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ST. GEORGE'S SCHOOL, ALAKNANDA
MIDTERM EXAMINATION (2017-2018)
SUBJECT-PHYSICS
CLASS-XI

DATE: 16.9.17
TIME : 3 HRS

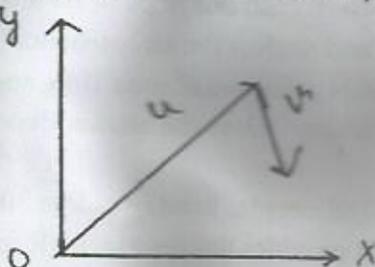
M:M : 70
NO OF PAGES : 3

Instructions:

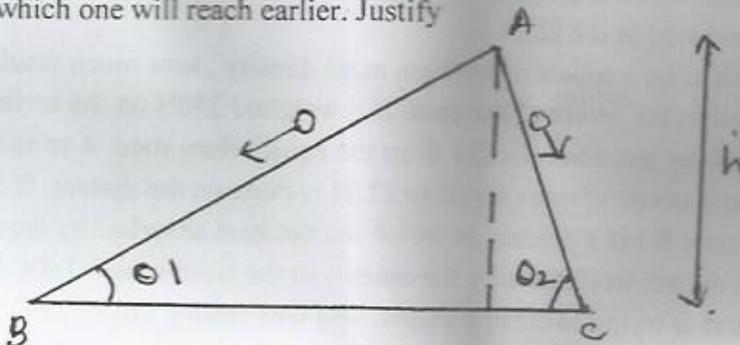
- Q1 to Q4 carries one mark each
- Q2 to Q13 carries two marks each
- Q14 to Q21 carries three marks each
- Q22 is of four marks
- Q23 to Q26 carries five marks each

- Q1. Give an example of a constant which has a unit.
- Q2. Figure shows the orientation of two vectors u and v in the XY plane. Write about a, b, p, q . Whether they are positive or negative.

TAKE $\vec{u} = a\hat{i} + b\hat{j}$
 $\vec{v} = p\hat{i} + q\hat{j}$



- Q3. Write the relationship between angle of inclination and the angle of repose.
- Q4. Two inclined frictionless tracks, one gradual and the other steep meet at A, from where two stones are allowed to slide down from rest, one on each track. What will happen to speed for both the stones and which one will reach earlier. Justify



- Q5. A cricket ball of mass 150g moving with a speed of 126km/hr hits the middle of the bat, held firmly at its position by the batsman. The ball moves straight back to the bowler after being hit by the batsman. Collision is elastic and the time the two remain in contact is 0.001s. Find the force the batsman had to apply to hold the bat firmly at its place.

- Q6. State parallelogram of Vector Addition
- Q7. Two masses of 5kg and 3kg are suspended with the help of massless inextensible strings. Calculate T_1 and T_2 when whole system is going upwards with acceleration of 2m/s^2
- Q8. Show that total energy of a freely falling body is conserved with the help of a diagram.
- Q9. Does the escape speed of a body from the Earth depend on a) mass of the body b) height of the location from where the body is launched. Justify
- Q10. Derive the expression for the effect on the gravity due to depth?
- Q11. Derive the expression for the work done in isothermal process.?
- Q12. Derive the relation for the impulse. *and represent it graphically*
- Q13. Show that the linear momentum is conserved in an isolated system?
- Q14. Dimensionally derive the relation $F = 6\pi\eta v r$. r is the radius, η is the coefficient of viscosity and v is the velocity
- Q15. On a two-lane road, car A is travelling with a speed of 36km/hr . Two cars B and C approach car A in opposite directions with a speed of 54km/hr each. At a certain instant, when the distance AB is equal to AC, both being 1km , B decides to overtake A before C does. What minimum acceleration of car B is required to avoid an accident?
- Q16. A bullet fired at an angle of 30° with the horizontal hits the ground 3km away. By adjusting its angle of projection, can one hope to hit a target 5km away? Assume the muzzle speed to be fixed, and neglect the air resistance.
- Q17. A horizontal force of 600N pulls two masses 10kg and 20kg connected by a light string. What is the tension in the string? Does the answer depend on which mass end the pull is applied?
- Q18. A train rounds an unbanked circular bend of radius 30m at a speed of 54km/hr . The mass of the train is 10^6kg . What provides the centripetal force required for this purpose? The engine or the rails? What is the angle of banking required to prevent wearing of the rail?
- Q19. A bullet of mass 0.012kg and horizontal speed 70m/s strikes a block of wood of mass 0.4kg and instantly comes to rest with respect to the block. The block is suspended from the ceiling by means of thin wires. Calculate the height to which the block rises. Also estimate the amount of heat produced in the block.
- Q20. Assuming the Earth to be a sphere of uniform mass density, how much would a body weight half way down to the centre of the earth if it weighed 250N on the surface?
- Q21. In changing the state of the gas adiabatically from the equilibrium state A to another equilibrium state B, an amount of work equal to 22.3J is done on the system. If the gas is taken from state A to state B via a process in which the net heat absorbed by the system is 9.35cal , how much is the net work done by the system in the latter case? Take $1\text{cal} = 4.19\text{J}$
- Q22. Raju saw her grandmother trying to clean a carpet. She was feeling difficulty in lifting the carpet. Raju helped his grandmother in cleaning the carpet by beating it with a stick.
- What are the values displayed by Raju
 - Name the scientific principle involved in Raju's action
 - Give one such more example

Q23. a) The relation between t and the distance x is $t = ax^2 + bx$, where a and b are constants. Express the instantaneous acceleration in terms of instantaneous velocity.

a) Show that there are two angles of projection for which the horizontal range is same. Also show that the sum of the maximum heights for these two angles is independent of the angle of projection.

Q24. Derive the expression for the velocities of the two bodies in term of their initial velocities before collision. Discuss the conditions

Q25. Define orbital velocity. Derive the expression for orbital velocity of a satellite. Prove $v_e = \sqrt{2}v_o$

Q26 Derive Carnot's theorem. Write the expression for the efficiency of a refrigerator