

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2019

ADVANCED LEVEL

Subject Title	Physics
Paper No	Paper 2
Paper Code	0780

Two and a half hours

Answer ALL questions

Section I is designed to be answered in 1 hour. Section II in 30 minutes and Section III in 1 hour. You are advised to divide your time accordingly.

You are reminded of the necessity for good English and orderly presentation in your answers.

In calculations you must show all the steps in your working, giving your answer at each stage. Calculators and formulae booklet are allowed.

Turn Over

(One hour)

Answer all Questions

1. The capacitance (C) between two parallel metal plates is given by,

$$\frac{\epsilon_0 A}{d}$$

where ϵ_0 is the permittivity of air, A is the area of overlap of the plates, and d is the plate separation.

- (a) Show that the equation above is homogeneous.

- (b) If the area of overlap of the plates of a capacitor whose plates are separated by $1.25 \times 10^{-6} \text{ m}$ is $1.64 \times 10^{-24} \text{ cm}^2$, what is its capacitance? (6 marks)

2. Distinguish between solids and liquids in terms of the following properties.

- (i) Molecular arrangements
(ii) Intermolecular forces

(6 marks)

3. Two protons A and B each of mass $1.70 \times 10^{-27} \text{ kg}$ are separated by a distance a of $1.00 \times 10^{-13} \text{ m}$.

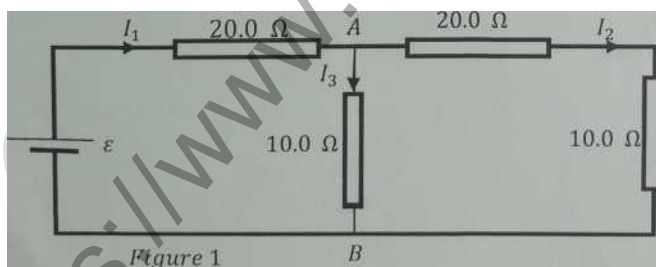
- (a) Draw a diagram showing the forces acting on the protons
(b) Calculate the ratio of the electric force to the gravitational force between the protons

(6 marks)

4. (a) State two conditions for a constructive interference pattern to be observed between two sources of light?

- (b) A parallel beam of light of wavelength 559 nm is incident normally on a diffraction grating having 600 lines per mm. Determine the maximum number of orders possible. (5 marks)

5. Figure 1 shows a circuit diagram containing 4 resistors and a battery of emf, $\mathcal{E} = 4.40 \text{ V}$.



Determine:

- (a) the currents I_1 , I_2 and I_3 .

- (b) the potential difference across AB

(7 marks)

Answer EITHER 6 (a), (b) and (c) OR 6 (d), (e) and (f).

EITHER 6 (a), (b) and (c)

- 6 (a) State the zeroth and first laws of Thermodynamics (4 marks)
- (b) Describe an experiment to determine the Specific Heat Capacity of copper. Your account should include a diagram, procedure, precautions, observations and a conclusion. (8 marks)
- (c) Figure 2 shows a ball M of mass 0.800 kg moving with a velocity of 10.0 m s^{-1} that collides head-on with a ball N of mass 0.4 kg moving with a velocity of 4.00 m s^{-1} . After the collision, M acquires a velocity of 6.00 m s^{-1} while N acquires a velocity of 12.0 m s^{-1}

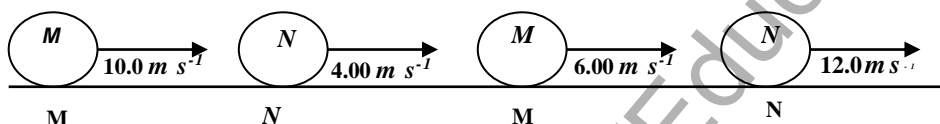


Figure 2

- (i) Show that the collision obeys the law of conservation of linear momentum.
- (ii) Define an elastic collision and determine whether this collision is elastic or inelastic. (8 marks)

OR 6 (d), (e) and (f)

6. (d) (i) Define photoelectric effect. (2 marks)
- (ii) State two experimental observations with regards to the photoelectric effect which classical physics could not explain. (4 marks)
- (e) Describe an experiment to determine Planck's constant. Your account should include a diagram, procedure, precautions, observations and a conclusion. (8 marks)
- (f) A certain element has a work function of 1.90 eV. Determine:
- (i) its threshold wavelength;
- (ii) the maximum kinetic energy of the emitted electrons when the element is illuminated by light of wavelength $4.50 \times 10^{-7} \text{ m}$; and
- (iii) the stopping potential of this element (6 marks)

SECTION II (30 minutes)

DATA ANALYSIS

7. A student investigated the variation of potential difference (V) and the current (I) through a semiconductor diode and obtained the following results:

$I/x 10^{-4} A$	V/mV
0.004	255
0.016	315
0.036	345
0.089	385
0.182	410
0.552	455
0.903	475
1.400	495
1.820	505
2.230	515

Table 1

The equation relating, I and V is

$$I = I_0 e^{\beta V} \dots \dots \dots (1)$$

where I_0 and β are constants.

- (a) Plot a suitable graph from which β and I_0 could be obtained. (11 marks)
- (b) Determine the values for the constants β and I_0 ? (8 marks)
- (c) What is the physical significance of I_0 ? (1 mark)

SECTION III (1hour)

OPTIONS

Answer any two questions from the four options

OPTION 1: ENERGY RESOURCES AND ENVIRONMENTAL PHYSICS

- 8 (a) With the aid of an example, explain the meaning of each of the terms:
- Functional energy sources;
 - Secondary energy sources
- (4 marks)
- (b) Explain consequences of global warming on;
- human health
 - the environment
- (4 mark)
- (c) State three factors on which the amount of solar radiation in any part of the world depends. (3 marks)
- (d) Natural uranium contains 0.7 % Uranium - 235. When Uranium — 235 atom undergoes fission, 200 MeV of energy is released. Calculate:
- the number of U - 235 nuclei contained in 1.00 kg of natural uranium;
 - the cost to be paid to an Electricity company such as ENEO, if electrical energy is sold at the rate of 60 frs per unit when the U - 235 content in 1.00 kg completely undergoes fission and all the energy released is converted to electrical energy.
- (4 marks)
- (Total 15 marks)

OPTION 2: COMMUNICATION.

9. (a) Draw the diagram of a simple radio receiver. (4 marks)
- (b) (i) Briefly explain the difference between FM and AM transmission. (3 marks)
- (ii) A tuning circuit contains an inductor of inductance 12.7 mH . If a capacitor of capacitance $2.00 \mu\text{F}$ is connected to the circuit, calculate the frequency to which the circuit is tuned. (3 marks)
- (c) (i) State two physical quantities that can be varied in order to capture a particular radio station using a mobile phone. (2 marks)
- (ii) State and explain two uses of cell phones. (3 marks)

OPTION 3: ELECTRONICS

10. (a) (i) Distinguish between intrinsic and extrinsic semiconductors, (4 marks)
- (ii) With the aid of diagrams explain the band theory. (3 marks)
- (b) Figure 3 shows a simple amplifier circuit.

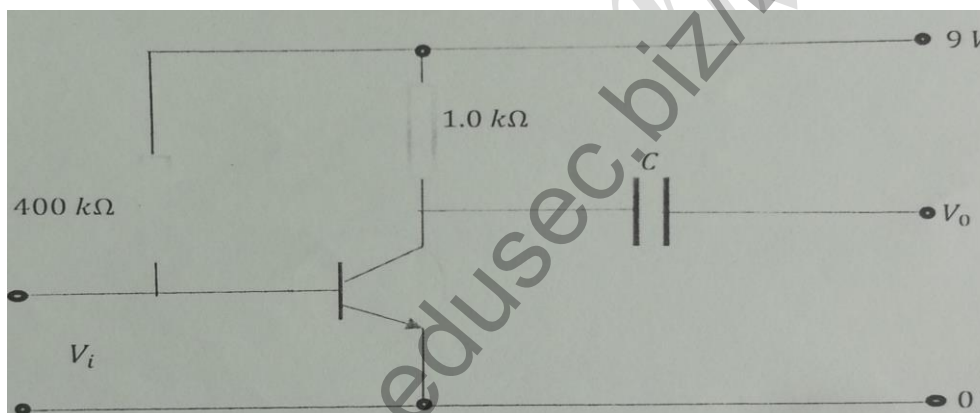


Figure 3

When the Collector-emitter Voltage is between $+1 \text{ V}$ and $+9 \text{ V}$, the Collector Current is $60 I_B$, the base-emitter voltage is 0.7 V .

- (i) Identify the type of amplifier
- (ii) Calculate the base current;
- (iii) the output voltage; and
- (iv) the voltage gain. (6 marks)
- (e) Compare the functions of a diode and a capacitor in an electric circuit (2 marks)

(Total 15 marks)

OPTION 4: MEDICAL PHYSICS

11. (a) Compare X - rays and ultrasound in medical diagnosis (4 mark)
- (b) A person's near point is 100 cm . Explain using a diagram how the defect can be corrected. (4 marks)
- (c) (i) Draw a simple labelled diagram of the human heart (ii) (4 marks)
- State any three functions of the heart. (3 marks)
- (Total 15 marks)