

Physics 1
780

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD
General Certificate of Education Examination

JUNE 2007

Physics 1

ADVANCED LEVEL

CENTRE NAME	
CANDIDATE NUMBER	
SURNAME	

One and a half hours

INSTRUCTIONS TO CANDIDATES

USE AN HB PENCIL THROUGHOUT THIS TEST

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

Before the test begins:

1. Check that your answer sheet, which is enclosed, is headed "Advanced level 780 - Physics Paper 1".
2. Insert the information required in the spaces provided on the answer sheet.

How to answer the test:

3. For each question there are five suggested answers: A, B, C, D, and E. When you have selected your answer to a question, write the letter for the answer you have chosen in the box provided on the answer sheet for that question. For example, if you think the answer to question 1 is E you write:

I	E
---	---

4. Write only one answer for each question. If you change your mind about the answer, rub out the first letter carefully and write your new answer.
 5. There are 45 questions on this paper and you are to answer ALL of them. You will score two marks for each correct answer. No marks will be deducted for incorrect answers or questions not answered.
 6. All rough work must be done in this booklet.
 7. Calculators are allowed.
- You must not take this booklet out of the examination room. All question booklets and answer sheets will be collected at the end of the examination.

You may find the following data useful in answering this paper.

- $g = 9.8 \text{ m s}^{-2}$
- $e = 1.6 \times 10^{-19} \text{ C}$
- $c = 3.0 \times 10^8 \text{ m s}^{-1}$
- $h = 6.64 \times 10^{-34} \text{ J s}$
- $C_v = 4.2 \times 10^3 \text{ J kg}^{-1} \text{ K}^{-1}$
- $L_v = 2.26 \times 10^6 \text{ J kg}^{-1}$

Turn over

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SECTION I

Questions 1- 7 (seven questions)

Directions: Each group of questions below consists of five lettered headings followed by a list of numbered questions. For each numbered question, select the one heading, which is most clearly related to it. Each heading may be used once, more than once, or not at all.

Questions 1 - 4

The following graph figure 1 shows the variation of a dependent variable, Y plotted as ordinate against an independent variable X plotted as abscissa.

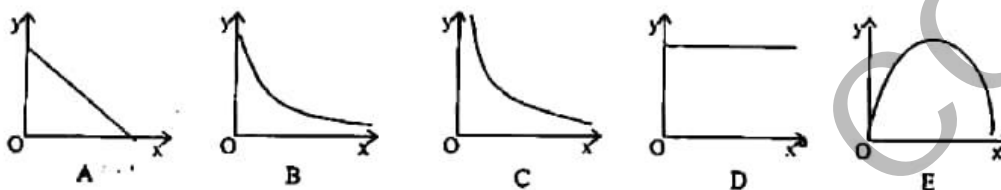


Figure 1

	y	x
1	Total energy of a body undergoing simple harmonic motion	Time
2	Electric field intensity outside a charged metal sphere	Distance from surface of sphere.
3	Resistance of a thermistor	Temperature.
4	Natural logarithm of count rate of γ rays.	Thickness of lead

Questions 5 - 7

Choose from the list A to E below, the particle or physical process which best describes the process or phenomenon that follows:

The following are some words associated to waves with radio systems.

- A Reflection
- B Polarisation
- C Refraction
- D Interference
- E Diffraction

Which of them may account for:

- The change in the intensity of a microwave when a metal grill placed perpendicular to its path is rotated.
- The use of sound to locate an object in an ocean bed.
- The cause of the split of white light into different colours after passing through a medium.

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SECTION II

Questions 8 - 27

(twenty questions)

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

8. A narrow coil of 10 turns and area $4 \times 10^{-2} \text{ m}^2$ is placed in a uniform magnetic field of flux density, $B = 10^{-3} \text{ T}$. So that the flux links the turns normally. The induced emf in the coil if it is removed completely from the field in 0.5 s is

A	B	C	D	E
$8 \times 10^{-3} \text{ V}$	$2 \times 10^{-4} \text{ V}$	$4 \times 10^{-3} \text{ V}$	$4 \times 10^4 \text{ V}$	$2 \times 10^{-3} \text{ V}$

9. The force on a 1 kg mass on the earth's surface is 10 N. If the radius of the earth is 6400 km, the force on a 4 kg mass at a point 2000 km from the center of the earth, (assuming the earth has uniform density) is:

- A) 3.125 N B) 40 N C) 12.5 N
D) 12.8 N E) 3.2 N

10. Figure 2 shows a couple acting on a rod XY of length 0.8 m

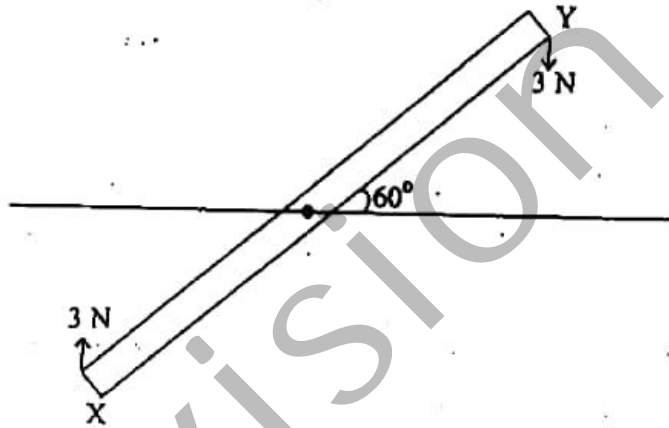


Figure 2

The torque of the couple is

A	B	C	D	E
0.6 N m	$6\sqrt{3} \text{ N m}$	$3\sqrt{3}/2 \text{ N m}$	2.4 N m	1.2 N m

11. Which of the following could cause the surface of insulated conductors to become charged.

A	Microwave emission
B	Photoelectric emission
C	Gamma ray emission
D	Thermal radiation emission
E	X-ray emission

A metal surface is irradiated with radiation of frequency 3.0×10^{14} Hz. If the stopping potential is 0.5 eV, the minimum frequency needed to eject an electron from that metal surface will be.

A	B	C	D	E
0.8×10^{13} Hz	2.0×10^{13} Hz	1.1×10^{14} Hz	1.6×10^{14} Hz	3×10^{13} Hz

Red light of wavelength 7×10^{-7} m, incident normally on a diffraction grating gives a second order maximum at an angle of 82° . The spacing of the diffraction grating is

A	B	C	D	E
$2 \mu\text{m}$	$0.71 \mu\text{m}$	$3.2 \mu\text{m}$	$1.4 \mu\text{m}$	$3 \mu\text{m}$

A car traveling at 20 m s^{-1} collides with a massive wall and stops instantly. A passenger of mass 75 kg, who is wearing a seat belt, is brought to rest in 0.2 s. What force does the seat belt exert on the passenger.

A	B	C	D	E
750 N	6500 N	3750 N	300 N	7500 N

The amount of energy needed to convert 20 kg of pure water at 80°C to steam at atmospheric pressure is

- A) 1680 J B) 49000 J C) 2000 J D) 6888 J E) 68880 J

Which of the following quantities have units of kg s^{-3} ?

- A) Energy B) Power C) Intensity D) Impulse E) Pressure

In which one of the following are all three quantities vectors?

A	Field strength, power, energy
B	Torque, mass, tension.
C	Force, pressure, impulse
D	Field strength, torque, impulse
E	Moment, Power, weight.

Given the system in figure 3 consist of three springs joined end to end, the tension, w, in each of the springs x, y, z respectively is



Figure 3

	x	y	z
A	w	w	w
B	$\frac{w}{3}$	$\frac{w}{3}$	$\frac{w}{3}$
C	w	2w	3w
D	$\frac{w}{3}$	$\frac{2w}{3}$	w
E	w	0	0

Which of the thermometer listed A - E is a standard thermometer

A	Constant volume gas thermometer
B	Mercury in glass thermometer
C	Resistance thermometer
D	Radiation pyrometer
E	Thermocouple

20. A nucleus undergoes a radioactive decay and gives out an alpha particle of mass M_α with kinetic energy K_α and a new nucleus of mass M_n and velocity U_n . Which of these expressions is the kinetic energy of the alpha particle.

- A. $\frac{M_n^2 V_n^2}{2M_n}$ B. $\frac{M_n V_n}{2M_\alpha}$ C. $\frac{M_n V_n^2}{2M_\alpha}$ D. $\frac{M_\alpha V_n}{2M_\alpha^2}$ E. $\frac{M_\alpha V_n^2}{2M_\alpha}$

21. Which of these statements is NOT TRUE about photons or photoelectric effect?

A	Photon energy is proportional to frequency
B	Reactive metals have a lower work function than less reactive metals
C	For a fixed light intensity, the number of electrons ejected increases with an increase in the frequency of the radiation.
D	There is a minimum energy required to eject electrons from a metal surface
E	A photon gives all its energy to one electron only.

22. An a.c has a peak value of V . The rms current in a light bulb of power P is

- A. $\frac{V}{\sqrt{2P}}$ B. $\frac{\sqrt{2}P}{V}$ C. $\frac{P}{\sqrt{2}V}$ D. $\frac{2V}{P}$ E. $\frac{\sqrt{2}V}{P}$

23. Figure 4 shows an electrical circuit.

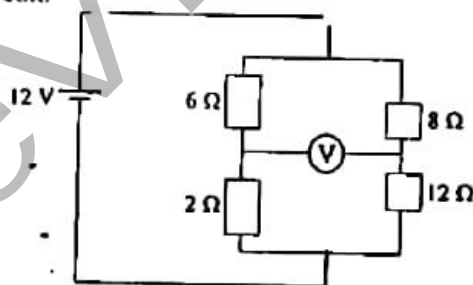


Figure 4

The reading on V is

- A. 7.2 V B. 3 V C. 4.2 V D. 10.2 V E. 22.2 V

24. A radioisotope has a half-life of 6 hours. If there are 10^{20} undecayed atoms, how long will it take for 1.25×10^{19} undecayed atoms to be left.

- A) 3 h B) 4 h C) 8 h D) 12 h E) 18 h

25. A satellite of mass m orbits a planet of mass M with orbital radius R at a speed U and angular frequency W .

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Which of the equations is NOT CORRECT?

- A $v^2 = gR$ B $v^2 = \frac{GM}{R}$ C $v^2 = \frac{GM}{R}$ D $W^2 = \frac{GM}{R^2}$ E $W^2 = \frac{g}{R}$

26. A 4 μF capacitor is charged to a p.d of 100 V. It is then connected to 6 μF capacitor C_2 . The charge on C_2 is
 A) 200 μC B) 400 μC C) 160 μC D) 240 μC E) 800 μC
27. In Is the amplitude of a lightly damped oscillator drops to 95 % of it's original value. The fraction of the energy dissipated is
 A) 90.25 % B) 95 % C) 97.5 % D) 80 % E) 92.5 %

SECTION III

Questions 28 - 39 (Fourteen questions)

Directions: For each group of questions below ONE or MORE of the responses given is/are correct. Decide which of the responses is/are correct. Then choose

- A if 1, 2 and 3 are all correct
 B if 1, 2 only are correct
 C if 2 and 3 only are correct
 D if 1 only is correct
 E if 3 only is correct.

Directions Summarized				
A	B	C	D	E
1, 2, 3 correct	1, 2 only	2, 3 only	1 only	3 only

28. Which of the following may improve long distance optical fibre communication systems?
 (1) Information transmitted is in analogue form.
 (2) Signs are carried by monochromatic light.
 (3) The fibre link has regenerators.
29. A transformer has an efficiency of 80 %. Which of the relationship is / are true ($N_s, N_p, I_s, I_p, V_s, V_p$ have their usual meanings)?
 1) $N_s V_s = N_p V_p$ 2) $V_s = 0.8 \frac{I_p V_p}{I_s}$ 3) $N_s = \frac{8N_p I_p}{10I_s}$
30. Which of the following can be explained by the wave-particle duality?
 (1) Electron diffraction patterns in crystals.
 (2) Photoelectric effect
 (3) Deflection of an electron beam by an electric field
31. Which of the following statement(s) is/are true? 31

- (1) Biomass, sun, and nuclear power reactor are not primary sources of energy.
- (2) Biomass, hydroelectric plant and wind are secondary sources of energy.
- (3) Biomass, petrol and sun are primary sources of energy.

32. Which of the following statement(s) is/are true?

- (1) Hydroelectric plant, wind, and nuclear power reactor can produce electric energy by rotating turbines
- (2) Biomass, petrol and sun can produce mechanical energy by burning fuel.
- (3) Biomass, petrol and nuclear power reactor produce mechanical energy by chemical reaction.

33. In Figure 5 R is a light dependent resistor.

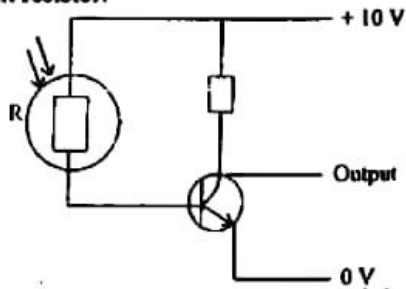


Figure 5.

When light intensity increases, which of the following statement(s) describes what happens in the circuit?

- (1) The collector current increases
- (2) The base current increases
- (3) The output voltage falls.

34. Which of the following statements is/are correct?

- (1) The capacitance of a given capacitor depends on the charge on its plates.
- (2) Filling the space between the plates of a parallel plate capacitor with a dielectric material decreases the capacitance of the capacitor.
- (3) Increasing the distance between the plates of a charged parallel plate capacitor does not affect the charge on the plates provided it is not connected to a battery.

35. Which of the following statements is/are true about the laser?

- (1) There is population inversion for its production.
- (2) LASERs are used to perform keyhole operations.
- (3) It is an acronym for long amplification by stimulated emission of radiation.

36. X - rays are produced by:

- (1) Acceleration of fast moving electrons
- (2) The droppings of electrons from outer shells to inner shells.
- (3) Decaying of an unstable nucleus.

Figure 6 shows a circuit, which can be used to measure the emf of a cell, P using a potentiometer.

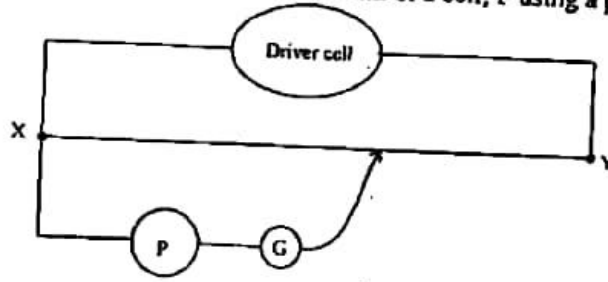


Figure 6.

It is noticed that a galvanometer G deflects in the same direction when the slide is pressed at X and Y. This can be due to the fact that

- (1) The wire X Y is not uniform
- (2) The emf of P is larger than that of the driver cell.
- (3) The positive terminal of the driver cell is connected to the negative terminal of P.

38. Figure 7 shows a graph indicating the maxwellian distribution of speeds of gas molecules at two different temperatures T_1 and T_2 .

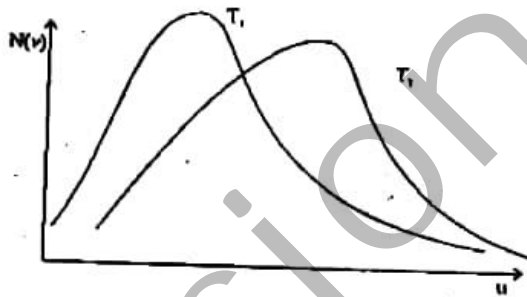


Figure 7

Which of the following statements is/are correct?

- (1) $T_1 > T_2$.
- (2) The rms speed is the velocity at the peak of the curve.
- (3) The area under both curves is the same.

39. Figure 8 shows the path of an electron in an electric field E created by a PD, V. m_e and e are mass and charge of the electron.

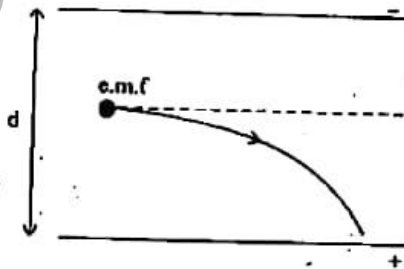


Figure 8.

The vertical displacement, Y of the electron from its original height, neglecting gravitational force, at any time, T is

1. $y = \frac{2Ect^2}{8m_e}$
2. $y = \frac{eE(2t^2)}{8m_e}$
3. $y = \frac{Vc}{2m_e d} t$

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SECTION IV

Questions 40 - 45 Six Questions.

Directions: The questions in this section are grouped together. Each question in a group relates to a common theme. Select the best answer for each question.

Questions 40 - 42

Figure 9 shows an electric circuit set up which can be approximately used to measure the emf of a thermoelectric thermometer.

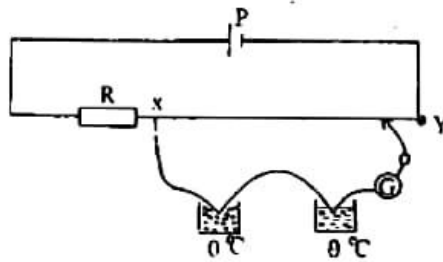


Figure 9.

40. The resistor, R , is connected in series to the uniform wire XY to
- Protect the galvanometer.
 - Increases the terminal pd of the cell P
 - Produce a measurable balance length
 - Reduce the current drawn from the driver cell P .
 - Maintain a constant current in the circuit.
-
41. Given that the driver cell has a steady emf V_p , the resistance of the wire, XY , R_{xy} , and that the PD across XY is V_{xy} , then the resistance R is.
- $\left(\frac{V_p - V_{xy}}{V_{xy}}\right) R_{xy}$
 - $\frac{R_{xy} V_p}{V_{xy}}$
 - $\left(\frac{V_p + V_{xy}}{V_p}\right) R_{xy}$
 - $\frac{V_x}{V_p} R_{xy}$
 - $\left(\frac{V_p - V_{xy}}{V_p}\right) R_{xy}$
-
42. If xy is l and the balance length is l_0 , then the emf of the thermoelectric thermometer is
- $\frac{V_{xy} l}{l_0}$
 - $\frac{V_p l}{l_0}$
 - $\frac{V_p l_0}{l}$
 - $(V_p - V_{xy})$
 - $\frac{(V_p - V_{xy}) l}{l_0}$

Questions 43 - 45

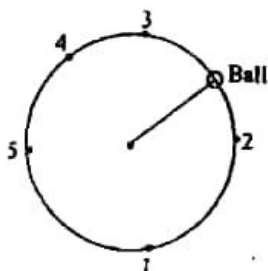


Figure 10

Figure 10 shows a ball of mass 0.5 kg tied to a string 0.5m long and whirled in a vertical circle at a constant speed, v .

43. When the string breaks the ball will
- A. Continue to describe a circular path
 - B. Describe a parabola
 - C. Fall vertically downwards.
 - D. Move downwards with an increasingly horizontal speed.
 - E. Move tangential to the circular path.
-
44. At which of the points in figure 10 is the tension likely to be maximum.
- A) 1 B) 2 C) 3 D) 4 E) 5
-
45. The tension at point 3 in newtons is
- A) 105 B) 100 C) 95 D) 120 E) 110

If $v = 10 \text{ m s}^{-1}$

THE END
GO BACK AND CHECK YOUR WORK.

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