

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD
PHYSICS 1 General Certificate of Education Examination

0780

JUNE 2016

ADVANCED LEVEL

Centre Number	
Centre Name	
Candidate Identification No.	
Candidate Name	

Mobile phones are NOT allowed in the examination room.

MULTIPLE CHOICE QUESTION PAPER

One and a half hours

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you start answering the questions in this paper. Make sure you have a soft HB pencil and an eraser for this examination.

1. USE A SOFT HB PENCIL THROUGHOUT THE EXAMINATION.
2. DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Before the examination begins:

3. Check that this question booklet is headed "Advanced Level—0780 PHYSICS 1".
4. Fill in the information required in the spaces above.
5. Fill in the information required in the spaces provided on the answer sheet using your HB pencil: Candidate Name, Exam Session, Subject Code, Centre Number and Candidate Number. Take care that you do not crease or fold the answer sheet or make any marks on it other than those asked for in these instructions.

How to answer the questions in this examination

6. Answer ALL the 50 questions in this Examination. All questions carry equal marks.
7. Calculator and Formulae book are allowed.
8. Each question has FOUR suggested answers: A, B, C and D. Decide which answer is appropriate. Find the number of the question on the Answer Sheet and draw a horizontal line across the letter to join the square brackets for the answer you have chosen.

For example, if C is your correct answer, mark C as shown below:

[A] [B] [C] [D]

9. Mark only one answer for each question. If you mark more than one answer, you will score a zero for that question. If you change your mind about an answer, erase the first mark carefully, then mark your new answer.
10. Avoid spending too much time on any one question. If you find a question difficult, move on to the next question. You can come back to this question later.
11. Do all rough work in this booklet using the blank spaces in the question booklet.
12. At the end of the examination, the invigilator shall collect the answer sheet first and then the question booklet. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH IT.

Turn Over

Section I

(Thirty five questions)

Questions: 1-35

Direction: Each of the thirty five questions or incomplete statements in this section is followed by four suggested answers. Select the best answer in each case.

- 1 Which three of the following physical quantities are all scalars?
 A Power, temperature, mass
 B Weight, displacement, speed
 C Work, energy, momentum
 D Force, displacement, velocity
- 2 From the equation $P = \frac{3}{2}KT$, where K is Boltzmann's constant and T is absolute temperature, one can deduce that the unit of P is the same as that of:
 A Power
 B Pressure
 C Energy
 D Work done per second
- 3 When a hot object and a cold one are placed in thermal contact, the temperature at equilibrium will be:
 A Somewhere between their initial temperatures
 B At a point midway between their initial temperatures
 C At a point closer to the higher of the two initial temperatures
 D At a point equal to half the sum of their initial temperatures.
- 4 Becquerel's discovery of radiation from uranium salts was important in that:
 A It confirmed that both phosphorescence and luminescence can result in the emission of energy
 B It opened a market for uranium
 C His grant provided support for Pierre and Marie Curie.
 D Energy was emitted from this material continuously, without an external input of energy
- 5 In an experiment to measure the wavelength of light in air, two slits are illuminated with white light and their images are obtained on a screen. For best results:
 A the slit to screen distance should be at least 3.00 m.
 B the light used can be a mixture of coloured light.
 C the light used should be obtained from a LASER source;
 D the slit width should be made smaller than the wavelength of light.
- 6 The trace displayed on a CRO screen of a sinusoidal voltage has a peak to peak height of 5.2 V. The root mean square value of this voltage is:
 A 1.84 V
 B 2.80 V
 C 2.60 V
 D 5.20 V
- 7 A particle of mass m strikes a vertical rigid wall perpendicularly from the left with velocity v . If the collision is perfectly elastic, the total change in momentum of the particle is
 A $2mv$ to the left
 B $2mv$ to the right
 C mv to the left
 D mv to the right
- 8 What is the critical angle in a polystyrene block whose index of refraction is 1.49 when this block is immersed in carbon disulphide whose index of refraction is 1.63?
 A 37.80
 B 42.20
 C 66.00
 D There won't be total internal reflection inside the polystyrene when it is in carbon disulphide.
- 9 The mass of a satellite orbiting the earth is doubled. The orbital period will remain same if its distance from the centre of the earth must:
 A Be doubled
 B Be halved
 C Increase four fold
 D Remain unchanged

10. Which of the following is NOT a property of sound waves?
- A Diffraction
 - B Reflection
 - C Refraction
 - D Polarisation

11. Radiocactive ^{14}C dating was used to determine the age of a wooden archaeological specimen. Measurements were made in three situations, yielding the following results:

Specimen	Count rate
1 g of living wood	80 counts per minute
1 g sample of archaeological specimen	35 counts per minute
No sample	20 counts per minute

If the half life ^{14}C is 5700 years roughly, what is the approximate age of the archaeological specimen?

- A 2500 years
- B 700 years
- C 11,000 years
- D 13,000 years

12. Three isolated identical spheres M, N and P are mounted on insulating stands. Charges of $+4Q$ and $-1Q$ are introduced on M and N respectively while P is left electrically neutral. The spheres are then made to touch each other in such a way that their centers of mass are at the respective apices of an equilateral triangle.

- A Each of the spheres is now neutral
- B Each sphere now carries a net charge of $+Q$
- C Each sphere now carries a net charge of $1.67Q$
- D P now carries a net charge of $+3Q$, while M and N are now electrically neutral

13. A 4.00 kg mass sliding on a frictionless horizontal platform had a velocity of 5.00 m s^{-1} due north. 6.00 s later, it was found to be moving due north with a velocity of 7.00 m s^{-1} . The average net external force that acted upon it during this time interval was:

- A 1.33 N due north
- B 3.33 N due south
- C 4.33 N due north
- D 8.00 N due north

14. A long one side of a house, the lawn slopes from left to right. A painter called up to paint this side of the house leans a ladder against the wall and finds that only the left leg of the ladder is touching the ground. He needs to climb up this ladder to do his job, so he should:

- A Proceed since the ladder is in equilibrium
- B Ensure that the left leg is free to move before climbing up the ladder
- C Place wooden blocks under the right leg until both legs are supported
- D Dig a hole for the left leg until both legs are supported by the ground

15. The image of an object placed on one side of a thin lens, 0.49 m away from its principal focus is obtained on a screen (S) on the other side of the lens. If the screen is 0.25 m away from the principal focus on that side of the lens, then its focal length must be:

- A 0.35 m
- B 0.25 m
- C 0.166 m
- D 0.74 m

16. Which of the following would affect atomic spectra?

- A The element involved
- B The atom's state of ionization
- C The temperature and pressure of a gaseous sample
- D The responses in A, B and C above are all correct.

17. Which of the following will produce the greatest increase in the volume of a sample of an ideal gas in a cylinder with a moveable piston, when all other properties remain unchanged?

- A Doubling its pressure
- B increasing the temperature from 50.0°C to 100.0°C
- C Doubling the number of molecules in the sample
- D Each of these would produce the same doubled volume.

18. Convert 1 MeV to a.m.u.

- A $1.78 \times 10^{-4} \text{ u}$
- B $1.07 \times 10^{-3} \text{ u}$
- C $1.60 \times 10^{-13} \text{ J}$
- D $9.67 \times 10^{13} \text{ u}$

Turn Over

19. The human eye can detect very small quantities of light under optimum conditions. The sensation of "seeing light" can occur with light of minimum energy 4×10^{-19} J entering the eye. Assuming this is light of 510 nm wavelength, how many photons are sufficient to be detected?

A) Billions and billions of them
B) Just one is enough
C) About ten
D) Between 10^2 and 10^3

20. In an experiment, the need arose to warm 3.00 kg of air. As a result, all the heat extracted when 5.00 kg of water was cooled through 4°C was supplied to the air. Assuming the respective specific heat capacities of water and air to be $4186 \text{ J/kg}^\circ\text{C}$ and $721 \text{ J/kg}^\circ\text{C}$, by how much did the temperature of the air rise?

A) 1°C or less
B) 5.53°C
C) 6.67°C
D) 38.7°C

21. A current of 5.00 A flows through a wire placed at an angle of 30° to the field lines of the earth's magnetic field. If the flux density of this field is $5.00 \times 10^{-5} \text{ T}$, what force would the wire (which is 0.500 m long) experience due to its interaction with the field?

A) $6.3 \times 10^{-7} \text{ N}$
B) $1.25 \times 10^{-4} \text{ N}$
C) $2.5 \times 10^{-4} \text{ N}$
D) $6.25 \times 10^{-5} \text{ N}$

22. The length per unit resistance of copper wire has a value of 7.63 mm per ohm for a diameter of 1.450 mm. This corresponds to a resistivity of:

A) $2.16 \times 10^{-4} \Omega \text{ m}$
B) $1.72 \times 10^{-4} \Omega \text{ m}$
C) $5.04 \times 10^{-4} \Omega \text{ m}$
D) $7.63 \times 10^{-5} \Omega \text{ m}$

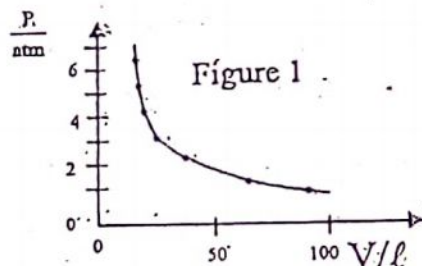
23. A toy car of mass m is attached to one end of a light horizontal spring, fixed to a rigid support. The toy car is so arranged to move on a frictionless surface. The spring is pulled and released, compelling the toy car to be moving back and forth simple harmonically in a horizontal plane. Which of these actions would increase the frequency of the oscillations of the toy car?

A) Increasing the amplitude of oscillation.
B) Using a weaker spring.
C) Decreasing the mass of the car.
D) Increasing the mass of the toy car.

24. A nuclide ${}_{83}^{210}\text{X}$ decays to another nuclide ${}_{80}^{206}\text{Y}$ in four successive radioactive decays. Each decay involves the emission of either an alpha particle or a beta particle. The value of A is:

A) 210
B) 206
C) 208
D) 212

25. Figure 1 shows the P-V graph for a sample of a gas at 298 K. If this sample were heated to 312 K, this would be represented by a point on the graph by a point:



A) At the top, left end of the line
B) Off the line, above and to the right of it.
C) At the lower, right end of the line
D) Off the line, below and to the right of it.

26. By comparing the frequency of a received echo with the known frequency of the emitted sound, SONAR units on submarines can determine the locations and velocities of other ships. Suppose a submarine that is virtually at rest emits a pulse of sound at a frequency f through water at the speed of sound v . What would be the frequency detected by a fast surface vessel, approaching at a speed of $0.08 v$?

A) $0.93 f$
B) $0.92 f$
C) $1.08 f$
D) $1.008 f$

27. Two identical resistors M and N each of resistance $10\ \Omega$ are connected in series with each other and to a $3.0\ \text{V}$ supply of negligible internal resistance. If a third identical resistor Q of resistance $10\ \Omega$ is connected across M , the potential difference across N :
- increases by $0.50\ \text{V}$
 - increases by $1.00\ \text{V}$
 - Decreases by $2.00\ \text{V}$
 - Increases by $2.00\ \text{V}$
-
28. White light passes through a diffraction grating and forms rainbow patterns on a screen behind the grating. For each rainbow:
- The violet side is closest to the center spot of the screen; the red side is furthest from the center spot.
 - The red side is on the left; the violet side is on the right of the centre spot.
 - The red side is on the right, of the center spot the violet side is on the left of the center spot.
 - The violet side is further from the center spot.
-
29. A hydrogen molecule has a mass of $3.35 \times 10^{-27}\ \text{kg}$. If Boltzmann's constant is $1.38 \times 10^{-23}\ \text{J K}^{-1}$, the root-mean-square speed of hydrogen (H_2) molecules at $1.00 \times 10^3\ \text{K}$ is:
- Less than $1.00\ \text{m s}^{-1}$
 - $3.5 \times 10^3\ \text{m s}^{-1}$
 - $1.2 \times 10^7\ \text{m s}^{-1}$
 - $5.3 \times 10^3\ \text{m s}^{-1}$
-
30. A ship is towed into a port by two tugs, each of which is pulling the ship by a steel cable. The angle between the two cables is 60° and tension in each of them is $8.00 \times 10^3\ \text{N}$. If the motions of ship is resisted by a viscous drag force of $5.856 \times 10^3\ \text{N}$ then the resultant force on it is:
- $1.386 \times 10^3\ \text{N}$ at an angle of 60° to one of the cables
 - $2.144 \times 10^3\ \text{N}$ at an angle of 30° to one of the cables.
 - $8.00 \times 10^3\ \text{N}$ at an angle of 30° to one of the cables
 - $5.856 \times 10^3\ \text{N}$ at an angle of 30° to one of the cables
-
31. A girl weighs $490\ \text{N}$ on the earth's surface at a place where the local value of the earth's gravitational field strength is $9.8\ \text{N kg}^{-1}$. What would happen to her weight if enough meteorites were to crash various craters on earth in such a way that its mass doubles without its mass doubles without its radius changing?
- Her weight would become $693\ \text{N}$.
 - Her weight would increase by a factor of $\sqrt{2}$.
 - Her weight would increase by $490\ \text{N}$.
 - Her weight would increase by a factor greater than 2.
-
32. Oxygen gas with a density of $3\ \text{kg m}^{-3}$ exerts a pressure of $3 \times 10^6\ \text{Pa}$ on the walls of its container. What is the root-mean-square velocity of the oxygen molecules?
- $1000\ \text{m s}^{-1}$
 - $535\ \text{m s}^{-1}$
 - $1500\ \text{m s}^{-1}$
 - $1732\ \text{m s}^{-1}$
-
33. A transformer has a coil of 1000 turns wound on its central core and the terminals of the coil are connected to a mains of $240\ \text{V}$ supplying a current of $120\ \text{mA}$. Another coil of 50 turns is wound on the first coil and its terminals connected to a radio of power $24\ \text{W}$. Which of the following is NOT correct?
- The turns ratio of this transformer is $20:1$
 - The output current is $0.20\ \text{A}$.
 - The efficiency of the transformer is $83.3\ \%$
 - This is a step-down transformer.
-
34. An amplified sound system in a car's $12.0\ \text{V}$ circuit delivers $2.0 \times 10^2\ \text{W}$
- It would take a mole of electrons one to two hours to move round this circuit
 - Interference effects cannot be obtained using this system, since it has only one loudspeaker
 - The amplification is achieved using a transistor connected in the common-emitter mode
 - This can only be achieved if an operational amplifier is incorporated into the system
-
35. When a thin slice of silicon is doped with indium or boron atoms
- It acquires a net positive charge.
 - A junction barrier potential difference develops in it
 - Holes become the majority carriers in it
 - The free flow of thermally generated charge carriers through the material is inhibited

SECTION II (Ten questions)

Multiple Selection

Questions 36 – 45

Directions: For each group of questions below ONE or TWO of the responses given is/are correct.

Choose.

- A If 1 and 2 are correct
 B If 2 and 3 are correct
 C If 1 only is correct
 D If 3 only is correct

Directions Summarised			
A	B	C	D
1,2 only	2,3 only	1 only	3 only

- 36 Which of the following does NOT constitute a pair of ohmic conductors?
- 1 A tungsten filament and a copper wire
 - 2 A copper wire and an iron wire
 - 3 A strip of gold foil and a strip of iron
-
- 37 Electric charge is moved from point A to point B by a potential difference. Which of these statements about the work done in the process is correct?
- 1 More work would be done if A is at 240 V and B is at 120 V than if A is at 120 V and B is at 0 V
 - 2 The same amount of work would be done if A is at 120 V and B is at 0 V as would be done if A is at 0 V and B is at 120 V
 - 3 Strictly speaking, the amount of work done does not depend on which of A or B is at a higher potential but on the difference between their potentials.
-
- 38 The electron energy in the ground state for a hydrogen atom is -13.6 eV. Based on this value the Bohr model would predict other permitted electron energy values of:
- 1 -3.4 eV and -1.5 eV
 - 2 -6.8 eV and -3.4 eV
 - 3 -27.2 eV and -40.8 eV

- 39 In an inductive circuit containing a resistor, if the self-inductance of the circuit increases:
- 1 The rate of change of the current with respect to time increases.
 - 2 The voltage drop across the resistance in the circuit remains constant since it has no reactance
 - 3 The rate of change of the current with respect to time decreases.
-
- 40 When the nuclide $^{214}_{83}\text{Bi}$ decay, the decay product is either $^{214}_{81}\text{Po}$ or $^{210}_{81}\text{Tl}$, because the disintegration of the nuclide can occur in one of two ways. The half life of $^{214}_{83}\text{Bi}$ is 19.7 minutes. Which of the following statements is/are correct?
- 1 $^{214}_{81}\text{Po}$ is produced by β^- emission
 - 2 $^{210}_{81}\text{Tl}$ is produced by α emission
 - 3 In 19.7 minutes, the total number of Bi, Tl and Po nuclei increases by 50 %.
-
- 41 Which of the following statements about an astronaut circling the earth in a satellite is NOT correct?
- 1 The astronaut is in equilibrium under the influence of two gravitational forces
 - 2 If the astronaut stands on a compression balance, it would read zero
 - 3 Both the astronaut and the satellite are accelerating freely under the influence of the earth's gravity
-
- 42 Nylon breaks when the tensile stress within it reaches 1.0×10^9 Pa. Which range below includes the heaviest load that could be lifted by a nylon thread of diameter 1.00 mm? The value lies between:
- 1 2.00 N and 20.0 N
 - 2 150 N and 310 N
 - 3 310 N and 800 N

43. The Earth-to-sun distance is about 1.5×10^{11} m and the Earth takes roughly 365 and a quarter days to orbit the sun. It is common practice to approximate the orbit of the Earth to be a circular one. Under these circumstances,

- 1 The centripetal acceleration of the earth round the sun is about $5.9 \times 10^{-1} \text{ m s}^{-2}$.
- 2 It is easy to calculate the centripetal acceleration of the Earth in its orbit round the sun.
- 3 The centripetal acceleration of the earth round the sun is 9.81 m s^{-2} .

44. A 12.0 pF capacitor with air between its plates is charged through a p.d. of $4.00 \times 10^2 \text{ V}$. The capacitor is then disconnected from the supply. A material of relative permittivity 4.00 is then inserted so that it fills the region between the plates completely.

- 1 This will cause the p.d. between the plates to acquire a value of $1.00 \times 10^2 \text{ V}$;
- 2 This causes the charge stored in the capacitor to decrease as charge flow between the plates must take place, in order for the p.d. to decrease;
- 3 The new value for the p.d. between the plates is $2.00 \times 10^2 \text{ V}$.

45. With regards to the comparison of the conduction of electricity along a uniform wire with the conduction of heat along a lagged metal bar, which of the following statements is / are correct?

- 1 The p.d. across the ends of the wire is analogous to the temperature difference between the ends of the bar.
- 2 The electric current in the wire is analogous to the rate of flow of heat along the lagged bar.
- 3 The electrical resistance of the wire is analogous to the reciprocal of thermal conductivity of the bar.

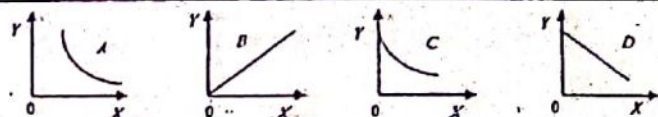
SECTION III (five questions)

Questions 46 - 50

Direction: Each of the questions (46-50) has four sets of graphs A - D. Which of the graphs in each question best fits the relationship between x and y ?

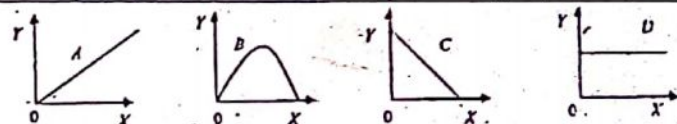
46.

Y	X
The resistance of an ohmic conductor of constant length	The cross-sectional area of the conductor



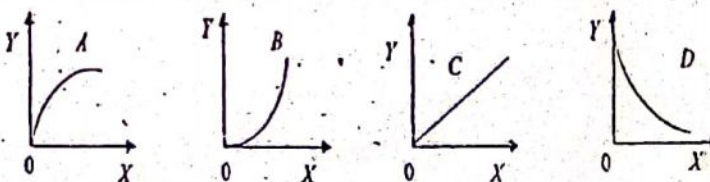
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Y	X
The pulsance (ω) of a simple harmonic oscillator	The acceleration of the oscillating mass



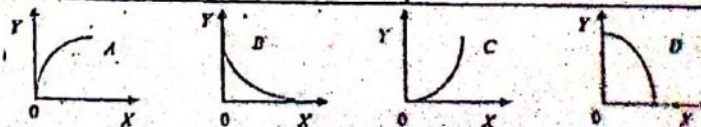
48.

Y	X
The vertical displacement of a beam of electrons projected horizontally into a vertical electric field	The horizontal distance moved by the beam



49.

Y	X
The potential energy of the at one side bob of an oscillating simple pendulum	Distance from the equilibrium position



50.

Y	X
The magnetic flux density along the axis of a solenoid	Distance along the axis outward and away from one end of it

