HSE (I) | Model Examination 2012 | Score: 60
PHYSICS | Time: 2.15 hr

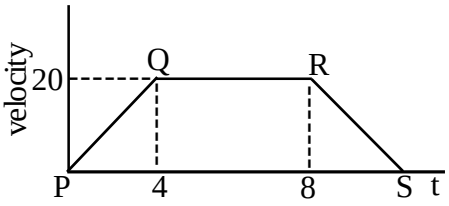
1. A stone tied to the end of a string is whirled by a boy in a horizontal circle at constant velocity. While doing this experiment, he realised that the force required for rotation may depend upon mass m velocity, v and radius r.
   (a) Find the formula for force required for rotating using the method of dimensions. {2}
   (b) Check the correctness of this formula using the method of dimensions. {2}

2. Fill in the blanks:

A	B	C
a) Power	watt	.....
b)	kgm^2	ML^2.
c) Torque	joule	.....
d) Surface Tension	.....	MT^{-2}.

{2}

3. The graph shows the v - t graph of a moving car.



   (a) The type of motion represented by PQ. {1}
   (b) Find the retardation of the car before coming to rest. {1}
   (c) Find the total distance travelled by the car before coming to rest. {2}

4. A boy throws a cricket ball with a velocity u at an angle q with horizontal.
   (a) What is the path followed by the ball? {1/2}
   (b) What are the vertical and horizontal components of velocity at the highest point? {1}
   (c) Derive expression for time of flight and horizontal range of the ball. {2 1/2}

5. A block of mass m rests on an inclined plane at an angle of q with the horizontal.
   (a) Draw a diagram representing various forces acting on the block. {1}
   (b) When the mass just begins to slide down, what is the coefficient of friction between block and surface? {2}

6. A man of mass 70 kg stands on a weighing scale in the lift. What is the reading of the scale when:
   (a) The lift is moving upwards with uniform speed of 10 m/s. {1}
   (b) The lift is moving upwards with an acceleration 5 m/s^2. {1}
   (c) The lift is moving down with an acceleration 5 m/s^2. {1}
   (d) The lift mechanism failed and it fall down freely under gravity. {1}

7. Work is required to be done to lift a body from the ground. Let the body be dropped from height h.
   (a) State work energy theorem. {1}
   (b) Draw graphically its variation of KE and PE. {1}
   (c) A boy catches the ball at the ground and he draws his hands backwards while catching the ball. Why? {1}

8. The formation of tides in ocean is due to the force of attraction between moon and ocean water.
   (a) State the law which governs this phenomenon. {1}
   (b) Distinguish between g and G. How are they related to each other? {2}
   (c) The acceleration due to gravity at the moon's surface is 1.67 m/s^2. If the radius of the moon is 1.74×10^6m. Calculate the mass of the moon. {2}

9. Two forces with equal magnitude but opposite directions are acting on a body.
   (a) What is the condition for calling the above pair of forces a couple? {1}
   (b) Explain the term moment of couple. {1}
   (c) Obtain the expression for moment of couple. {3}

10. A boy dips a thin tube in water and water rises through it.
   (a) Name the phenomenon. {1}

(b) How does this rise vary with the radius of the tube. {1}
(c) Mention any two factors affecting the rise of the liquid. {1}

11. Bernoulli's theorem has a lot of applications in fluid dynamics.
(a) State and explain equation of continuity for a liquid in steady flow. {2}
(b) Explain how a cricket ball spins in air? {2}

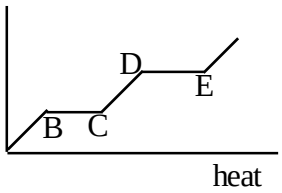
12. Match the following.

A	B
a) Mayer's relation	PV^{γ}= constant.
b) Adiabatic process	$C_P - C_V = R$.
c) Frequency	a Sin (kx - wt)
d) S. H.M	1/T.

{2}

13. A patient is admitted to hospital. The temperature of the patient is found to be 100^0F.
(a) What is meant by temperature? {1}
(b) Convert this temperature into degree Celsius. {1}

14. A graph showing temperature versus heat is given.



(a) What does the horizontal region BC and DE represent? {1}
(b) What does the slope CD represent? {1}

15. Heat engine is a device which converts heat energy into mechanical energy.
(a) Which law of thermodynamics is used to explain working of heat engine? {1}
(b) What are sink, source, and working substance of a domestic refrigerator? {1}
(c) Explain the operations of a Carnot's engine. Draw the Carnot's cycle and deduce the expression for efficiency. $v = \sqrt{\frac{gP}{r}}$ {3}

16. The displacement of a particle in SHM is given by y = asinwt. From this derive expressions for maximum velocity and maximum acceleration. Also draw their graphs. {2}

17. A transverse harmonic wave on a string is given by y(x,t) = 3 sin (36t + 0.018 x + p/4) where x and y are in cm and t in seconds. The +ve direction of x is from left to right.
(a) Is this a travelling or standing wave? What is the speed and direction of propagation? {1}
(b) What are amplitude and frequency? {1}
(c) What is the initial phase at the origin? {1/2}
(d) What is its wavelength? {1/2}

18. The formula $v = \sqrt{\frac{gP}{r}}$ is used to explain the speed of sound in air.
(a) Who discovered this formula? {1/2}
(b) Is it affected by pressure? {1}
(c) What happens to speed if temperature and humidity is increases. {11/2}