF A BLOCK OF LEAD

	Counts Per Second
Count rate with the source in place	69
Count rate with the source and block in place	32
Count rate with the source and block removed	_____

(i) Complete Table 2 by inserting the missing value.

(1 mark)

786

(ii) a) The source is known to emit one type of radiation only. Deduce what type of radiation it is.

.....

.....

(1 mark)

b) Give TWO reasons to support your answer.

.....

.....

.....

(2 marks)

Total 15 marks

A000

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No. ☐

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No. ☐

786

A000

DO NOT
WRITE ON
THIS PAGE

CANDIDATE'S RECEIPT

INSTRUCTIONS TO CANDIDATE

1. **Fill in all the information requested clearly in capital letters.**

TEST CODE | 0 | 1 | 2 | 3 | 8 | 0 | 2 | 0 |

SUBJECT PHYSICS – Paper 02

PROFICIENCY GENERAL

REGISTRATION NUMBER | | | | | | | | | | | |

786

FULL NAME _____

(BLOCK LETTERS)

SIGNATURE _____

DATE _____

2. **Ensure that this slip is detached by the Supervisor or Invigilator and given to you when you hand in this booklet.**

3. **Keep it in a safe place until you have received your results.**

INSTRUCTION TO SUPERVISOR/INVIGILATOR

A000

Sign the declaration below, detach this slip and hand it to the candidate as his/her receipt for this booklet collected by you.

I hereby acknowledge receipt of the candidate's booklet for the examination stated above.

Signature _____
Supervisor/Invigilator

Date _____

0 1 2 3 8 0 2 0 2 4