

PHYSICS
(312)

Time : 3 Hours]

[Maximum Marks : 80

- Note :**
- (i) This question paper consists of 43 questions in all.
 - (ii) All questions are compulsory.
 - (iii) Marks are given against each question.
 - (iv) Use log tables if necessary.
 - (v) **Section A** consists of
 - (a) Question Nos. 1 to 16 - Multiple choice type questions (MCQs) carrying 1 mark each. Select and write the most appropriate option out of the four options given in each of these questions.
 - (b) Question Nos. 17 to 28 - Objective type questions carrying 2 marks each. Attempt these questions as per the instructions given for each.
 - (vi) **Section B** consists of
 - (a) Question Nos. 29 to 37 - Very short answer type questions carrying 2 marks each and to be answered in the range of 30 to 50 words.
 - (b) Question Nos. 38 to 41 - Short answer type questions carrying 3 marks each and to be answered in the range of 50 to 80 words.
 - (c) Question Nos. 42 and 43 - Long answer type questions carrying 5 marks each and to be answered in the range of 80 to 120 words.

NOTE :

- (1) Answers of all questions are to be given in the Answer-Book given to you.
- (2) 15 minutes time has been allotted to read this Question Paper. The Question Paper will be distributed at 2.15 p.m. From 2.15 p.m. to 2.30 p.m., the students will read the Question Paper only and will not write any answer on the Answer-Book during this period.

Section - A

Note : Q.No. 1 to 16 multiple choice type questions (MCQs) carrying 1 mark each.

1. First law of motion is also known as : 1
(A) Law of force (B) Law of inertia
(C) Law of momentum (D) Law of action and reaction

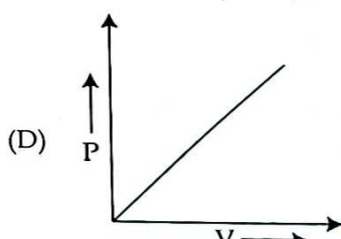
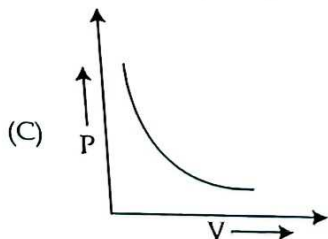
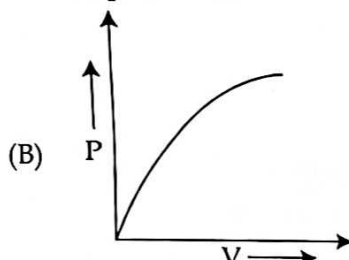
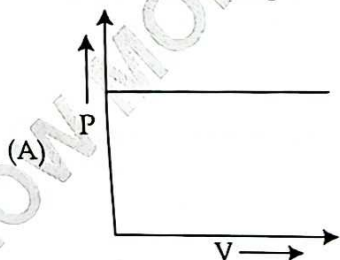
2. When a body is thrown upward work done by the gravity is : 1
(A) negative (B) zero
(C) positive (D) insufficient information

3. Which one of the following is a conservative force ? 1
(A) frictional force (B) air resistance
(C) gravitation (D) tension in a cord

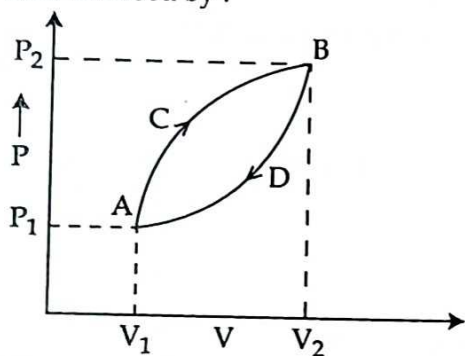
4. During dust storm sometimes, the roof of some houses are blown off because : 1
(A) Storm creates high pressure over and under the roof.
(B) Storm creates high pressure over the roof and low pressure under the roof.
(C) Storm creates low pressure over and under the roof.
(D) Storm creates low pressure over the roof and high pressure under the roof.

5. Kerosene oil rises up in a wick of a lantern because of : 1
(A) air pushes the oil through the wick (B) viscosity
(C) buoyant force of oil (D) surface Tension

6. Which of the following P-V diagram best represent an isothermal process ? 1



7. A thermodynamic system is taken from state A to state B along path ACB and is brought back to A along path BDA. Net work done during one complete cycle will be given by the area enclosed by : 1



- (A) $P_1P_2BDAP_1$ (B) $ACBV_2V_1A$
 (C) $ACBDA$ (D) $ADBV_2V_1A$

8. Which of the following phenomenon does not arise due to superposition of two waves ? 1
- (A) interference (B) reflection
 (C) beats (D) stationary waves

9. X-rays are : 1
- (A) emitted by hot bodies
 (B) found mixed with ultra violet light
 (C) emitted by heavy nuclei
 (D) produced when fast moving electrons, strike a heavy metals

10. In the third normal mode of vibrations of a closed (organ) pipe, the number of nodes and antinodes respectively are : 1
- (A) (4, 4) (B) (3, 3) (C) (3, 4) (D) (4, 3)

11. Speed of sound wave in air : 1
- (A) is independent of temperature
 (B) increases with increase in pressure
 (C) increases with increase in humidity
 (D) decreases with increase in humidity

12. Two identical charges q_1 and q_2 placed 3.0 m apart experience a mutual force of 16×10^{-15} N. If the separation between two charges is changed to 6.0 m the magnitude of force becomes : 1
- (A) 4×10^{-15} N (B) 2×10^{-14} N (C) 64×10^{-15} N (D) 8×10^{-15} N

13. A magnetic field 2.2×10^{-3} T is set up inside a 10 cm long solenoid when carries a current of 3.5 A through it. The number of turns is the solenoid are : 1
 (A) 20 (B) 30 (C) 40 (D) 50
14. Two copper wires A and B have same length. The diameter of A is twice that of B. The ratio of their resistance will be : 1
 (A) $R_B = 2R_A$ (B) $R_B = R_A$ (C) $R_B = 4R_A$ (D) $R_B = \frac{R_A}{2}$
15. The nucleus of an atom is surrounded by : 1
 (A) electrons (B) protons (C) neutrons (D) α - Particles
16. The potential carrier at the p-n junction is due to the charges on the either side of the junction. These charges are : 1
 (A) majority carriers (B) minority carriers
 (C) fixed donors and acceptor ions (D) donor ions only

Note : Q.No. 17 to 28 are the objective types questions of 2 mark each.

17. Read the passage given below and answer the questions (a) and (b) that follows it : 1x2=2

According to Newton's Second law of motion $F = ma$ where F is the force required to produce an acceleration a in an object of mass m . For a given mass $F \propto a$. From the equation $F = ma$ it is clear that if $F = 0$, then $a = 0$. If no net external force acts upon the object, then acceleration of the body is zero. i.e. in the absence of external force ($F = 0$) the body is either at rest or is moving with uniform velocity along a straight line.

- (a) When the force applied on an object is doubled then its acceleration :
 (A) remains same (B) becomes double
 (C) becomes half (D) becomes four times
- (b) When a constant net external force acts on an object which of the following may not change ?
 (A) acceleration (B) velocity
 (C) position (D) speed

18. Complete the sentence using the options given in bracket below 1x2=2
 (Static friction, negative, positive, kinetic friction)
 (a) Maximum force of _____ between a pair of surfaces is independent of the area of contact.
 (b) Work done by the spring force is _____.

19. Read the passage given below and answer the questions (a) and (b) that follows it :

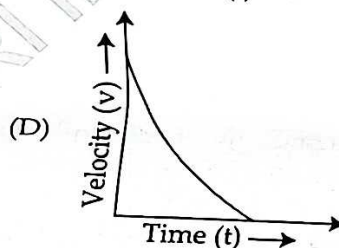
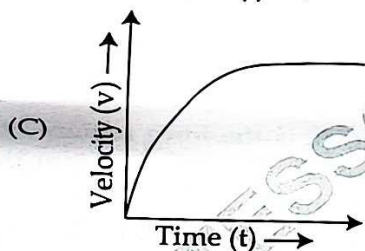
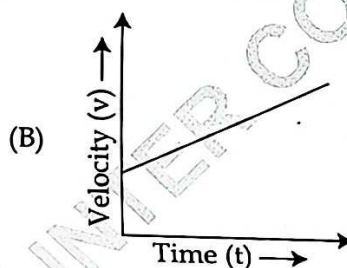
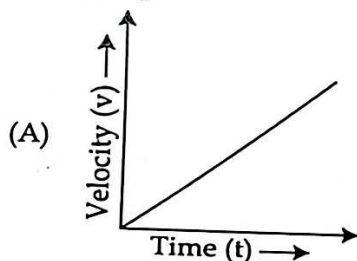
1x2=2

When a small spherical body falls freely through a viscous fluid three forces act upon it - weight of the body acting vertically downwards, buoyant force and viscous drag (F) which act in the direction opposite to the direction of motion of the body. According to Stoke's law $F \propto v$ viscous drag F increases with increase in velocity v of the body. A stage reaches when the true weight of the body becomes just equal to the sum of the upward buoyant force and viscous drag now there is no net force acts upon the body and body starts falling with a constant maximum velocity. It is called terminal velocity

$$v = \frac{2r^2 (\rho - \sigma)}{9\eta} g$$

where symbols have their usual meanings.

- (a) Which of the following curves shows the variation of the velocity of a small solid spherical body released from rest falling freely under the effect of gravity in a viscous liquid ?



- (b) The radius of a spherical body falling freely in a viscous liquid is doubled keeping density and viscosity of the liquid constant. The terminal velocity of the body :
- (A) remains same (B) is halved
(C) is doubled (D) is quadrupled

20. Match Column-I with the correct option of Column-II :

1x2=2

	Column-I		Column-II
(a)	Swing of a cricket ball	(i)	Archimedes principle
(b)	Hydraulic lift	(ii)	Stoke's law
		(iii)	Bernoulli's principle
		(iv)	Pascal's law

21. Fill in the blanks :

1x2=2

- (a) pressure and temperature diagram showing three different states of Matter is called a _____.
- (b) In thermodynamics negative work (-w) done indicates that work is done _____ the system.

22. Write 'True' for correct statement and 'False' for incorrect statement :

2

- (a) An adiabatic curve is steeper than isothermal Curve.
- (b) First law of thermodynamics tells about the direction of the process.

23. Write 'True' for correct statement and 'False' for incorrect statement :

2

- (a) Sound wave can propagate in vacuum.
- (b) For small temperature variations speed of sound wave in air increases with every degree Celsius rise in temperature.

24. Match Column-I with the correct option of Column-II :

2

	Column-I		Column-II
(a)	Resistance	(i)	Motion of electrons in a closed path
(b)	Current	(ii)	Motion of electrons in a conductor without any collision
		(iii)	Random motion of electrons
		(iv)	The collision of electrons while moving through the conductor

25. Write 'True' for a correct statement and 'False' for incorrect statement :

1x2=2

- (a) To convert a galvanometer into ammeter a high resistance wire is connected in parallel to it.
- (b) A current carrying solenoid behaves as a bar magnet.

26. Fill in the blanks

1x2=2

- (i) The bending of light around the edges of an obstacle is known as _____.
- (ii) According to Huygen's theory, light propagates in the form of _____.

27. Match Column-I with the correct option of Column-II

1x2=2

	Column-I		Column-II
(a)	Interference of light	(i)	Dual nature of light
(b)	Polarisation of light	(ii)	Transverse nature of light
		(iii)	Coherent sources
		(iv)	Size of slit $\approx \lambda$

28. Fill in the blanks :

1x2

- (a) A p-n junction can be used as a _____ to convert alternating current into direct current.
- (b) A Zener diode _____ the output of a power supply.

40

Section - B

Note : For Q.No. 29 to 37 an internal choice has been provided in some of these questions. You have to attempt only one of the given choices in such questions.

- ✓ 29. Find the average recoil force on a machine gun that is firing 150 bullets per minute, each with a speed of 900 ms^{-1} . Mass of each bullet is 12 g. 2

OR

A 10 kg block is resting on a horizontal surface for which $\mu_k = 0.1$. Calculate the acceleration of the block if it is pulled by a force of 15N acting on it in the horizontal direction.

- ✓ 30. Show that total mechanical energy for a mass oscillating on a spring is conserved. 2

OR

What is meant by zero work? state the conditions under which a force does no work. Give any one example for it.

- ✓ 31. Draw a circuit diagram to compare the emf of two cells with the help of potentiometer also give necessary mathematical steps to compare their emfs. 2

OR

Derive an expression for temperature coefficient of resistivity, plot a curve showing variation of resistivity of a semiconductor with temperature.

- ✓ 32. A body is suspended from a vertical spring. What shall be the effect on the position of the body when a current is passed through the spring. Give reason for your answer. 2

- ✓ 33. Calculate the refractive index of an equilateral prism if the angle of minimum deviation is equal to the angle of prism. 2

OR

What would happen to the interference pattern obtained in the young's double slit experiment when.

- (a) The experiment is performed in water instead of air ;
- (b) One of the slit is closed ;
- (c) The separation between slits and screen is increased ;
- (d) The separation between the two slits is gradually increased.

- ✓ 34. The half life of a radioactive substance is 5 years. In how much time 10 g of this substance will reduce to 2.5 g? 2

- ✓ 35. State any two laws of photoelectric emission : 2

- ✓ 36. Why the peak inverse voltage of a p-n junction diode in half wave rectifier with filter circuit is double of that without the capacitor? 2

- ✓ 37. Draw the input and output characteristics for a common emitter configuration of a p-n-p transistor. Also draw a circuit diagram for it. 2

38. Two balls A and B having masses m_1 and m_2 collide head on elastically. Derive the expression for the final velocities of the two balls after collision. 3

39. What do you mean by the dispersive power of the material of a prism? The deviation produced for red, yellow and violet colours by a crown glass are 2.84° , 3.28° , and 3.72° respectively. Calculate the dispersive power of the glass material. 3

OR

State Brewster's law. The polarising angle for a medium is 60° . Calculate the refractive index of the medium.

40. Show that the de-Broglie wavelength associated with electrons accelerated through a potential V is given by the relation $\lambda = \frac{12.3}{\sqrt{V}} \text{ \AA}$. 3

41. What is a signal? Differentiate between a continuous signal and a digital signal. Draw diagrams for these signals. 3

OR

Draw the Zener regulated voltage supply circuit. Explain How the output voltage has been stabilised against the variation in the current and the input voltage.

42. Define constructive interference and destructive interference. Derive an expression for intensity of fringes in the phenomenon of interference arise due to superposition of two coherent light waves. Describe the causes for maximum intensity and minimum intensity. 5

OR

Establish a relation between the angle of deviation (δ), angle of prism (A) and refractive index (μ) of the material of the prism and show $\mu_v > \mu_r$

43. A series LCR circuit with $R = 580 \Omega$, $L = 31 \text{ mH}$ and $C = 47 \text{ nF}$ is driven by an ac source. The amplitude and angular frequency of the source are 65 V and 33 K rad/s respectively calculate (a) impedance of the circuit (b) the phase difference between the voltage across the sources and the current. Give the nature of the circuit. 5

OR

An air cored solenoid has a length of 25 cm and diameter of 2.5 cm and contains 1000 closely wound turns. The resistance of the coil is measured to be 1.00Ω compare the inductive reactance at 100 Hz with the resistance of the coil. Will the current lead or lag behind the voltage in the solenoid across ac source.

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