

# GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

0780 PHYSICS 1

JUNE 2023

ADVANCED LEVEL

Centre No.	
Centre Name	
Candidate Identification No	
Candidate Name	

Mobile phones are NOT allowed in the examination room.

## MULTIPLE CHOICE QUESTION PAPER

One and half hours (1½ 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 PHYSICS1"
4. Fill in the information required in the spaces above.
5. Fill the information required in the spaces provided on the answer sheet using your HB pencil:

**Candidate Name, Exam Session, Subject Code and Candidate Identification 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 instruction.

How to answer the questions in this examination

6. Answer ALL the 50 questions in this Examination. All questions carry equal marks.

7. Each question has FOUR suggested answers: A, B, C and D. Decide on which answer is correct. 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]

8. 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.
9. 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.
10. Do all rough work in this booklet, using the blank spaces in the question booklet.
11. 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.
12. The use of calculator and Formulae book are allowed.

Turn Over

## SECTION I (Thirty five questions)

## Questions: 1- 35

Directions: 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 of the following consists of only scalar quantities?
- Electric field intensity, mass, and volume
  - Momentum, acceleration and displacement
  - Charge, work, temperature
  - Speed, electromagnetic force, distance

2. Rutherford's alpha-particle scattering experiments reveal strongly that an atom
- Has a nucleus of very small size and very high density.
  - has an evenly distributed mass
  - has a nucleus of relatively large size and of low density
  - is a positive mass with electrons spreading all over inside to make it neutral

3. A ball bearing was made to fall freely through a viscous liquid in a very long tube. State which of the following statements is true?
- The acceleration of the ball remains constant throughout.
  - The net upward force remains constant.
  - The net downward force remains constant.
  - The velocity of the ball remains constant throughout

4. Which of the force diagram(s) show(s) an object moving to the right with a constant velocity?

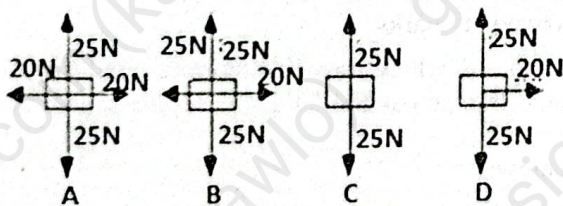


Figure 1

5. According to Newton's third law, every force is accompanied by an equal and opposite reaction force. The reason why these forces do not cancel each other is?
- the action force acts for a longer time period
  - the two forces are not always in the same direction
  - one of the two forces is greater than the other
  - the two forces act upon different objects; only forces on the same object can balance each other.

6. A student applies a force of 26 N, parallel to a plane surface inclined at  $30^\circ$  to the horizontal in order to pull an object of weight 40 N along the plane at constant speed. The frictional force between the plane and the object is?

- 6 N
- 24 N
- 26 N
- 30 N

7. Figure 2 shows a transverse wave traveling through a medium to the right. See diagram below. The particles of the medium are vibrating.

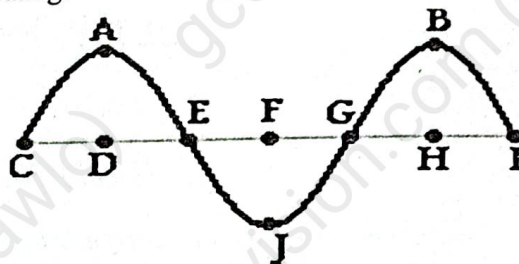


Figure 2

- perpendicular to the line joining AD.
  - parallel to the line joining AD.
  - along the line joining CI.
  - at various angles to the line CI.
8. Which of the following statements is true concerning a ball thrown vertically upwards and caught on its return by the thrower?
- the ball takes a shorter time to go up than to come down.
  - the speed is constant throughout the flight.
  - the velocity is constant throughout the flight
  - the acceleration is constant throughout the flight.
9. A power cable carrying a current of 300 A is placed normally in a uniform B-field of flux density  $10^{-5}$  T. If the cable experiences a force of 1.2 N, then the length of the cable is
- 40 m
  - 400 m
  - 4000 m
  - 1200 m

10. Which thermometer is best for measuring rapidly changing temperatures?
- Liquid-in-glass
  - thermocouple
  - constant volume gas thermometer.
  - platinum resistance

11. The amount of energy needed to completely convert 1 kg of pure water at  $60^\circ\text{C}$  to steam at  $100^\circ\text{C}$  and at atmospheric pressure is
- $1.68 \times 10^5 \text{ J}$
  - $2.26 \times 10^6 \text{ J}$
  - $2.09 \times 10^6 \text{ J}$
  - $2.43 \times 10^6 \text{ J}$

12.



Figure 3

Figure 3 shows three charges of the same sign and magnitude placed at points R, S and T. The point at which the resultant electric field strength is zero is:

- Between R and S
  - Midway between S and T
  - Between S and T but closer to T
  - Lies along the line joining R and T but behind T or B
13. A light ray which is incident on an air – water boundary at an angle of incidence different from zero. Which of the following statements is correct?
- The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant.
  - The wavelength of the light increases as it moves from air to water.
  - The speed of light increases as it moves from air to water.
  - The frequency of light increases as it moves from air to water.
14. The force on a 1 kg mass on the surface of the earth is 10 N. If the radius of the earth is 6400 km, the force on 91 kg mass at a point 4000 km from the centre of the earth (assume the earth has uniform density) is
- 1.6 N
  - 67.6 N
  - 16.0 N
  - 6.3 N
15. An a.c signal of 400 Hz is applied to the y-plate of a CRO whose time-base is set at  $2 \text{ ms cm}^{-1}$ . The number of cycles on the 60 cm wide screen of the CRO is
- 12
  - 120
  - 48
  - 60

16. A train of mass  $m$  is travelling with a speed  $v$ . If the mass of the train is tripled by loading it, and if the velocity is halved, then how will the kinetic energy of the train vary?
- Decrease by a factor of  $3/4$
  - Increase by a factor of  $3/2$
  - Remains the same
  - Decrease by a factor of  $1/3$

17. Figure 4 shows an electric circuit. The reading on V is

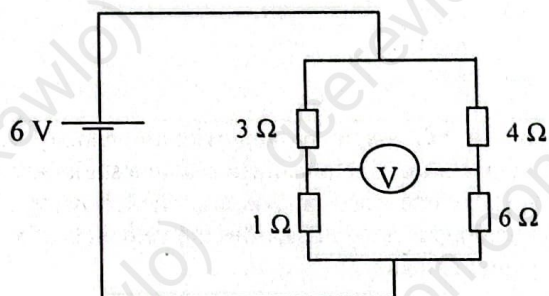


Figure 4

- 1.5 V
  - 2.1 V
  - 3.6 V
  - 5.1 V
18. A vehicle is climbing a hill at constant velocity. Which of the following statements about the vehicle is true?
- The rate of change of the vehicle's momentum is zero.
  - The net force acting on the vehicle is pointing upwards.
  - The frictional force between the vehicle and the surface is zero.
  - The force produced by the vehicle's engine is equal to the frictional force between the tyres and the road.
19. A stretched string is made to vibrate such that its third harmonic frequency is 2000 Hz. Its fundamental frequency is
- 2000 Hz
  - 1000 Hz
  - 667 Hz
  - 500 Hz

Turn Over

20. A pure inductor has an inductance of  $5 \times 10^{-2}$  H. Calculate the rate of change of current through it that would produce an induced emf of 100 V?

A  $500 \text{ As}^{-1}$   
 B  $2000 \text{ As}^{-1}$   
 C  $200 \text{ As}^{-1}$   
 D  $5 \text{ As}^{-1}$

21. The pressure  $P$ , volume  $V$  and temperature of a real gas are related by the equation

$$\left(P + \frac{a}{V^2}\right)(V - b) = RT, \text{ the unit of the constant, "a" is}$$

A  $\text{kgm}^{-1} \text{ s}^{-2}$   
 B  $\text{kgm}^5 \text{ s}^{-2}$   
 C  $\text{kgm}^{-2} \text{ s}^{-2}$   
 D  $\text{kgm}^{-5} \text{ s}^{-2}$

22. A body,  $x$ , of mass,  $m$ , moving with a velocity,  $v$ , makes an elastic head on collision with a stationary body,  $y$ , of same mass,  $m$ . Which of the following combinations correctly describes the velocities of  $x$  and  $y$  after collision.

	$x$	$y$
A	$v$	0
B	0	$v$
C	$v/2$	$v/2$
D	0	$v/2$

23. The half life of a radioactive isotope,  $X$ , is 10 hours. If the original activity is 20 Bq, its activity in Bq, after 30 hours will be

A 10  
 B 5  
 C 2.5  
 D 1.25

24. A battery of emf 10 V and internal resistance 3 ohms is connected to a resistor. If the current in the circuit is 0.5 A, what is the resistance of the resistor and the p.d. across it when the circuit is closed?

A 17 ohms and 8.5 V  
 B 20 ohms and 10V  
 C 8.5 ohms and 9V  
 D 8.5 ohms and 9V

25. When a forward bias p.d is applied to a p-n junction, it;

A lowers the barrier potential  
 B raises the barrier potential  
 C reduces the majority carrier current  
 D increase number of carriers crossing the junction

26. A silver wire has a resistance of 2.1 ohms at  $27.5^\circ\text{C}$  and a resistance of 2.7 ohms at  $100^\circ\text{C}$ . The temperature coefficient of the silver wire is?

A  $0.02^\circ\text{C}^{-1}$   
 B  $0.05^\circ\text{C}^{-1}$   
 C  $0.005^\circ\text{C}^{-1}$   
 D  $0.009^\circ\text{C}^{-1}$

27. A 10 kW drilling machine is used to drill a hole in an aluminium block of mass 8.0 kg. How much is the rise in temperature of the block in 2.5 minutes, given that the specific heat capacity of aluminum is  $910 \text{ J kg}^{-1} \text{ K}^{-1}$

A  $103^\circ\text{C}$   
 B  $288^\circ\text{C}$   
 C  $1.7^\circ\text{C}$   
 D  $206^\circ\text{C}$

28. Figure 5 shows a potentiometer the test cell of emf 1.5 V is balanced at the point C.

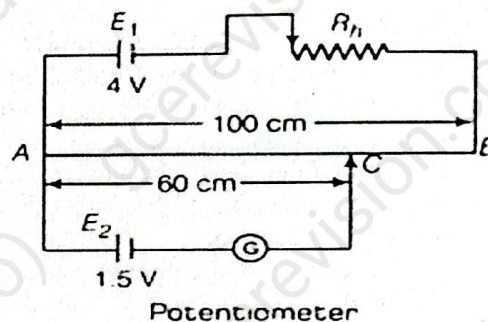


Figure 5

What is the p.d between the ends A and B of the potentiometer?

A 1.5 V  
 B 3.75 V  
 C 2.5 V  
 D 4 V

29. Which of the following quantities has units?

A relative refractive index  
 B relative velocity  
 C relative permeability  
 D relative permittivity

30.

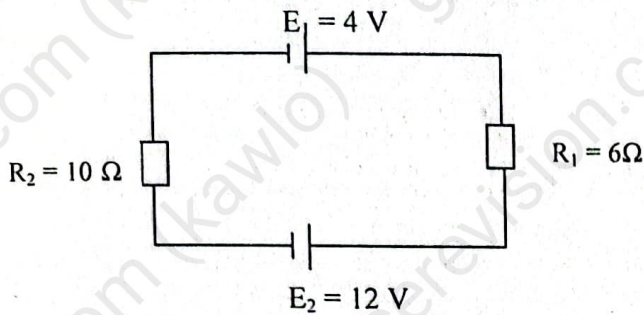


Figure 6

Figure 6 shows an electric circuit which contains two resistors and two sources of emf. The internal resistances of the batteries are negligible. Which of the following is correct?

- A The power dissipated in  $R_1$  is 1.5 W
- B The pd across  $R_2$  is 8 V
- C The current in the circuit is 1.0 A
- D The power dissipated in  $R_2$  is 6 W

31. A simple harmonic oscillator has a period of 0.01 s and amplitude of 0.2 m. The maximum velocity in  $\text{ms}^{-1}$  of the oscillation is

- A 126
- B 62.8
- C 25
- D 20

32.

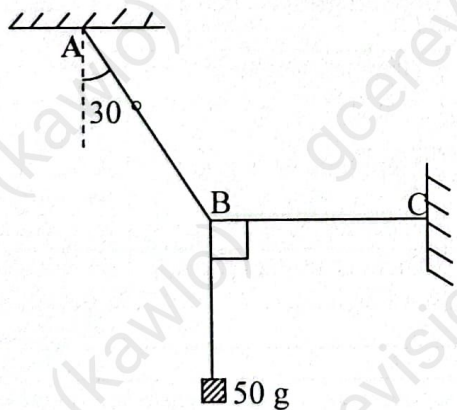


Figure 7

A mass of 50 g is attached to a spring which is fixed at supports, A and C as shown in figure 7. The tension in AB is

- A 0.98 N
- B 0.25 N
- C 0.42 N
- D 0.57 N

33.

Figure 8 shows a straight wire passing through a piece of cardboard. The wire carries a current  $I$ .

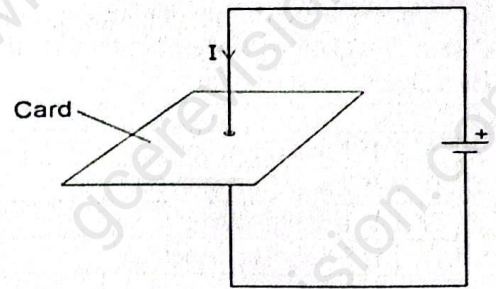


Figure 8

Which of the following is correct about the direction of the magnetic field formed?

- A It is clockwise as given by Lenz's law
- B It is anti-clockwise according to Fleming's left-hand rule
- C It is anti-clockwise according to Fleming's right-hand rule
- D It is clockwise according to Maxwell's corkscrews rule

34. The table below shows four energy levels of the hydrogen atom with their associated energies.

N	Energy/ $10^{-19}$ J
1	-21.8
2	-5.3
3	-2.4
4	-1.3

The shortest wavelength line seen in the emission spectrum of hydrogen can result from a transition between which of these energy levels?

- A  $n = 4$  to  $n = 3$
- B  $n = 3$  to  $n = 1$
- C  $n = 4$  to  $n = 1$
- D  $n = 2$  to  $n = 1$

35.

The pressure of a fixed mass of an ideal gas is doubled by heating at constant volume. Which of the following is true about the gas?

- A The density of the gas doubles.
- B The number of molecules per unit volume doubles.
- C The mean square speed of the molecules doubles.
- D The root mean square speed of the molecules doubles

Turn Over

## 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. Then 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

6. An object is released from an aeroplane travelling horizontally at a height of 200 m above the ground. Which of the following statements is/are correct?
- The initial velocity of the object relative to the plane is zero
  - The minimum time taken before the object hits the ground is 6.4 s
  - The horizontal velocity of the object increases with time

7. Which of the following observations of the photoelectric effect can be explained using the classical wave theory?
- No time lapse between illumination and emission of electrons
  - Emission only occurs when the frequency of the light is above a certain threshold.
  - Number of emitted electrons per unit time is directly proportional to the light intensity

8. In the S.I system of units, the unit of current, the ampere, is defined in terms of the force between two parallel conductors placed 1 m apart in a vacuum. Which of the following statements is/are true?
- The magnitude of the force doubles if the current through each wire is doubled.
  - When a material of higher permeability is introduced into the space between the wires, the force increases slightly
  - The force acting per unit length of each wire is  $2\pi \times 10^{-7} \text{ Nm}^{-1}$

39.



Figure 9

Two waves of the same wavelength,  $\lambda$ , constant phase difference and same amplitude are emitted from X and Y, as shown in figure 9 above. At P there is a maximum; at Q a minimum and at R a maximum disturbance. Such an observation may be obtained if

- $XP = YP$
- $YQ - XQ = \lambda/2$
- $YR - XP = \lambda/2$

40. Which of the following types of damping would be most suitable for a moving coil galvanometer?
- critical damping
  - heavy damping
  - light damping

41. Which pair(s) of the following statements is/are true about progressive and stationary waves.

	For progressive waves	For stationary waves
1	There is no net transfer of energy	There is net transfer of energy
2	Amplitude is constant.	Adjacent points have different Amplitudes
3	There is gradual phase variation	Points between adjacent nodes are in phase

42. Convex and concave lenses are image-forming devices. Which of these statements is/are correct about lenses?
- For an object placed 20 cm from a convex lens of focal length 4cm, the image magnification is 0.25
  - For a convex lens, if the image is larger than the erect object, then the object distance is less than the focal length.
  - If an object is placed between a concave lens and the principal focus then the image formed is larger than the object.

43. If a metal wire of cross-sectional area  $A$ , has  $n$  free electrons per unit volume each having a charge  $e$  and moving with a drift velocity  $v$ , then:
- 1 The total charge in the wire is  $nev$
  - 2 The current per unit area is  $nev$
  - 3 The rate of flow of charge is  $nevA$

44. Which of the following statements is/are true for a sinusoidal signal of peak voltage  $V_0$  and Peak current  $I_0$  flowing through a capacitor?
- 1 Average power dissipated through a resistive load is constant.
  - 2 Current always leads voltage by  $\pi/2$
  - 3 The average power dissipated in a resistive load is  $P_{av} = \frac{V_0 I_0}{\sqrt{2}}$

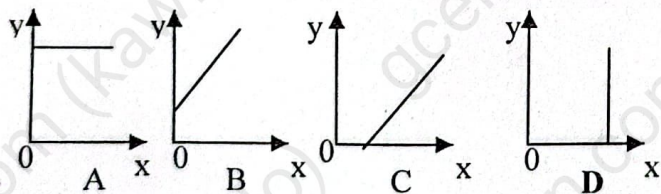
45. If you deep you hand in alcohol and remove, it feels cooler than the other fingers because;
- 1 Alcohol is a good conductor of heat
  - 2 the alcohol is at a lower temperature than the atmospheric temperature
  - 3 the alcohol molecules absorbs energy from the finger as they evaporate

**Section III (five questions)**  
**Questions 46-50**

Directions: 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  $y$

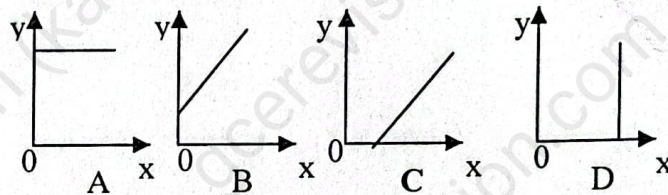
46.

$y$	$x$
Average kinetic energy of molecules of a substance undergoing a change of state	Temperature of substance



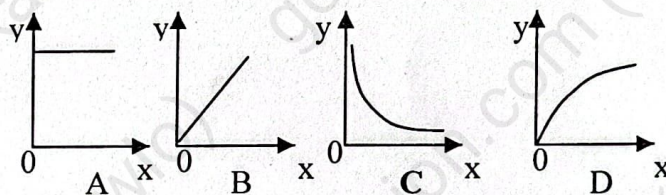
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$y$	$x$
Maximum kinetic energy of a photoelectron	Frequency of incident radiation



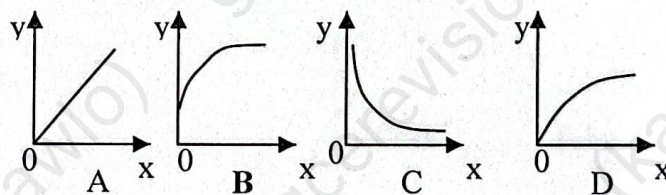
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$y$	$x$
Potential energy of a planet orbiting the sun	Distance from the sun



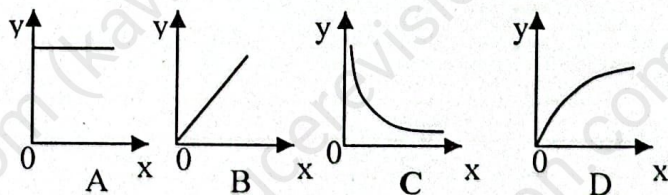
49.

The magnitude of velocity of a box falling through air from an aeroplane in the sky.	The time of fall
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50.

$y$	$x$
The reactance of a capacitor	Frequency of a.c



**STOP**  
**GO BACK AND CHECK YOUR WORK**