Experts' Institute
8-D, Kutchery Road Prayagraj. Ph:9415368884

JAVA Comp. Applications   **Python** Robotics & AI

ST. JOSEPH'S COLLEGE, PRAYAGRAJ
HALF YEARLY EXAMINATION 2024
PHYSICS

TIME: 2 Hours   CLASS – X   MM: 80

Instructions

You will not be allowed to write during first 15 minutes.
This time is to be spent in reading the question paper.
The time given at the head of this Paper is the time allowed for writing the answers.
Section A is compulsory. Attempt all questions from Section B.
The intended marks for questions or parts of questions are given in brackets. [ ]

SECTION A – [40 Marks]
(Attempt all questions from this section)

Q 1) Select the correct answers to the questions from the given options. (Do not copy the question. Write the correct option and answer only) **[15]**

1. A pendulum is oscillating on either side of its resting position. The correct statement is
a) It has only the kinetic energy at each position.
b) It has the maximum kinetic energy at its extreme position.
c) It has the maximum potential energy at its mean position.
d) The sum of its kinetic and potential energy remains constant throughout the motion.

2. When seven spectral colours pass through a glass block from air, then which one of the following statements is correct?
a) In the glass block, speed of blue light > speed of yellow light.
b) In the glass block, speed of green light > speed of orange light.
c) In the glass block, speed of violet light > speed of red light.
d) In the glass block, speed of orange light > speed of Indigo light.

3. The characteristic of sound which enables to differentiate between two sounds of different intensity is:
a) Quality   b) Amplitude   c) Pitch   d) Loudness

4. The ratio of frequency of A: frequency of B is:
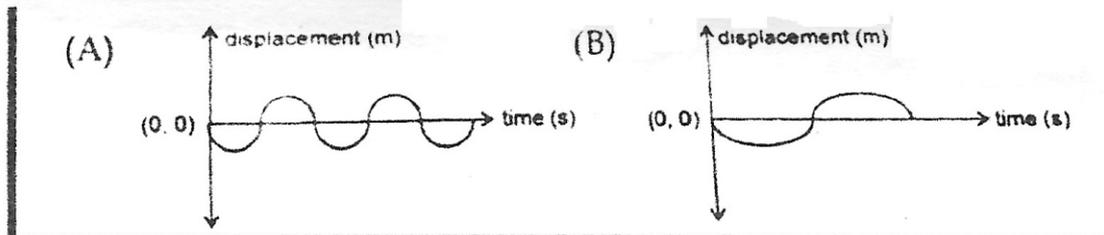
a) 5 : 2   b) 1 : 2   c) 2 : 1   d) 2: 3

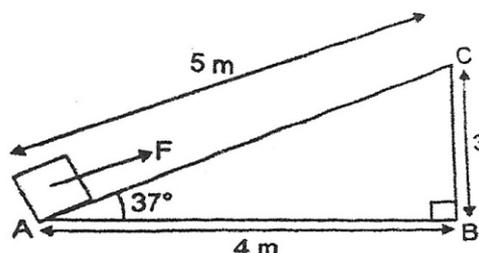5. From the diagram, identify the characteristics of the image that will be formed:

a) Real
b) Diminished
c) Formed within the focal length
d) Virtual
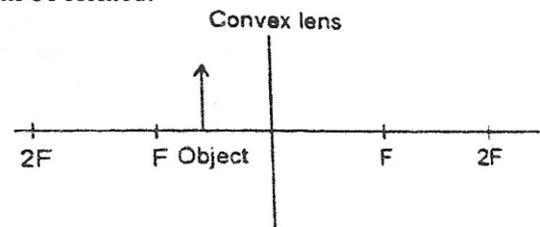
6. Assertion (A): Ultraviolet radiations are scattered more as compared to be microwave radiations.
Reason (R): Wavelength of ultraviolet radiation is more than the wavelength of microwave radiation.
a) Both A and R are true   b) A is true but R is false
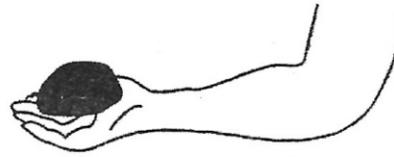c) A is false but R is true   d) Both A and R are false.

7. A force 'F' moves a load from A to C as shown in the figure below. For the calculation of the work done, which of these lengths would you use as the displacement?

a) 3 m
b) 4 m
c) 5 m
d) 7 m

[1]

8. When the stem of vibrating tuning fork is pressed on a table, the tabletop starts vibrating. These vibrations are definitely an example of:
a) resonance   b) natural vibrations   c) forced vibrations   d) damped vibrations

9. Which of the following is a class II lever"
a) Pair of scissors   b) Wheelbarrow   c) Crowbar   d) Sugar Tongs

10. Linear magnification (m) produced by a concave lens is:
a) m < 1   b) m > 1   c) m = 1   d) m =2

11. In refraction of light through a prism, the light ray:
a) Suffers refraction only at one face of the prism.
b) Emerges out from the prism in a direction parallel to the incident ray.
c) Bends at both the surfaces of prism towards its base.
d) Bends at both the surfaces of prism opposite to its base.

12. Assertion: Mechanical advantage (MA) for a simple machine is always greater than 1

Reason : $MA = \dfrac{Load}{Effort}$

a) Both A and R are true   b) A is true but R is false
c) A is false but R is true   d) Both A and R are false.

13. In which of the following diagram is refraction not correct.

14. A man playing a flute is able to produce notes of different frequencies. If he closes the holes near his mouth, will the pitch of the note produced, increase or decrease? Give a reason. (a) increase (b) decrease affected (c) remain unchanged

15. A convex lens forms an image which is real, inverted and equal to the size of the object, if the object is placed:
a) at infinity   b) between F and 2 F   c) between optical centre and focus   d) at 2F

Q 2) 1. a) A body is acted upon by two forces each of magnitude **F**, but in opposite directions. State the effect of the forces if: [3]
i) both forces act at the same point of the body.
ii) the two forces act at two different points of the body at a separation *r*.
b) What is the position of the centre of gravity of a hollow cylinder?

2. A machine raises a load of 750 N through a height of 16 m in 5 s.   [2]
Calculate: a) the energy spent by the machine,
            b) the power of the machine if it is 100% efficient.

3. Indicate the positions of load L, effort E and fulcrum F in the forearm shown in the figure given below. Name the class of lever. [2]

4. A monochromatic ray of light passes from air to glass. The wavelength of light in air is λ, the speed of light in air is c and in glass is v. If the refractive index of glass is 1.5, write down: [2]
a) the relationship between c and v   b) the wavelength of light in glass

5. Is it possible to burn a piece of paper using a convex lens in day light without using a match box or any direct flame? Draw a diagram to support your answer. [2]

6. The frequency of violet light is 7.5×10^{14} Hz. Find its wavelength in: [2]
a) nm   b) Å.   [Speed of light $c = 3 \times 10^8$ m s^{-1}]

7. The figure given below shows two tuning forks A and B of the same frequency mounted on two separate sound boxes with their open ends facing each other. The fork A is set into vibration. [2]
a) Describe your observation.
b) State the principle illustrated by this experiment.
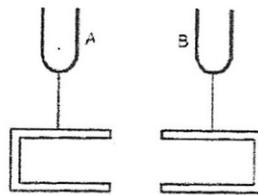
Q 3) 1. Why it is difficult to open the door by pushing it or pulling it at the hinge? Explain. [2]
2. If the power of a motor by 100 KW, at what speed can it raise a load of 50000 N? [2]
3. A crane 'A' lifts a heavy load in 5 seconds, whereas another crane 'B' does the same work in 2 seconds. Compare the power of crane 'A' to that of crane 'B'. [2]
4. A body of mass 4 kg initially at rest is subjected to a force of 16 N. What is the kinetic energy acquired by the body at the end of 10s? [2]
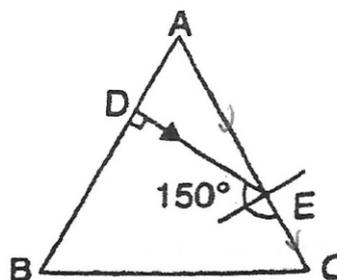Calculate the resultant torque about O from the following diagram: [2]
(5.)
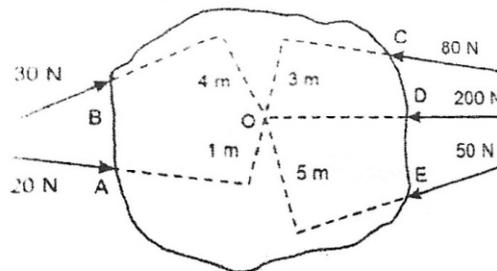
SECTION B – [40 Marks]
(Attempt all questions from this section)

Q 4) 1) The critical angle for glass of which the equiangular prism ABC is made, is 60^0. A ray of light incident on the side AB of the prism is refracted along DE such that the angle it makes with the side AC is 150^0. Also, EDB = 90^0. Draw the path of the incident ray on the side AB (which travels along DE) and also the path which the ray DE travels from the point E onwards. [3]


[3]

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2. A ball of mass 50 g is thrown vertically upwards with an initial velocity of 20 ms⁻¹. Calculate: [3]

a) the initial kinetic energy imparted to the ball.
b) the maximum height reached if air friction is neglected, and
c) the maximum height reached if 40% of the initial energy is lost against the air friction. Take $g = 10$ ms⁻².

3. The figure shows a block and tackle system of pulleys used to lift a load. [4]
    a) How many strands of tackle are supporting the load?
    b) Draw arrows to represent tension T in each strand.
    c) When load is pulled up by a distance 1 m, how far does the effort end move?
   d) How much effort is needed to lift a load of 100 N?
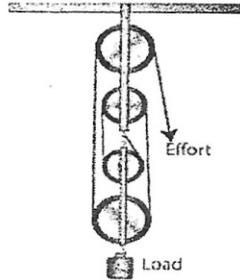
Q 5) 1. The diagram below shows a point source P inside a water container. Four rays A, B, C & D starting from the source P are shown upto the water surface. [3]
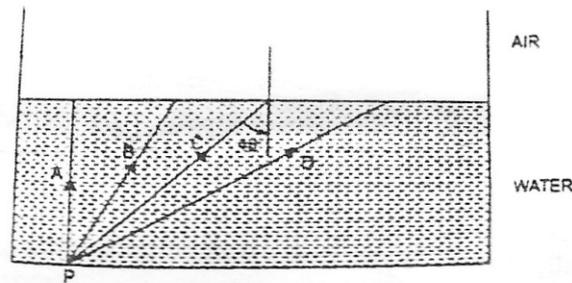
a) Show in the diagram the path of these rays after striking the water surface. The critical angle for water air surface is 48⁰.
b) Name the phenomenon which the rays B and D exhibit.

2. a) Suggest one way, in each cases, by which we can detect the presence of: [3]
    i) Infrared radiations
    ii) Ultraviolet radiations.
  b) Give one use of infrared radiations.

3. a) In a hospital, an ultrasonic scanner is used to locate tumors in a tissue. What is the wavelength of sound in a tissue in which the speed of sound is 1.7 Km s⁻¹? The operating frequency of the scanner is 4.2 MHz. [4]
  b) A postage stamp appears raised by 7.0 mm when placed under a rectangular glass block of refractive index 1.5. Find the thickness of the glass block.

Q 6) 1. An object is placed at a distance 24 cm in front of a convex lens of focal length 8 cm. [3]
  a) What is the nature of the image so formed?
  b) Calculate the distance of the image from the lens.
  c) Calculate the magnification of the image.

2. Draw a diagram to locate the position of a convex lens kept between a candle and screen separated by a distance of 90 cm so that a small image of the candle half the size of it may be formed on the screen. Deduce the focal length of the lens. [3]

3. a) i) What do you understand by free vibration of a body? [4]
    ii) Why does the amplitude of a vibrating body continuously decrease during damped vibrations?
  b) Two waves of the same pitch have amplitudes in the ratio 1:3. What will be the ratio of their:
    i) intensities and ii) frequencies.

Q 7) 1. a) It is observed that during march-past we hear a base drum distinctly from a distance compared to the side drums. [3]
    i) Name the characteristic of sound associated with the above observation.
    ii) Give a reason for the above observation.

[4]

b) State the safe limit of sound level in terms of decibel for human hearing.

2. A man standing in front of a vertical cliff fires a gun. He hears the echo after 3 s. On moving closer to the cliff by 82.5m, he fires again and hears the echo after 2.5 s. Find: **[3]**

a) the distance of the cliff from the initial position of the man,

b) the speed of sound.

3. Two pendulums C and D are suspended from a wire as shown in the figure given below. Pendulum C is made to oscillate by displacing it from its mean position. It is seen that D also starts oscillating. **[4]**
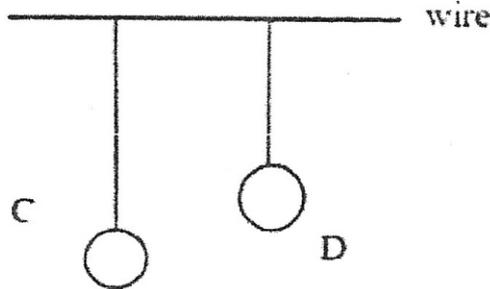
a) Name the type of oscillation, C will execute.

b) Name the type of oscillation, D will execute.

c) If the length of D is made equal to C, then what difference will you notice in the oscillation of D?

d) What is the name of the phenomenon when the length of D is made equal to C?