Federal Board HSSC-I Examination
Physics Model Question Paper

Time allowed: 2.35 hours Total Marks: 68

Note: Sections 'B' and 'C' comprise pages 1-8 and questions therein are to be answered on the separately provided answer book. Answer all the questions from section 'B' and section 'C'. Use supplementary answer sheet i.e., sheet B if required. Write your answers neatly and legibly.

SECTION – B
(42 marks)

NOTE: Attempt **ALL** the questions. The answer to each question should not exceed 3 to 4 lines.

Q.2 If an object is being moved by a force ' ' through a displacement ' ' in time 't' show that the equation

$P = \frac{\text{work done}}{\text{time taken}}$ can be written as $P =$. (2)

Q.3 Can scalar product of two vectors be negative? If your answer is yes, give an example, if no provide a proof. (2)

Q.4 Eating a banana enables a person to perform 4.0×10^4J of work. To what height does eating a banana enable a 60kg man to climb? (2)

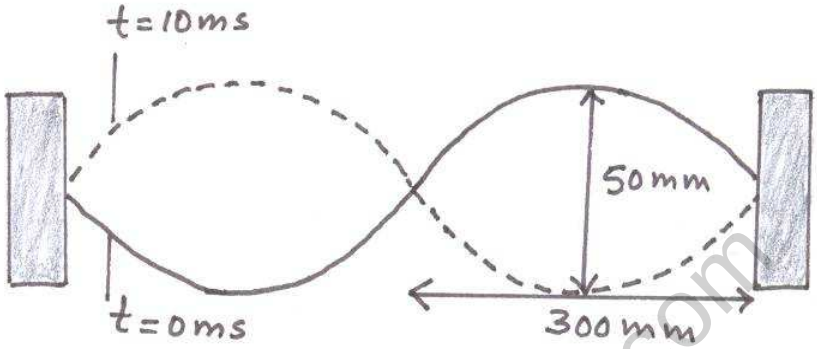
Q.5 A man on the ground sees an airplane climbing at an angle of 35° above the horizontal. He gets into his car and by driving at 120kmh^{-1} is able to stay directly below the airplane. What is the airplane's speed? (2)

Q.6 What is the weight of a freely falling body? Explain your answer. (2)

Q.7 At what angle, with the horizontal, the range of the projectile becomes half of its R_{max}. (2)

Q.8 Adiabatic process is free of any heat exchange with the surroundings. Yet cooling is produced during adiabatic expansion. Explain. (2)

Q.9 Figure below shows part of a standing wave on a string at t = 0 ms and t = 10 ms, during which time the string has moved from the first position to the second:



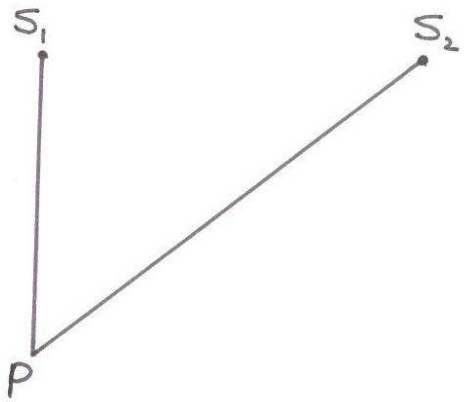
a. What is the period of the oscillation? (1)
b. Calculate the speed of transverse waves on this string. (1)

Q.10 Is the equation $v = \sqrt{\frac{T}{\mu}}$ dimensionally consistent. (2)

Where

T is the tension in the wire
v is the speed of the wave
is the mass per unit length of the wire.

Q.11 Water waves of wavelength 4m are produced by two generators S_1 and S_2, as shown. Each generator, when operated by itself, produces waves which have an amplitude A at P, which is 3m from S_1 and 5m from S_2. When the generators are operated in phase, what is the amplitude of oscillation at P? (2)



Q.12 Give reasons for the following:

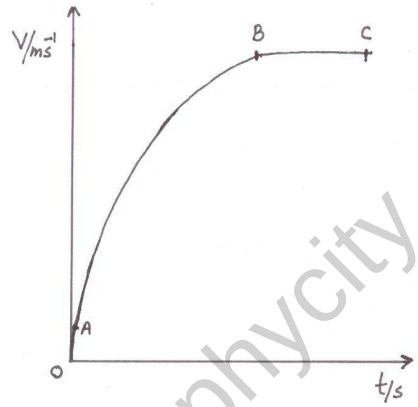
a. A compound microscope should have an objective of short focal length and small aperture.

(1)

b. A telescope should have an objective of long focal length and large aperture.

(1)

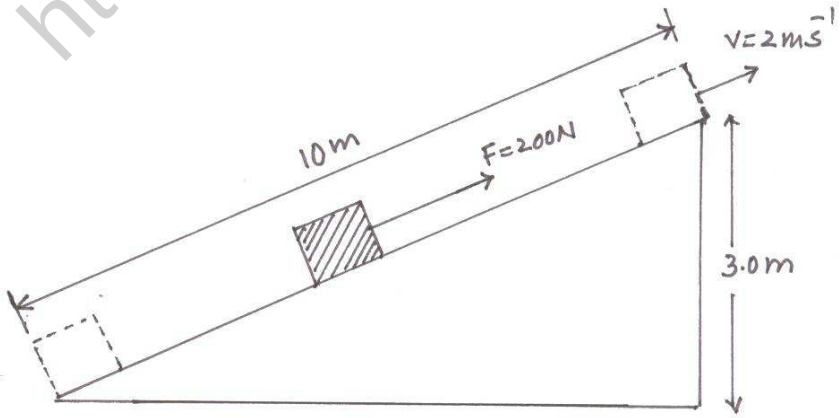
Q.13 The following graph shows the velocity of a sky diver:



a. What is his acceleration at point 'A'? (1)

b. Explain the graph from B to C. (1)

Q.14 A 25kg box is pulled up a ramp 10m long and 3.0m high by a constant force of 200N as shown below. If the box starts from rest and has a speed of $2ms^{-1}$ at the top, what is the work done against the force of friction? (3)



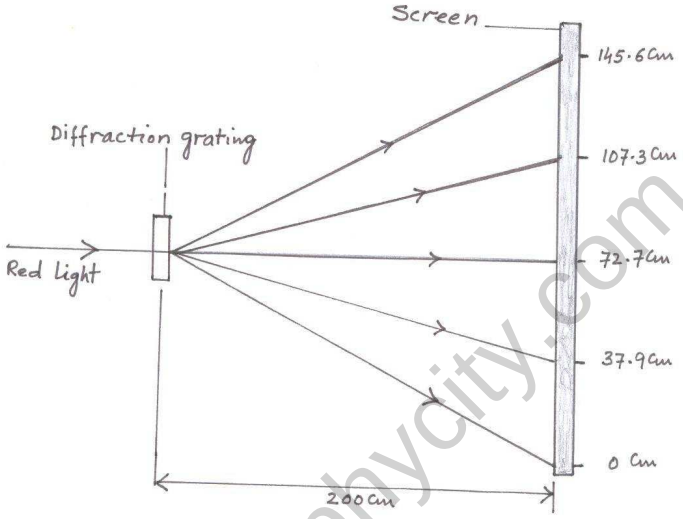
(OR)

A pipe closed at one end is 12cm long. What is the

a. wavelength of 3rd harmonic, (2)

b. frequency of 5th harmonic, (1)
where speed of the sound is 330ms^{-1}.

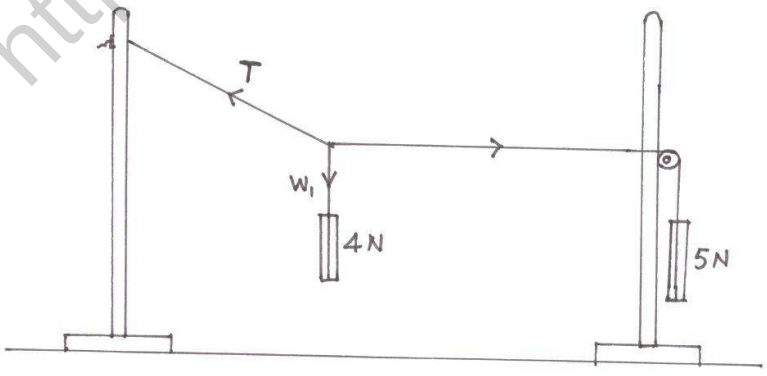
Q.15 A diffraction grating with 250 lines per mm is placed in front of a monochromatic source of red light. A screen placed 200cm beyond the grating has red light images measured at certain positions on a scale on the screen, as shown in the figure. Use the 1st order spectrum to calculate the wave length of red light. (3)



(OR)

Water flows through a hose whose internal diameter is 1cm at a speed of 1ms^{-1}. What should be the diameter of the nozzle if water has to emerge at 21 ms^{-1}? (3)

Q.16 What is the tension 'T' in the section of string, as shown in the figure? (3)



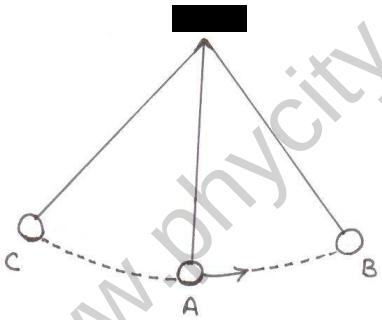
(OR)

For an atom to escape completely from the earth's gravitational field it must have a speed of approximately 1.1x10^4 ms^{-1} at the top of the earth's atmosphere. Estimate the temperature at the top of the atmosphere,

so that helium, assumed to be an ideal gas, escapes from the earth. The mass of helium atom is 6.6×10^{-27}kg. (3)

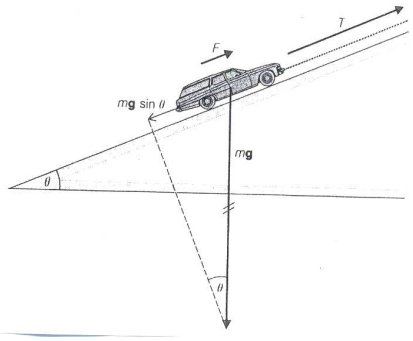
Q.17 Summarize the values of the variables of SHM at different points in the oscillation ABAC, illustrated in the figure for the case of a simple pendulum. (Copy the columns on the answer sheet). (3)

Position / Variable	B	A	C
Displacement			
Velocity			
Acceleration			
Kinetic Energy			
Potential Energy			



(OR)

A rope whose working strength is 2000N is used to tow a 1000kg car up a 10°incline, as shown in the figure. Find the maximum acceleration that can be given to the car. (3)



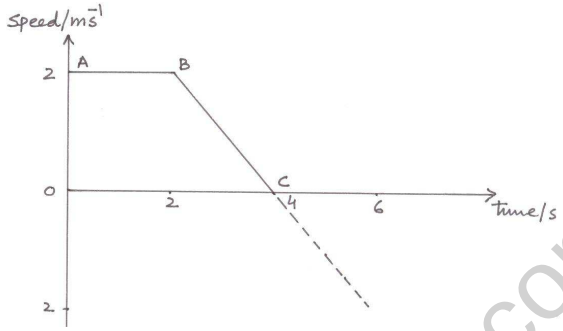
Q.18 A power station has an efficiency of 40% and generates 1000MJ of electrical energy. What is the input and waste energy? (3)

(OR)

An electric motor with an output of 15kw provides power for the elevator of a ten-story building. If the total mass of the loaded elevator is 1000kg, what is the minimum time needed for it to rise the 30m from the ground floor to the top floor? (3)

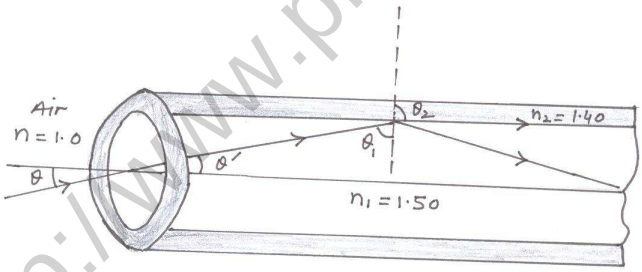
Q.19 a. Describe the motion from A to B and B to C, shown in the graph. (2)

b. What distance is traveled in first 2 seconds? (1)



(OR)

What is the critical angle and angle of entry for an optical fibre having core of refractive index 1.50 and cladding of refractive index 1.40, as shown in the figure. (3)



SECTION – C

(Marks: 26)

Note: Attempt **ALL** the questions.

Q.20 a. Derive expressions for the magnitude and direction of the resultant of two vectors using their rectangular components. (5)

b. If $\vec{A} = 3\hat{i} + 4\hat{j}$ and $\vec{B} = 5\hat{i} - 3\hat{j}$, show that $|\vec{A}+\vec{B}|^2 + |\vec{A}-\vec{B}|^2 = 2A^2B^2$ (3)

Q.21 a. Explain projectile motion with suitable examples. Also deduce mathematical expressions for (6)

i. time of flight

ii. range of projectile that has been launched at an angle of 60° with the horizontal.

b. A football is kicked at an angle of 20° with the horizontal giving it a velocity of $50ms^{-1}$. Find the maximum horizontal and vertical distances covered by the ball. (2)

Q.22 a. State and explain first law of thermodynamics. (3)

b. Apply first law of thermodynamics to (4)
i. isothermal process
ii. adiabatic process
and draw their P-V graphs.

c. A reversible engine works between two temperatures whose difference is 100°C. If it absorbs 746J of heat from the source and rejects 546J to the sink, calculate the temperature of the source and the sink. (3)

(OR)

a. Define absolute potential energy and derive an expression for the absolute potential energy on the surface of the earth. (6)

b. Derive a relation between orbital radius and period of geostationary satellites. (4)