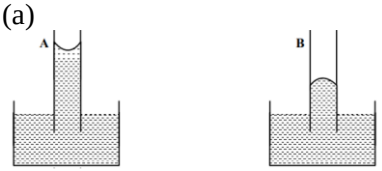
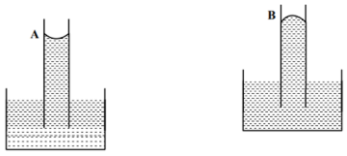
ARYAN INSTITUTE

CLASS-11TH
SUBJECT-PHYSICS
SAMPLE PAPER -05

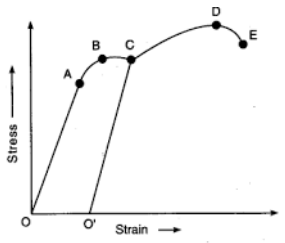
Time Allowed :3 Hr **Max. Marks :70**

	General Instructions: **1.** All questions are compulsory. There are 37 questions in all. **2.** This question paper has four sections: Section A, Section B, Section C and Section D. **3.** Section **A contains** twenty questions of one mark each, Section **B contains** seven questions of two marks each, Section **C contains** seven questions of three marks each, and Section **D contains** three questions of five marks each. **4.** There is no overall choice. However, internal choices have been provided in two questions of one mark each, two questions of two marks, one question of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions. **5.** Use of Calculation is not permitted. However, you may use log tables if necessary. **6.** You may use the following values of physical constants wherever necessary: Boltzmann's constant $K = 1.381 \times 10^{-23}\ J\ K^{-1}$ Avogadro's number $N_A = 6.022 \times 10^{23}\ /\ mol$ Radius of Earth $= 6400\ km$ 1 atmospheric pressure $= 1.013 \times 10^5\ Pa$ $g = 9.8\ m/s^2$ $R = 8.3\ J\ mol^{-1}\ K^{-1}$ **SECTION-A**	
Q1.	The length and breadth of a rectangular sheet are 16.2 cm and 10.1 cm respectively. The area of the sheet in appropriate significant figures and error is (a) 164 ± 3 cm^2 (b) 163.62 ± 2.6 cm^2 (c) 163.6 ± 2.6 cm^2 (d) 163.62 ± 3 cm^2	**1**
Q2.	A vehicle travels half the distance L with speed v_1 and half with speed v_2. Its average speed is (a) $\frac{v_1+v_2}{2}$ (b) $\frac{2v_1+v_2}{v_1+v_2}$ (c) $\frac{2v_1v_2}{v_1+v_2}$ (d) $\frac{L(v_1+v_2)}{v_1v_2}$	**1**
Q3.	A player caught a cricket ball of mass 150 g moving at a rate of 20 m s^{-1}. If the catching process be completed in 0.1 s, the force of blow exerted by the ball on the hands of the player is	**1**

	(a) 0.3 N (b) 30 N (c) 300 N (d) 150 N	
Q4.	A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. The weight of the block is- (a) 2 N (b) 20 N (c) 50 N (d) 100 N	**1**
Q5.	During inelastic collision between two bodies, which of the following quantities always remain conserved ? (a) Total kinetic energy (b) Total mechanical energy (c) Total linear momentum (d) Speed of each body	**1**
Q6.	A sphere, a cube and a thin circular plate, all of same material and same mass, are initially heated to same high temperature- (a) Plate will cool fastest and cube the slowest (b) Sphere will cool fastest and cube the slowest (c) Plate will cool fastest and sphere the slowest (d) Cube will cool fastest and plate the slowest.	**1**
Q7.	A capillary tube (1) is dipped in water. Another identical tube (2) is dipped in a soap water solution. Which of the figures shows the relative nature of the liquid columns in the two tubes? (a)  (b)  (c)  (d) 	**1**
Q8.	Length of a string tied to two rigid supports is 40 cm. Maximum length (wavelength) in cm of a stationary wave produced on it is- (a) 20 (b) 40 (c) 80 (d) 120	**1**
Q9.	Consider the quantities, pressure, power, energy, impulse, gravitational potential, electrical charge, temperature, area. Out of these, the only vector quantities are (a) impulse, pressure and area (b) impulse and area (c) area and gravitational (d) impulse and pressure	**1**
Q10.	The temperature of a wire is doubled. The Young's modulus of elasticity (a) will also double (b) will become four times (c) will remain same (d) will decrease	**1**

Q11.	For a simple harmonic oscillator, if displacement is half of its amplitude, the ratio of potential energy to total energy is..... **OR** In a SHM particle velocity leads the displacement by a phase angle.....	**1**
Q12.	1..... = 9.46×10^{15} m.	**1**
Q13.	Boiling of water at its boiling point is an .....as well as an.....process.	**1**
Q14.	If the earth shrinks to half of its present size but its mass remaining constant, then value of acceleration due to gravity on earth's surface will be..... m s^{-2}.	**1**
Q15.	As per impulse momentum theorem, the impulse of a force is equal to.....in momentum of the object on which the force is acting.	**1**
Q16.	What is the standard value of universal gas constant?	**1**
Q17.	A body of mass 4 kg is oscillating harmonically suspended from a massless spring of force constant 100 N kg^{-1}. What is its angular frequency?	**1**
Q18.	Obtain the dimensional formula for coefficient of viscosity.	**1**
Q19.	Can two non-zero vectors give zero resultant when they multiply with each other. If yes, give condition for the same. **OR** Under what condition $\left\|\vec{A}+\vec{B}\right\| = \left\|\vec{A}\right\| + \left\|\vec{B}\right\|$ holds good?	**1**
Q20.	What is the specific heat of a gas in an (i) isothermal process, (ii) adiabatic process?	**1**
	SECTION-B	
Q21.	Which of the following measurements is most accurate and which is most precise: (i) 4.00 mm (ii) 4.0 cm (iii) 4.00 m (d) 40.00 m Give reason for your choice.	**2**
Q22.	From the expression for pressure of a gas on the basis of kinetic theory, find an expression for rms speed of gas molecules. **OR** Calculate the molecular kinetic energy of 1 gram of helium (molecular mass = 4) at 127℃. Given R = 8.31 J mol^{-1} K^{-1}.	**2**
Q23.	A pump on the ground floor of a building can pump up water to fill a tank of volume 30 m^3 in 15 min. If the tank is 40 m above the ground, and the efficiency of the pump is 30%, how much electric power is consumed by the pump?	**2**

Q24.	Suppose there existed a planet that went around the sun twice as fast as the Earth, What be its orbital size as compared to that of the Earth? **OR** A body weighs 63 N on the surface of the Earth. What is the gravitational force on it due it due to the Earth at a height equal to half the radius of the Earth?	**2**
Q25.	Which of the following relationships between the force F acting on a particle and its displacement x represents a simple harmonic motion? Give reason too.	**2**
Q26.	The frequency 'v' of an oscillating drop may depend upon radius 'r' of the drop, density 'ρ' of the liquid and surface tension 'S' of the liquid. Establish an expression for 'v' dimensionally.	**2**
Q27.	Why does the whistle of an approaching railway engine appear shriller than a receding engine? **SECTION-C**	**2**
Q28.	The displacement (in meter) of a particle moving along $x-$axis is given as: $x(m) = 18t + 5t^2$ Calculate (i) the instantaneous velocity at $t = 2s$, (ii) average velocity between 2s and 3s, and (iii) instantaneous acceleration.	**3**
Q29.	A brass block of 1 kg is placed on an inclined plane of steel inclined at an angle of 30° to the horizontal. If the coefficient of friction between the block and plane be 0.2, what force should be applied (a) to keep the body from sliding down the plane, (b) to just move it up the plane, (c) to move it up the plane with an acceleration of 0.2 m s^{-2}. Given that $g = 10\ m\ s^{-2}$. **OR** (a) A person falling on a hard floor is more prone to injuries than on falling on a sandy (or grassy) surface. Give the reason. (b) A ship of mass 4×10^7 kg is pulled by a force of 6×10^5 N. Find the acceleration of the ship. Also find the velocity of ship after it has covered a distance of 300 m. Neglect the resistance of sea water.	**3**
Q30.	State work-energy theorem. Prove it for a variable force.	**3**
Q31.	(a) Two discs of moments of inertia I_1 and I_2 about their respective axes (normal to the disc and passing through the centre), and rotating with angular speeds ω_1 and ω_2 are brought into contact face to face with their axes of rotation coincident. (a) What is the angular speed of the two disc system? (b) Show that the kinetic energy of the combined system is less than the sum of the initial kinetic energies of the two discs. How do you account for this loss in energy? (Take $\omega_1 \neq \omega_2$).	**3**
Q32.	A brass boiler has a base area of 0.15 m^2 and thickness 1.0 cm. It boils water at the rate of 6.0 kg/min when placed on a gas stove. Estimate the temperature of the part of the flame in contact with the boiler. Thermal conductivity of brass = 109 J s^{-1} m^{-1} K^{-1}; Heat of vaporisation of water = 2256×10^3 J kg^{-1}.	**3**

Q33.	The stress-strain graph for a metal wire is given in figure. Up to the point B, the wire returns to its original state O along the curve BAO, when it is gradually unloaded. Point E corresponds to the fracture point of the wire.  (a) Up to which point of curve, is Hooke's law obeyed? This point is also called 'Proportionality limit'. (b) Which point on the curve corresponds to elastic limit and yield point of the wire? (c) Indicate the elastic and plastic regions of the stress-strain curve. (d) What change happens when the wire is loaded up to a stress corresponding to point C on curve, and then unloaded gradually?	**3**
Q34.	Two sitar string A and B playing the note 'Ga' are slightly out of tune and produce beats of frequency 6 Hz. The tension in the string A is slightly reduced and the beat frequency is found to reduce to 3 Hz. If the original frequency of A is 324 Hz, what is the frequency of B? **SECTION-D**	**3**
Q35.	(a) Derive an expression for the work done during the adiabatic expansion of μ mole of an ideal gas. (b) A steam engine delivers 5.4×10^8 J of work per minute and services 3.6×10^9 J of heat per minute from its boiler. What is the efficiency of the engine? How much heat is wasted per minutes? **OR** (a) What is a Carnot's reversible heat engine? Briefly describe the four stages of Carnot's cycle and find expression for network done by the engine in one complete cycle. (b) Obtain an expression for efficiency of a Carnot's engine. On what factors does it depend?	**5**
Q36.	(a) State triangle law of vector addition. Give an analytical treatment to find the magnitude and direction of a resultant vector by using this law. (b) In a harbour, wind is blowing at the speed of 72 km/h and the flag on the mast of a boat anchored in the harbour flutters along the N-E direction. If the boat starts moving at a speed of 51 km/h to the north, what is the direction of the flag on the mast of the boat? **OR** (a) Define centripetal acceleration. Derive an expression for centripetal acceleration of a particle moving with a uniform speed 'v' along a circular path of radius 'r'. (b) The position of a particle is given by $r = 3.0\ t\hat{\imath} - 2.0t^2\hat{\jmath} + 4.0\ \hat{k}$ m Where t is in seconds and the coefficients have the proper units for r to be in metres. (i) Find the $\vec{v}$ and $\vec{a}$ of the particle? (ii) What is the magnitude and direction of velocity of the particle at $t = 2.0\ s$?	**5**

Q37.	(a) A body tied to one end of a string is made to revolve in a vertical circle about a horizontal axis passing through the other end of the string. Derive expressions for the velocity of the body and tension in the string at any point. Also show that the difference in tension at lowest point and highest point is $6mg$. (b) A motorcyclist just loops a vertical loop of radius 8.0 m. What is his minimum speed at the highest and the lowest points of the loop? What is the reaction force due to loop on the motorcyclist at the lowest point? Given that the combined mass of motorcyclist and the rider is 180 kg. [Take g = 10 m s^{-2}] **OR** (a) What are conservative and non-conservative forces? Give examples. (b) Prove that the work done in moving a particle in a closed path in the field of a conservative force is zero.	**5**