FWC

தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்

மூன்றாம் தவணைப் பரீட்சை – 2022

Conducted by Field Work Centre, Thondaimanaru.

3rd Term Examination - 2022

பௌதிகவியல் I Physics I	One Hours Gr -12 (2022)	01	E	I

Part - I

01. Choose the pair of physical quantities having same dimensions and different units from the given pair of physical quantities

1) Frequency, angular velocity.

2) Gravitational potential energy, mechanical energy.

3) Work, energy.

4) Pressure, kinetic energy of unit volume.

5) Kinetic energy of unit volume, potential energy of unit volume.

02. The physical quantity X depends on mass M, length L and time T, as given below

$$X = M^a L^b T^{-c}$$

The percentage of errors in measuring mass, length and time are $\propto\%$, $\beta\%$, $\gamma\%$ respectively. The maximum error that can happen when measuring X is given by

1) $(\propto + \beta + \gamma)\%$ *2)* $(\propto + \beta - \gamma)\%$ *3)* $(a^{\propto} + b^{\beta} + c^{r})\%$

4) $(a \propto + b\beta + c\gamma)\%$ *5)* $(\propto^a + \beta^b + \gamma^c)\%$

03. A car moves from rest with uniform acceleration $\propto$ for a short time and then comes to rest by decelerating at β. Find the maximum velocity attained if the total time taken for the motion is t.

1) $\frac{\propto\beta}{2(\propto+\beta)}t$ *2)* $\frac{\propto\beta t}{(\propto+\beta)}$ *3)* $\frac{4\propto\beta t}{(\propto+\beta)}$ *4)* $\frac{\propto\beta t}{4(\propto+\beta)}$ *5)* $\frac{2\propto\beta t}{(\propto+\beta)}$

04. A shell is fired from a cannon to achieve a maximum horizontal range of 16km. The velocity of the shell should be,

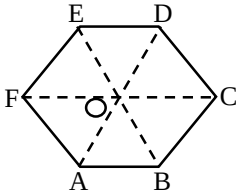
1) $200\ ms^{-1}$ *2)* $400\ ms^{-1}$ *3)* $800\ ms^{-1}$

4) $300\ ms^{-1}$ *5)* $500\ ms^{-1}$

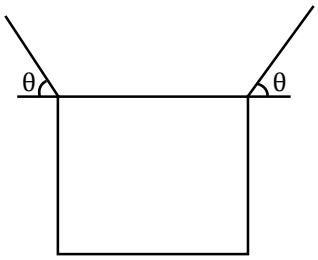
05. $ABCDEF$ is a regular hexagon. Its centre is O. Find the resultant vector of $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF}$ in terms of $\overrightarrow{AO}$

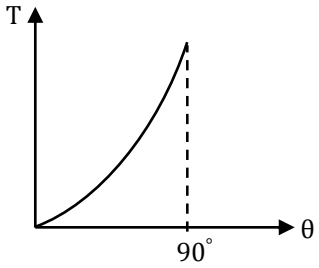
1) $2\overrightarrow{AO}$ *2)* $\overrightarrow{4AO}$ *3)* $6\overrightarrow{AO}$

4) O *5)* $3\overrightarrow{AO}$

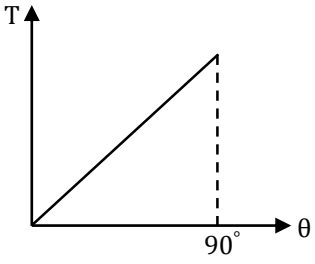


06. A signboard is suspended as shown in the figure. The variation of tension in the string with angle θ made by the string with the horizontal is best shown by the graph .





(1)



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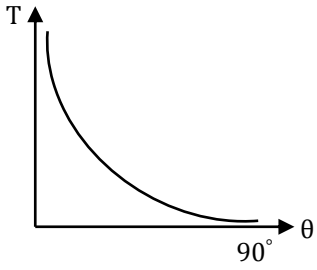

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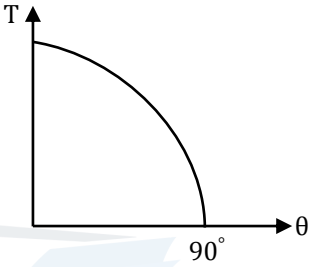

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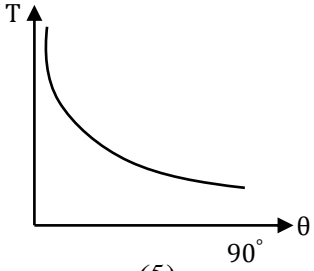
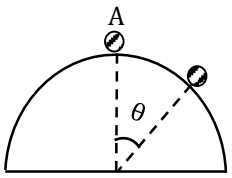


(5)

07. A particle is released from the highest point (A) of a smooth hemispherical surface as shown in the figure. If the radius at the point where the particle leaves the surface makes an angle (θ) with the vertical.



A) The value of θ depends on the radius of the hemisphere.

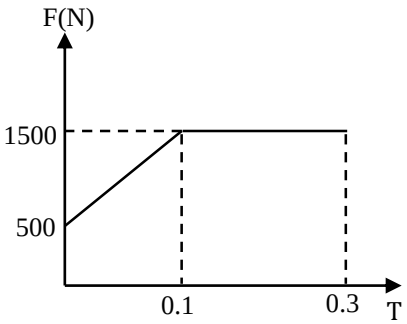
B) The value of θ depends on the mass of the particle.

C) The value of θ is same for all values of radius of the hemisphere and the mass of the particle.

1) Only A is correct 2) Only B is correct 3) Only A and B are correct

4) Only B and C are correct 5) All A, B, and C are correct

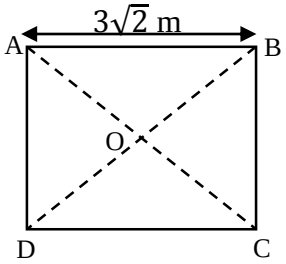
08. The figure shows how the force exerted on the ground by a volleyball player of mass 50 kg, when he jumps vertically upwards from the ground, varies with time. Find the highest height attained by the player.



1) 1.25m 2) 1 m 3) 0.5m

4) 0.75 m 5) 1.5 m

09. ABCD is a square shape lamina (plate) of non-uniform thickness and of mass 3M. Three particles each of mass M when placed at B, C and D, the centre of gravity of the system is at the centre of the lamina, then the centre of gravity of the lamina alone without the particles, is



1) OC line OC , 1m from the point O

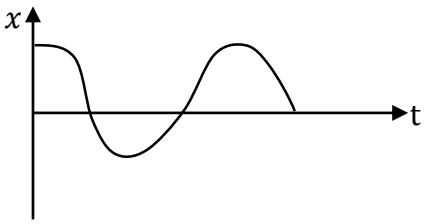
2) On line OA, 1m from the point O

3) On line OC, 2m from the point O

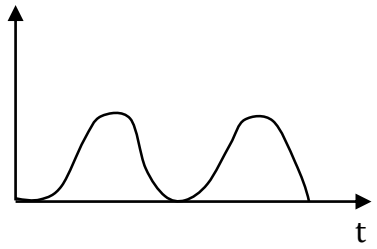
4) On line OA, 2m from the point O

5) On line OA, 3m from the point O

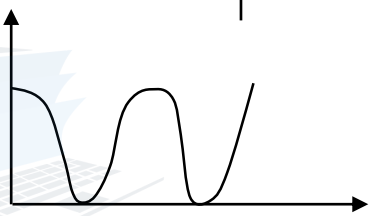
10. The figure shows the displacement – time graph of a particle performing a simple harmonic motion.



Consider the following graphs



(A)



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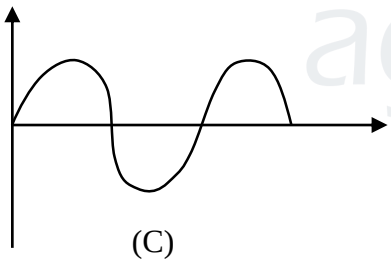

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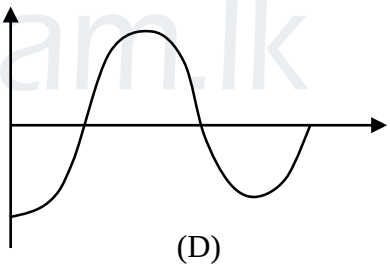


(D)

Of these, the variation of velocity, acceleration, potential energy and kinetic energy of the particle with time in the correct order is given by.

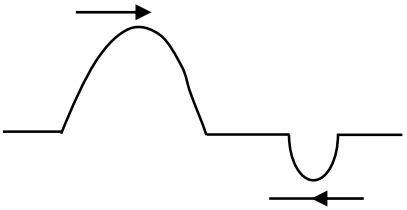
1) C, B, A, D 2) C, D, B, A 3) B, C, A, D

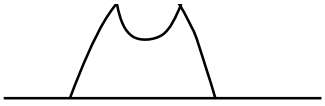
4) B, C, D, A 5) C, D, A, B

11. If the number of oscillations of two long swings of lengths ℓ_a and ℓ_b, in one second are n_a and n_b then the ratio, which is equal to the ratio of $\frac{n_a}{n_b}$ is,

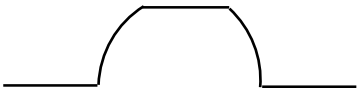
1) $\left(\frac{\ell_a}{\ell_b}\right)$ *2)* $\left(\frac{\ell_a}{\ell_b}\right)^{\frac{1}{2}}$ *3)* $\left(\frac{\ell_b}{\ell_a}\right)^{\frac{1}{2}}$ *4)* $\left(\frac{\ell_b}{\ell_a}\right)^{2}$ *5)* $\left(\frac{\ell_a}{\ell_b}\right)^{2}$

12. When two transverse wave pulses, as shown in the figure, travelling along a string in the opposite directions undergo superposition; the resultant wave shape is best denoted by.





(1)



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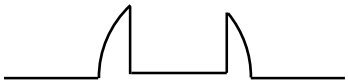

(3)

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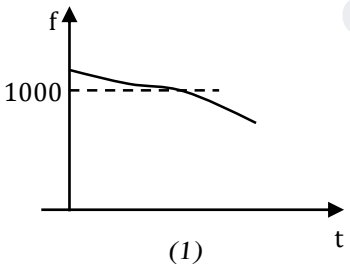
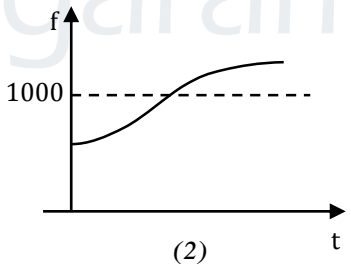
(5)

13. Choose the wrong statement from the statements about the seismic waves given below.
    1) P – type of waves first arrives the monitoring (observation) station.
    2) S – type of waves do not pass through liquids.
    3) Surface waves do greater damage.
    4) Transverse mechanical waves do not travel through fluids.
    5) Surface waves have greater frequency than that of the body waves.

14. An observer at rest is projecting a vibrator of frequency 1000 Hz vertically upwards from the ground, the graph that shows the variation of frequency heard by the observer with time is



(1)



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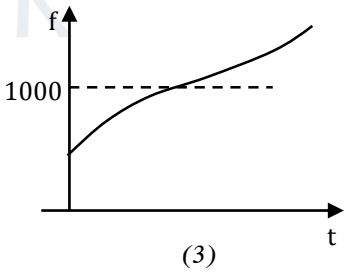

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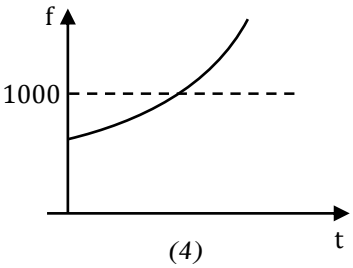

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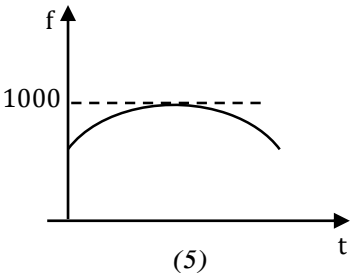

(5)

15. The intensity level of sound at a point 10 m from a point source of sound is 20dB. The lowest audible intensity of sound is $1 \times 10^{-12}\ \mathrm{Wm^{-2}}$. The greatest distance from where the sound from the source can just be heard is

    1) 20 m 2) 50 m 3) 80 m 4) 100 m 5) 1000 m

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16. Consider the following statements about compound microscope

A) The angular magnification of a compound microscope is greatest when the image is formed at infinity.

B) The angular magnification is equal to the product of the linear magnification of the objective and the linear magnification of the eyepiece. .

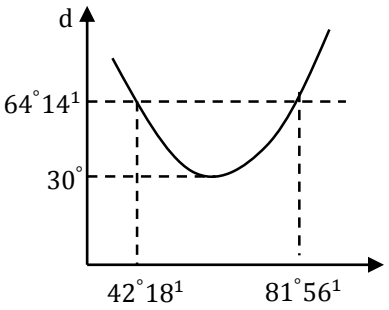
C) It is best, if the focal length of the objective is greater than the focal length of the eyepiece.

D) Under any adjustment, the separation between the lenses is less than the sum of the focal lengths of the objective and the eyepiece.

Choose the correct statement out of the following statements.

1) A, B, D 2) B, D 3) B, C, D 4) C, D 5) A, B, C, D

17. The graph of angle of incidence i and the angle of deviation d for a prism is shown here. The refractive index of the material of the prism is,



1) 1.64

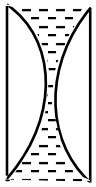
2) 1.50

3) 1.41

4) 1.49

5) 1.52

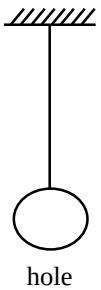
18. A symmetrical bi-convex lens of focal length 20cm is divided into two equal portions and water is kept in between them as shown in the figure. If this lens (combination) forms an equal size real image of an object placed at a distance 60 cm from its optical centre, then the type and focal length of the water lens is :

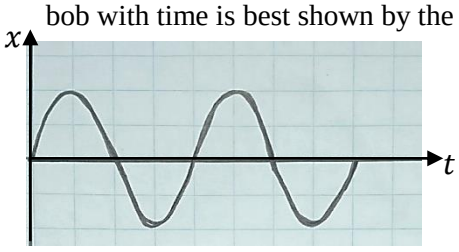


1) Convex 30 cm 2) Concave 30 cm 3) Concave 120 cm

4) Concave 60 cm 5) Concave 60 cm

19. Hollow pendulum bob having narrow hole is filled with water and allowed to oscillates as shown in the figure. The variation of the displacement, of the pendulum bob with time is best shown by the graph.





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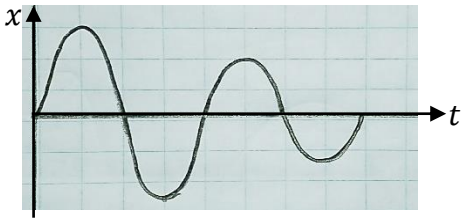

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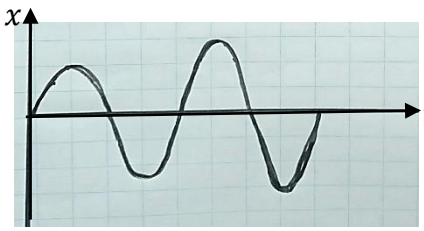

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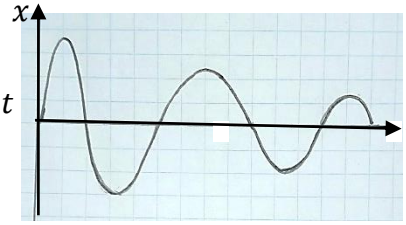

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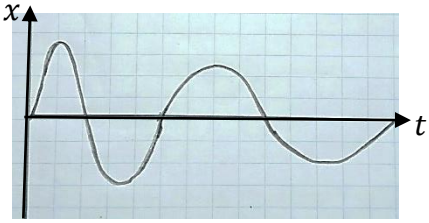
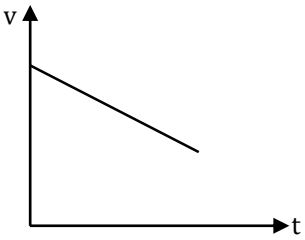


(5)

20. A fish in a fish tank is viewing an electric bulb, which is situated at a certain height from the surface of the water, and moves within the water in an upward direction with a uniform velocity, V. The graph that shows the variation of the image distance of the electric bulb to the fish with time is :



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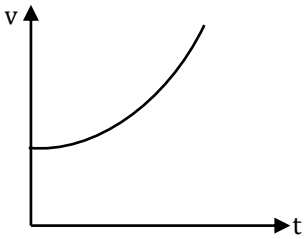

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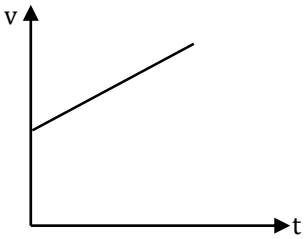

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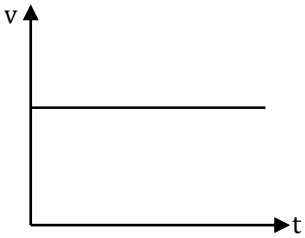

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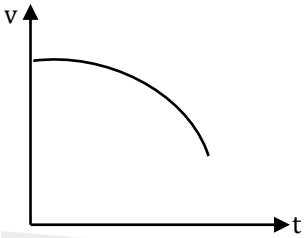


(5)

21. A person with defective eye vision, when viewing the bottom of a vessel from above appears to be not clear, but when water is poured into it the bottom appears clearly. The defect of the person's eye is

A) Eye ball may be larger.

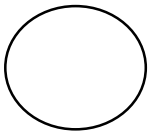
B) The contraction of the ciliary muscle may be small.

C) Eye ball may be smaller.

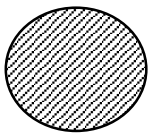
D) The relaxation of ciliary muscle may be less.

1) A, B 2) B, C 3) C, D 4) A, D 5) Only A

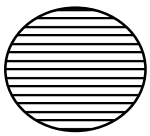
22.



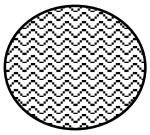
Circular ring
(X)



Circular disc
(Y)



Hollow sphere
(Z)



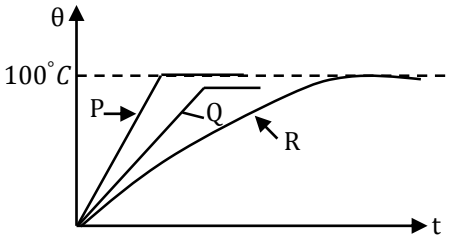
Solid sphere
(S)

When the temperature of circular ring (X), circular disc (Y), hollow sphere (Z) and solid sphere (S) of equal radius made of same material, raised through same degree, the increased in their radii are Δ_x, Δ_y, Δ_z and Δ_s. The correct relationship between these changes is given by:

1) $\Delta_x < \Delta_y < \Delta_z < \Delta_s$ *2)* $\Delta_x > \Delta_y > \Delta_z > \Delta_s$ *3)* $\Delta_x < \Delta_y > \Delta_z < \Delta_s$

4) $\Delta_x = \Delta_y < \Delta_z < \Delta_s$ *5)* $\Delta_x = \Delta_y = \Delta_z = \Delta_s$

23. Three different thermometers P, Q and R have same temperature range $O - 110^{\circ}C$ and same least counts. They are maintained at temperature $30^{\circ}C$, and at time $t = 0$ they are placed in a big tank of oil, which is maintained at $100^{\circ}C$. The readings of each thermometer with time is shown in the figure.



A) P – is a sensitive Thermometer.

B) P and R are accurate thermometers but not Q.

C) The scale of thermometer R is non – linear.

Of the above conclusions

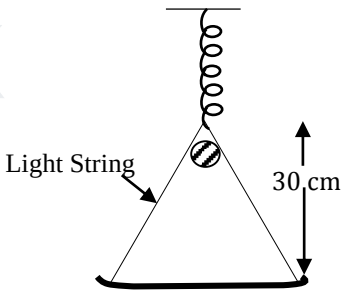
1) Only A is true 2) Only B is true 3) Only A and B are true

4) Only B and C are true 5) All A, B and C are true

24. A petrol tanker of capacity $100000\ \ell$ is fully filled in a province where the temperature is $20^{\circ}C$.The tanker arrives Jaffna in the afternoon, where the temperature is $30^{\circ}C$ The volume of petrol escaped from the tanker is (The apparent volume expansivity of petrol is $1.2 \times 10^{-3}°C^{-1}$, The linear expansively of the tanker is $0.2 \times 10^{-3}°C^{-1}$)

1) $1200\ \ell$ *2)* $120\ \ell$ *3)* $1000\ \ell$ *4)* $600\ \ell$ *5)* $1800\ \ell$

25. A 200g scale pan is attached to a light spring as shown in the diagram and. The spring undergoes an extension of 10cm. Now, a piece of clay of mass 200g is released to fall from a height of 30cm above the scale pan, and it sticks to the scale pan. The maximum distance moved downwards by the scale pan is



1) 10 cm 2) $10\sqrt{3}\ cm$ 3) 20 cm 4) $15\sqrt{3}\ cm$ 5) 30 cm

FWC

தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்
மூன்றாம் தவணைப் பரீட்சை - 2022

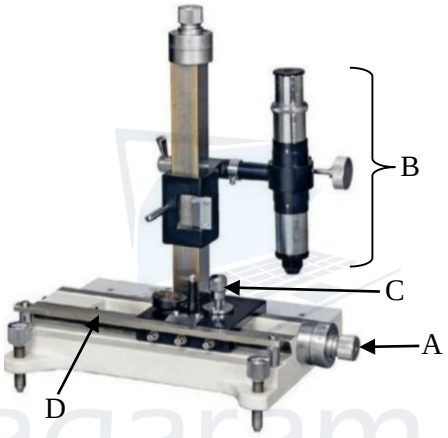
Conducted by Field Work Centre, Thondaimanaru.
3rd Term Examination - 2022

பௌதிகவியல் - II A Physics - II A	Two Hours 10 min Gr -12 (2022)	01	E	II A

Part - II
Structured Essay Questions

✶ **Answer all questions.**

01. A student wants to measure the internal diameter of capillary tube. For this purpose he is using a travelling microscope.



a) i) Identify the parts A, B, C and D in the above figure.

A – ……..

B – ……..

C – ……..

D – ……..

ii) Before making use of travelling microscope, a certain adjustment to be carried out. State how you would do that.

……..……

……..……

iii) The student says that the capillary tube must be fixed horizontally in the plane containing the microscope. Do you accept it? Explain.

……..……

……..……

iv) Although a student was able to obtain a clear image of the cross – wires and the cross – section of the capillary tube, another student is unable to see these images clearly. What is the reason?

……

……

v) When the cross – wires are positioned, the readings of the scales are as shown below.

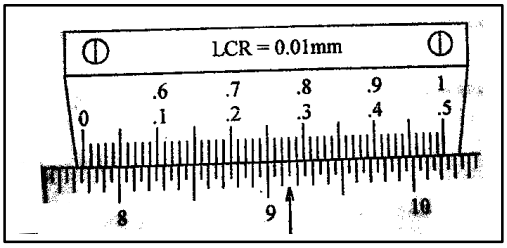


Fig (I)

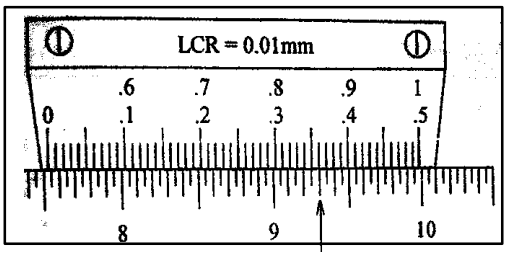


Fig (II)

1) Write down the reading shown by the figure (I)

……

2) Write down the reading shown by the figure (II)

……

3) Hence, find the diameter.

……

b) i) Another student says that the mean diameter of the capillary tube cannot be obtained using this method, do you accept it? Give reason.

……

……

ii) Write down the equation for obtaining internal diameter of the capillary tube using mercury thread.

……

iii) Mention the physical quantities, in the equation, to be measured.

……

……

iv) How would you verify whether the capillary tube has uniform diameter?

……

……

v) What problems are to be faced if water is used instead of mercury in This experiment?

……..……

……...

02. i) A cannon is stationed on a horizontal ground and at the same time a shell is fired to reach a target at a distance of $1000\,m$ from the cannon.

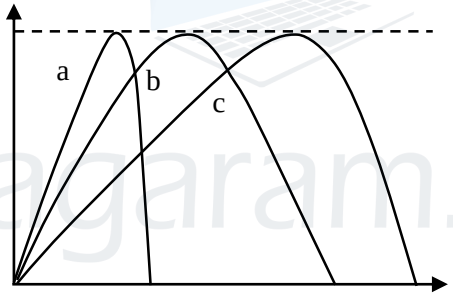
a) At what speed the shell was fired?

……

……

b) Draw the trajectory of the shell and mark the velocity of the shell, when it is at any one point on it.

c) The trajectories of different shells a, b and c fired form the cannon are shown in the figure.



i) If the time of flights of shells a, b and c are t_a , t_b and t_c respectively, express the relationship between them using the mathematical symbols $(> or < or =)$

……...

ii) If the vertical velocity components of the shells are V_a , V_b and V_c respectively, express, the relationship between them using the mathematical symbols $(> or < or =)$

……...

iii) At a certain instant, the horizontal components of their velocities are U_a , U_b , U_c respectively, express, the relationship between them using the mathematical symbols $(> or < or =)$

……..

d) If the drag on the shell due to air is not negligible, draw its trajectory with dotted line in the diagram drawn in section (b) and label it as X.

e) The shell accidentally explodes, at the highest point of its trajectory, into two pieces A and B of equal masses. The piece A retraces its original path and reaches the cannon.

i) Mark the action and reaction forces acting on the pieces A and B during the explosion.

ii) What is the change in momentum in A during the explosion?

……..…

……..

iii) Deduce the change in momentum in B during the explosion.

……..

iv) Will both pieces A and B hit the ground at the same time? Why?

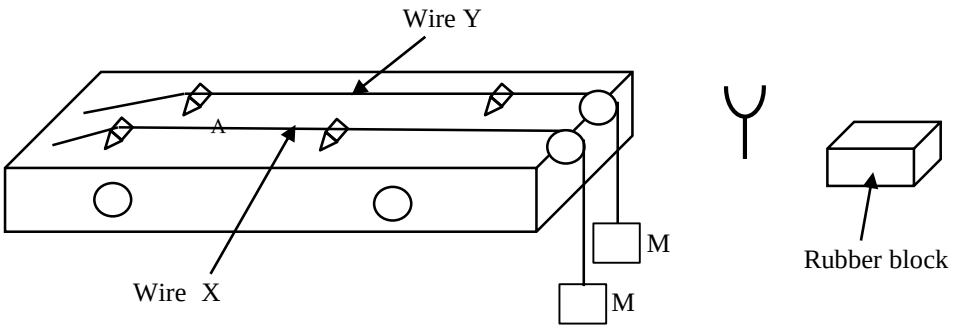
……

……

v) Draw the trajectory of the piece B relative to piece A.

vi) Draw the velocity-time graph for the piece B relative to piece A.

03. The figure shows the experimental setup arranged by a student to compare the mass per unit length of given sonometer wires x and y. In addition to this, the student is using a tuning fork of frequency f. Equal masses are suspended to both wires.



a) Give the kind of waves that would appear in the sonometer wire when it resonates with a tuning fork

Based on the motion of the wave : .....

Based on the appearance : .....

b) What is the purpose for which the rubber block is provided?

.....

.....

c) Give the speed of transverse waves created in the stretched wire in terms of suspended mass M and mass m of unit length.

.....

.....

d) State 2 advantages of obtaining fundamental resonance of the wire with the tuning fork.

.....

.....

e) Write down the experimental procedures involved in obtaining the perfect resonance of the sonometer wire with the tuning fork.

.....

.....

f) If l_1 is the length obtained for the fundamental resonance of the wire X, give the expression for l_1 in terms of above quantities. The mass of unit length of the wire X is m_x

.....

.....

g) Write down the expression in terms of above quantities for the length l_2 of the wire Y, which gives fundamental resonance for the same tuning fork. The mass of unit length of the wire Y is m_y

……

……

h) During the experiment, if the readings of $l_1 = 13.2\ cm$ and $l_2 = 26.4\ cm$, find the ratio of mass of the unit lengths, $\frac{m_x}{m_y}$

……

……

i) Another student says that the experiment can be carried out only using the sonometer wires without using the tuning fork. Give the procedure for this method.

……

……

……

04. The two lenses of a compound microscope used in normal adjustment and the position of the object are found as below.

a) Mark the position of the focus of the objective as F_o on the side of the object and clearly explain the reason for choosing that position.

……

……

b) Using 2 rays from the object, form the final image, and name it.

……

……

c) The focal length of the lenses used are 5cm and 10cm. The least distance of distinct vision of the viewer is 25cm.

i) Calculate the object distance for the eyepiece.

……

……

……

ii) Calculate the linear magnification (m_e) by the eyepiece.

……

……

iii) The distance of the object from the objective is 6cm. Calculate he linear magnification (m_o) by the objective.

……

……

iv) Write down the angular magnification of the instrument in terms of m_o and m_e and calculate its value.

……

……

d) In an optical instrument, the best position to place the eye and view is the eyering.

i) What is an eyering?

……

……

ii) What is the benefit of placing the eye at the eyering?

……

……

iii) Calculate the position of the eyering

……

……

குறியீடு

தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்
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3rd Term Examination - 2022

பௌதிகவியல் - II B Physics - II B	Gr -12 (2022)	01	E	II B

Part – II - B

Essay Questions.

❖ **Answer any two questions.**

01. Figure (i) shows two masses m_1 and m_2 $(m_1 > m_2)$ attached to the ends of a light string, which is placed over a pulley.

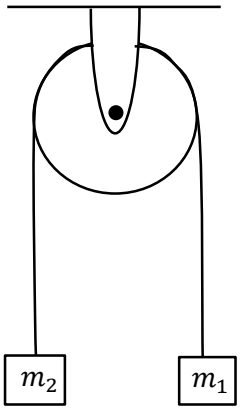


Fig (i)

a) For this section assume that the mass of the pulley is negligible, the axle of the pulley is smooth and there exist sufficient friction between the pulley and the string.

i) Find the tension in the string and the acceleration of the masses when the system is released to move freely.

ii) If mass m_1 moves downwards with uniform velocity V when an external torques is applied to the pulley.

a) Find the tension in the string on either sides of the pulley.

b) What is the external torque given to the pulley and its direction? (Assume that the radius of the pulley is r)

iii) What is the external torque and its direction to be given to the pulley for the mass m_2 to move downwards with uniform velocity V?

b)

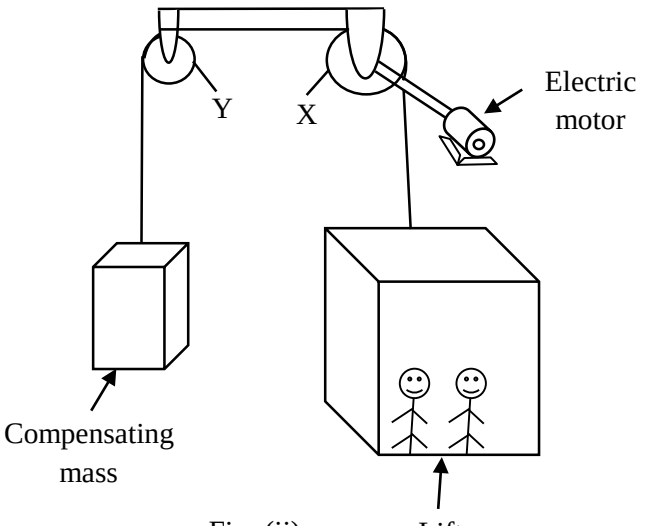


Fig (ii)

Figure (ii) shows the simplified diagram of a lift. The mass of the lift is 200kg and the compensating mass is 400 kg. It can carry at most 8people each of 50kg. Assume that the pulley Y is

massless and smooth. The pulley X is same as that in section (a). The diameter of the pulley X is 20cm Consider the situation of 8 people travelling in the lift. Make use of the results obtained in section (a)

i) When the system is released to move freely, find the acceleration of the lift and the tension in the cable.

ii) When the lift is moving downwards with uniform velocity $5\ ms^{-1}$
   a) Find the tension in the cable.
   b) What is the torque provided by the electric motor?
   c) What is the operating power of the motor?

iii) When the is moving with uniform velocity, how many people can be there for the motor to operate at low power?

iv) What is the power consumed by the motor when 8 people are in the lift and moving at $5\ ms^{-1}$ under the situation the compensating mass is zero.

v) What is the advantage of using compensating mass in a lift?

02. When there is relative motion between a source of sound and an observer, the frequency perceived by the observer is altered from the actual frequency f_o, which is known as Doppler effect

$$\text{Apparent frequency} = \frac{\text{Velocity of sound relative to the observer}}{\text{The wavelength of sound wave arriving the observer}}$$

As shown in the figure, a boy in between two identical speakers A and B is running to the right with uniform velocity U_o. Assume that the velocity of sound in air as C.

a) i) Find the wavelength created by speaker A in terms of C and f_o

ii) What is the difference in wavelengths received by the boy from the two sound sources.

iii) Find the velocity of sound created by the loud speaker A relative to the boy in terms of C and U_o using principle of relativity.

iv) By using the above equations, obtain the apparent frequency f' created to the boy by speaker A in terms of given quantities.

v) Similarly, give the apparent frequency f'' created to the boy by the speaker B in terms of given quantities.

vi) What do you understand by beat frequency?

vii) Give the beat frequency perceived by the boy in terms of the above quantities.

viii) When the frequency of a speaker is 286Hz, speed of sound in air is $343\ ms^{-1}$, the boy perceived 20 beats in two seconds, find the velocity of the boy. (Approximate your answer to a whole number

ix) Sketch a graph showing the variation of beat frequency with distance as the boy is moving from X to Y with the same velocity.

b) Now, if wind is blowing from A to B with uniform velocity V

i) What is the wavelength of the sound reaching the boy from the speaker A.

ii) What is the frequency of sound wave reaching the boy?

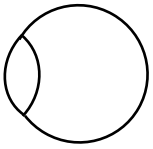
iii) Deduce the frequency of sound waves arriving that boy, which is created by the speaker B.

c) When the distance between the speakers is 40 m and the boy is standing at the middle point between them, the power of a speaker 7.2 W and assume that the speaker as a point source of sound.

i) What is the intensity of sound heard by the boy? (Toke $\pi = 3$)

ii) What is the intensity level of sound heard by the boy? ($\log_{10} 3 = 0.477$)

03. The range of vision of a person is between 50 cm and 400 cm. The distance between eye lens and retina is 2.5cm. The figure shows a simplified diagram of an eye including its lens. (copy and use this diagram when drawing ray diagrams)



a) i) Draw a ray diagram when he is clearly viewing a point source of light placed at his near point.

ii) What is the power of the eye lens in this situation?

b) The above person, who is affected by both defects long sight and short sight decided to use a spectacle. In this spectacle two lenses are fixed.

i) a) What kind of lens to be fixed in the upper part of the spectacle?

b) Draw ray diagrams for short sighted eye and for the method of correcting the defect.

c) What is the power of the lens used?

ii) a) What kind of lens to be fixed to the lower part of the spectacle.

b) Draw ray diagrams for the longsighted eye and for the method of correction for the defect.

c) What is the power of the lens used?

c) Due to defect during birth, Due to defect during birth the distance between eye lens and retina is 2.6cm and the eye has a focusing range of an eye lens with no defect.

i) Find the range of vision of the eye with no defect.

ii) Find the range of field of view of the child with birth defect.

04. a) i) State Boyle's law and Charles law.

ii) Using the above laws, obtain an equation for a combined gas law and hence, write down the ideal gas equation.

iii) Write down kinetic equation of an ideal gas and identify the symbols.

iv) Using the equations you wrote in sections (ii), (iii), show that the average kinetic energy of a gass molecule as $E = \frac{3}{2} kT$ (Where k – Boltzman constant)

b) A motorcycle tyre contains gas at temperature $27^{\circ}C$ and pressure $2.5 \times 10^5\ Pa$. Air is stored in a cylinder at temperature $27^{\circ}C$ and pressure $5 \times 10^5\ Pa$.

i) Keeping the volume of the tyre at $0.1\ m^3$ without any change, find the volume of air to be sent from the cylinder to the tyre to increase the pressure to $3 \times 10^5\ Pa$

(Assume that the temperature rema ins constant at $27^{\circ}C$)

ii) When the motor cycle is driven at high speed, the temperature if the air in the tyre increases to $57^{\circ}C$ and the volume increases by 50% find the new pressure of air in the tyre.

iii) At temperature $57^{\circ}C$, deduce the average kinetic energy of a molecule of the air (Avogadros number is $= 6.02 \times 10^{23}\ mol^{-1}$, Universal gas constant $= 8.3\ \text{JK}^{-1}\ mol^{-1}$)