தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்

இரண்டாம் தவணைப் பரீட்சை - 2022

Conducted by Field Work Centre, Thondaimanaru.

2nd Term Examination - 2022

FWC

பௌதிகவியல் I Physics I	One Hour Gr -12 (2023)	01	E	I

Part – I

01) In the equation $\left(P + \frac{a}{V^2}\right)(v - b) = RT$ P – pressure and v – volume, dimensions of $\left(\frac{a}{b}\right)$ is.

(1) $ML^{-4}T^{-2}$ *(2)* ML^2T^{-2} (3) MLT^{-2}

(4) $ML^{-2}T^{-2}$ *(5)* $ML^{-1}T^{-2}$

02) Which measurement cannot be obtained using vernier caliper, micrometer screw gauge, travelling microscope and meter ruler?

(1) 3.51mm (2) 100.5mm (3) 875mm

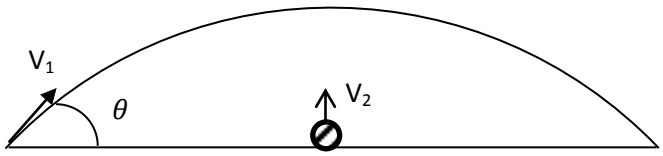
(4) 501.25mm (5) 2.06mm

03) A solid block is on the smooth horizontal table, a bullet collides and embeds itself in the solid block. In the meantime conserves.

(1) only kinetic energy *(2)* Only momentum *(3)* Only momentum

(4) momentum *(5)* momentum and total energy

04)



A particle A is projected with velocity V_1 at an angle θ with horizontal as shown in the figure at the same instant another particle B is thrown vertically with velocity V_2 a point directly below the path of maximum height reached 'A'. What is the value of $\frac{V_1}{V_2}$ both particle collide each other?

(1) $\cos\theta$ *(2)* $\sin\theta$ *(3)* $\frac{1}{\sin\theta}$

(4) $\frac{1}{\cos\theta}$ (5) 1

05) A wheel rotating about its axis at 300 revolution per minute with an angular acceleration $10\pi\ rads^{-2}$ it angular velocity after 5 sec is .

(1) $20\ rads^{-1}$ *(2)* $40\ rads^{-1}$ *(3)* $20\pi\ rads^{-1}$

(4) $40\pi\ rads^{-1}$ (5) $60\pi\ rads^{-1}$

06) A particle is thrown vertically in region of air resistance.

A – During the upward motion, deceleration of the particle decrease from the certain value.

B - acceleration of the particle at the maximum point is the gravitational acceleration.

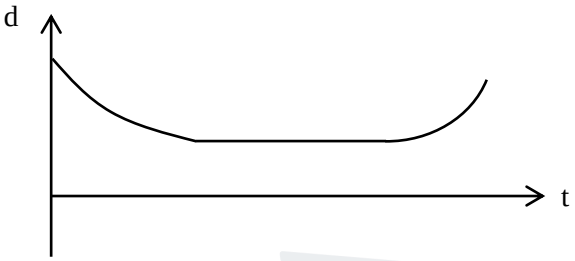
C - Cannot be used linear motion equations, in presence of air resistance

Of the above statements.

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

(4) all A, B, C are correct (5) Only C is correct

07) A body displacement – time graph as shown in the figure below corresponding speed time graph is best represented by



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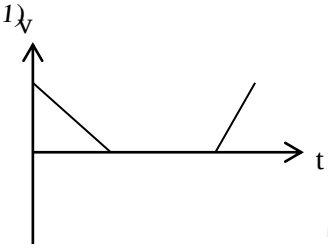

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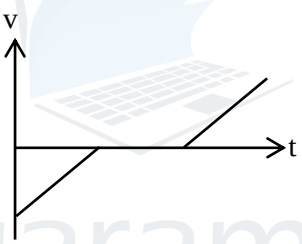

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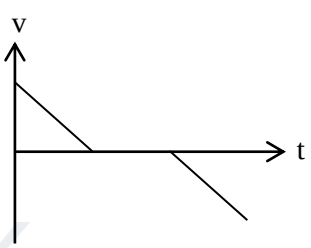

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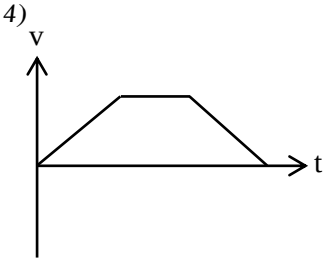

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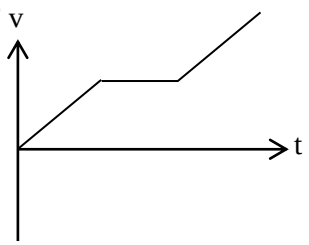
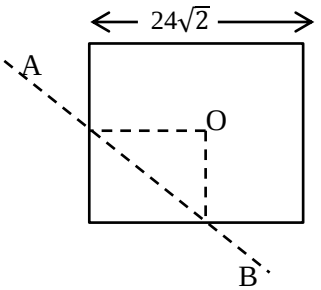


08) A uniform square plate of side length $24\sqrt{2}\,cm$ is folded through the line AB as shown in the figure, where O is the centre of the square plate. What is the distance, the center of gravity of square plate moves now? (The centre of gravity of a triangular plate of height h is, at a distance from apex is $\frac{2h}{3}$)

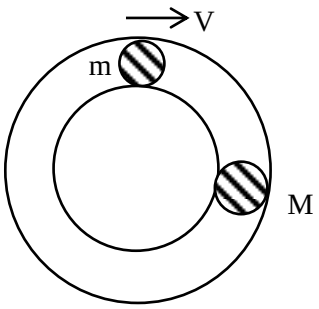


(1) 3cm (2) 6cm

(3) 4cm (4) 2cm

(5) 1cm

09) A mass M is at rest in a smooth circular tube towards which a mass m is thrown with a velocity V. If the collision is perfectly elastic, consider the following statements about the time from the first collision to the next collision, (r mean radius of tube).



A) M = m for $T = \frac{2\pi r}{V}$

B) M= 2m for T is grater than $\frac{2\pi r}{V}$

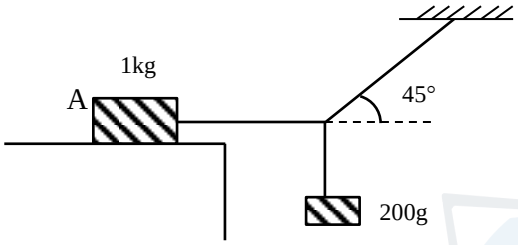
C) T doesn't depend on mass M.

of the statements

(1) only (A) is correct (2) Only B and C are correct (3) Only A and C are correct

(4) Only A and B are correct *(5)* all A, B and C are correct

10)

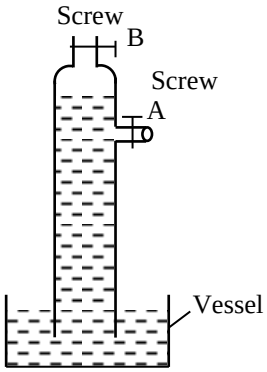


A block A of mass 1kg is placed on a rough table as shown in the figure. If the system is in limiting equilibrium find the coefficient of friction between A and the table?

(1) 0.2 (2) 0.1 (3)0.5

(4) 0.3 (5) 0.4

11)



The liquid is drawn into the vessel as shown in the figure, consider following stetements..

A - When screw A is opened, the liquid will only flow out through it.

B - If the screw A is opened the liquid will drop down and remain at the vessel level

C - If the screw A is opened the liquid will drop down and remain at the level of A

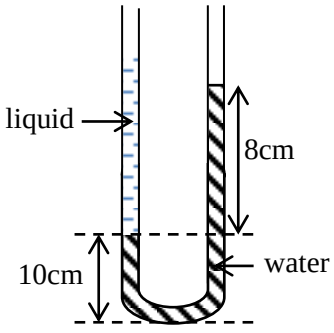
D - Either screw A or B is opened, the liquid level will drop down to reach the vessel level

(1) Only A is correct *(2)* Only B and C are correct

(3) Only A and B are correct (4) Only B, C and D are correct

(5) Only B and D are correct

12)



The U – shaped tube shown in the figure contains water and a liquid of relative density 0.8, A small crack has formed at a height of 18 cm from the bottom of the tube through which the liquid leaks and reaches equilibrium again, by how much height does common level change?

(1) falls 2 cm.

(2) rise by 1.33 cm.

(3) rise by 2 cm.

(4) falls 1.33 cm.

(5) will not change.

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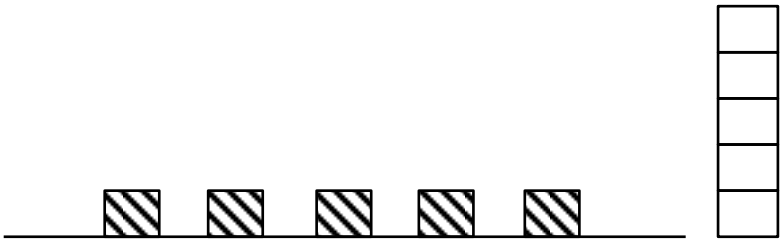
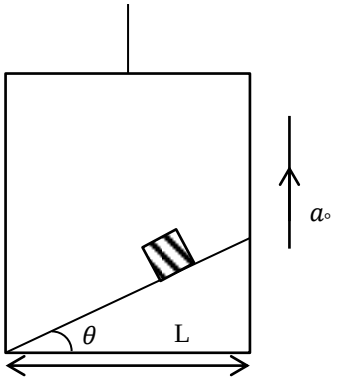
13)



What is the minimum work required to stack five cubes of side length a and mass m on top of each other?

(1) 8mga (2) 12.5mga (3) 10mga
(4) 12mga (5) 6mga

14) A smooth inclined plane making an angle θ with the horizontal is placed in an elevator moving upward with acceleration a_0 as show in the figure. What is the time taken by the mass m on the inclined plane to reach the bottom of the inclined plane from the top of the plane?

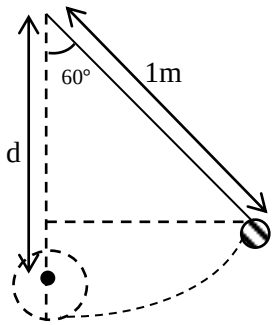


(1) $\left(\frac{2L}{(g+a_0)\sin 2\theta}\right)^{\frac{1}{2}}$ (2) $\left(\frac{4L}{(g+a_0)\sin 2\theta}\right)^{\frac{1}{2}}$

(3) $\left(\frac{(g+a_0)\sin 2\theta}{2L}\right)$ (4) $\left(\frac{2L}{(g+a_0)\sin\theta}\right)^2$

(5) $\left(\frac{4L}{(g+a_0)\sin 2\theta}\right)^{\frac{1}{2}}$

15) A 1m long pendulum is held at an 60° with vertical and release it as shown in the figure. What is the minimum length d at which horizontal thin peg should be kept so that pendulum make complete circular motion?



(1) 0.8m (2) 0.6m
(3) 0.9m (4) 0.7m
(5) 0.2m

16) A body in simple harmonic motion has angular velocity ω and amplitude a. What is the ratio of kinetic energy and potential energy at a distance x from oscillating centre?

(1) $\frac{x^2}{a^2-x^2}$ (2) $\frac{x^2}{a^2+x^2}$ (3) $\frac{a^2-x^2}{x^2}$
(4) $\frac{x}{a-x}$ (5) $\frac{a-x}{x}$

17) Consider the following statements about waves.

A- A wave passing through different planes under goes polarization as its intensity decreases
B- Electro magnetic waves doesnot diffraction.
C- Beasts are formed when two identical waves supper position each other.

Which of the above statement / statements is / are true?.

(1) Only A (2) Only B (3) Only C
(4) Only A and B மும் (5) Only B and C

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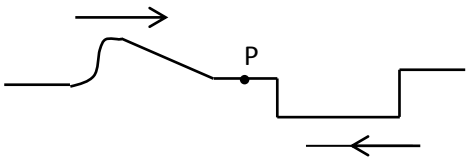
18) The frequency of B is 3% more than the frequency of A the frequency of C is 2% less then that of A. If B and C are played for 20 beats for two seconds, the frequencies of B and C are respectively.

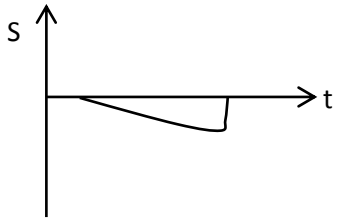
(1) 100Hz, 103Hz (2) 98Hz, 103Hz (3) 116Hz, 110Hz

(4) 103Hz, 98Hz (5) 206 Hz, 196 Hz

19) The figure shows two pulses travelling at the same speed in opposite directions in a string. Initially the pulses are equidistant from P. A graph showing displacement (s) at point P versus time T



1)



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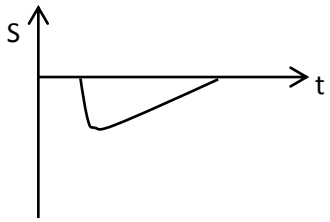

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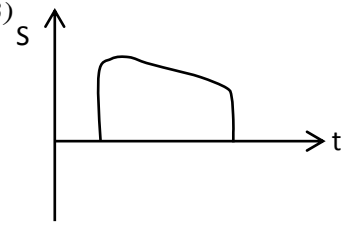

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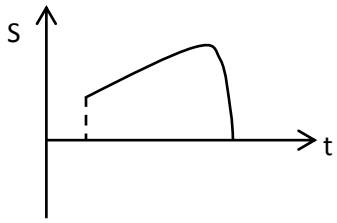

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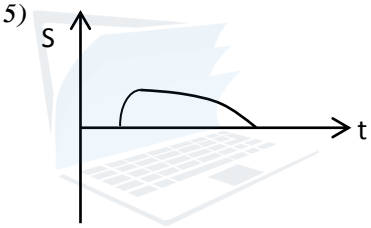


20) Two strings of the same length are made of the same material. If the fundamental frequency of both strings are same the tensions of the strings are T_1, and T_2 respectively and the diameters are d_1, and d_2 respectively the correct relationship is.

(1) $\frac{T_1}{d_1} = \frac{T_2}{d_2}$ (2) $\frac{T_1}{d_1^2} = \frac{T_2}{d_2^2}$ (3) $\frac{T_1^2}{d_1} = \frac{T_2^2}{d_2}$

(4) $\frac{T_1^2}{d_1^2} = \frac{T_2^2}{d_2^2}$ (5) $T_1 d_1^2 = T_2 d_2^2$

21) Choose the wrong statement among the following statements about tsunami wave .

(1) It is generated by earthquakes under the sea

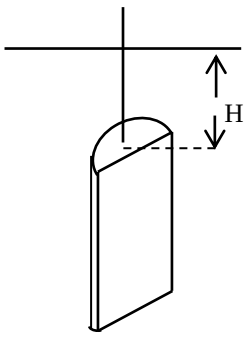
(2) When the tsunami wave reaches the coast, its amplitude decreases

(3) When the tsunami wave reaches the coast, its wave length decreases

(4) When the tsunami wave reaches the coast, its frequency do not change.

(5) The tsunami wave is a surface wave

22) A semi – circular solid cylinder of radius r and height h is immersed by means of a string at depth H from the surface of a liquid of density ρ as shown in the figure A thrust caused by a liquid on a curved surface.

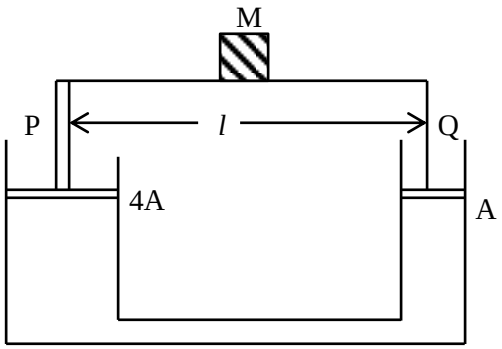


(1) $2rh\left(\frac{h+H}{2}\right)\rho g$ (2) $\pi rh\left(H+\frac{h}{3}\right)\rho g$

(3) $\pi rh\left(\frac{H+h}{2}\right)\rho g$ (4) $2rh\left(H+\frac{h}{2}\right)\rho g$

(5) $\frac{1}{2}\pi r^2 h\rho g$

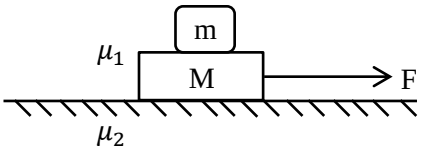
23) The figure shows pistons of cross – sectional area 4A and A are joined together by light rod and filled with incompressible liquid. What is the distance between pistion P and the centre of gravity of mass M is placed on a light rod and the rod is seen as horizonatal?



(1) $\frac{4l}{5}$ (2) $\frac{l}{3}$ (3) $\frac{2l}{3}$

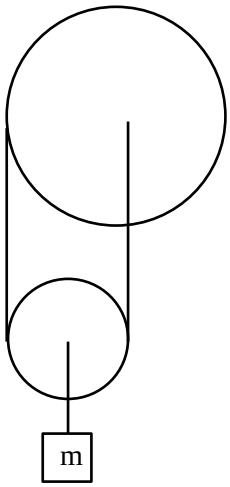
(4) $\frac{l}{2}$ (5) $\frac{l}{5}$

24) The coefficient of friction between the masses in the system shown in figure is μ_1. The maximum force F required by the mass m to move without slip on mass M is (the cefficicnt of friction between M and floor is μ_2



(1) $(M+m)\,(\mu_1-\mu_2)g$
(2) $(M-m)(\mu_1+\mu_2)g$
(3) $(M+m)(\mu_1+\mu_2)$
(4) $(\mu_1 m+\mu_2 m)g$
(5) $(\mu_1 m-\mu_2 m)g$

25) A pulley of moment of Inertia I and radius r, feely rotates about horizontal axis. The thread is wound on the pulley and the other end is kept with the weightless pulley and mass m is hung from axis of the pulley as shown in the figure. If the system is released from rest down ward acceleration of m is.



(1) $\frac{mgr^2}{2I+mr^2}$
(2) $\frac{mgr^2}{3I+mr^2}$
(3) $\frac{mgr^2}{5I+mr^2}$
(4) $\frac{3mgr^2}{4I+mr^2}$
(5) $\frac{mgr^2}{4I+mr^2}$

FWC

தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்

இரண்டாம் தவணைப் பரீட்சை - 2022

Conducted by Field Work Centre, Thondaimanaru.

2nd Term Examination - 2022

பௌதிகவியல் - II A Physics - II A	Two Hours 10 min Gr -12 (2023)	01	E	II A

Part - II

Structured essay

✶ **Answer all four questions in this paper itself.**

01) A student plans to find the acceleration due to gravity using a simple pendulum, for this he obtained simple pendulum, a cork cut vertically in the middle, a stand, a stop watch required amount of light string.

(a) i) What are the additional items, the student wants to carry out this experiment successfully?

.....

ii) If maximum error of the stopwatch is 0.5 *s* and period of the pendulum is 2.0 *s*, what is the number of oscillations of the pendulum to change the percentage of error of the time measurement to 1% ?

.....

.....

.....

(b) The length of the pendulum shown in the figure is (ℓ) and the period of oscillation is T.

i) What is the length of the pendulum considered to be?

.....

.....

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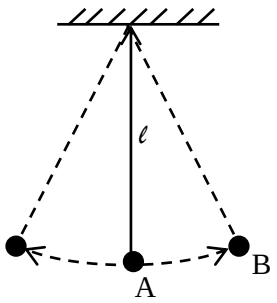

Fig (1)

ii) Write the equation for the period of oscillation T and identify the additional quantities.

.....

.....

.....

iii) State the valid condition for T that you wrote in b (iii).

.....

iv) Choose the most appropriate length from the following lengths for the initial length of the pendulum. state the reasons for not choosing the other two lengths 20 cm, 40 cm, 70 cm .

.....

.....

.....

v) What are the two processes that must be observed when a pendulum oscillates?

.....

.....

vi) To which point (A/B) would you direct one of the items specified in part a (i) to facilitate counting the oscillations? What would be the advantage?

.....

.....

vii) Draw the displacement – time graph of a pendulum left to oscillate in air.

(c) i) Rewrite the equation given in part b(ii) to find the acceleration of the gravity (g) by staright line graphing method.

.....

.....

ii) Calculate value of g given that the gradient of the graph is 4.0 s^2m^{-1} and $\pi = 3.14$ (Get the answer in two decimal)

.....

.....

iii) Write and expression for the error in the value of g that you predict, assuming that the value of g is $9.8ms^{-2}$.

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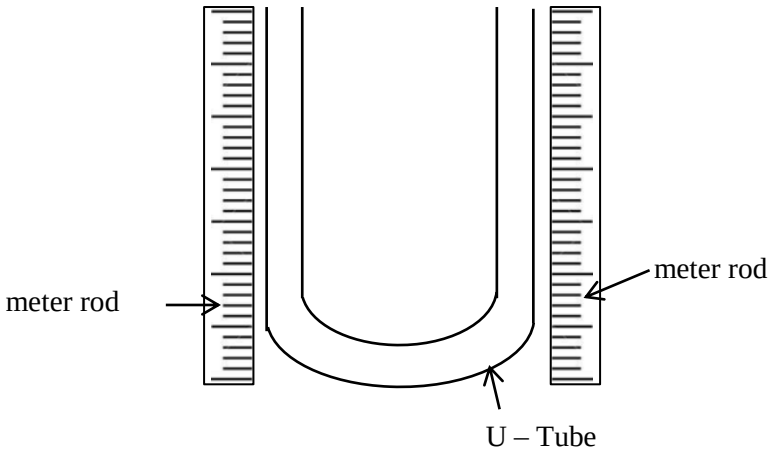
02) The relative density of a liquid with lower density than water has to be measured using a U tube. In complete diagram of the practical arrangement is given below.



(a) What is the main characteristic of a liquid to measure relative density using U tube?

.....

(b) i) Draw and denote the water and liquid levels in U tube.

ii) Mark, height of the water column h_w and height of the liquid column h_l in the above diagram .

iii) Label the readings to be taken as x, y, z

x- .....

y- .....

z- .....

iv) Write the expressions for h_w and h_l in terms of x, y, z.

h_w - .....

h_l - .....

v) What is the additional item to be used while taking readings for length scale?

.....

(c) Taking atmospheric pressure as π

i) The pressure at the common interface in terms of π, h_l and ρ_l (ρ_e – density of liquid)

.....

ii) Write the pressure at the common interface in terms of π, h_w and ρ_w (ρ_w – density of water)

.....

.....

iii) Obtain the relationship between above results in a(ii) and rearrange for linear graph.

.....

.....

.....

(d) i) What to do to get different readings.

.....

.....

ii) If the coordinates of the two points in the draw graph is (2.5,3.5), (9.5,9.8) find the relative density of liquid.

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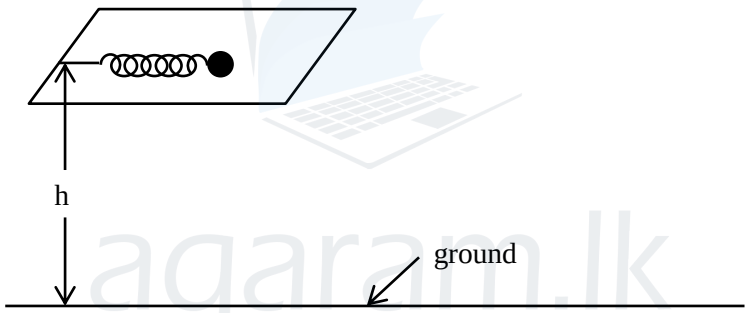
03) In cricket, bowling equipment is used for batting practice A student says that spiral spring can be used in the equipment. A student decides to find the force constant of the spiral spring through a simple experiment.



When a student compresses the spring to a distance x from its natural length and puts a ball of mass m in contact with it and releases it slowly, the ball runs on a smooth surface and then hits the ground.

(a) i) Write an expression for the energy stored in a spring of force constant k when it is compressed.

.....

ii) Write the equation for the kinetic energy of the ball when it leaves the spring.

.....

.....

iii) Derive an expression for the velocity U of the ball.

.....

.....

(b) If initial height of the ball from the ground is h,

i) Write the expression for the total energy of the ball as it leaves the spring.

.....

.....

ii) Neglecting the effects of air resistance and obtaining the expression for the velocity at which the ball hits the ground.

.....

.....

(c) i) Find the time taken by the ball to hit the ground after leaving the spring.

.....

.....

ii) Obtain the expression for the horizontal displacement (d) from the point of release to the moment of impact with the ground.

.....

.....

iii) Rearrange the expression to measure and plot the horizontal displacement for different values of compression length in the spring.

.....

.....

iv) Draw the rough sketch.

v) Give two reasons why the actual value of *k* may differ from the value of *k* obtained from gradient of the graph.

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04) The figure shows practical arrangement of the resonance tube for determining the velocity of sound in air and end correction of the tube. You are provided needed instrument and five, frequency known tuning forks, its frequencies are $256\ Hz,\ 312 Hz, 384\ Hz, 420\ Hz,\ 512\ Hz.$

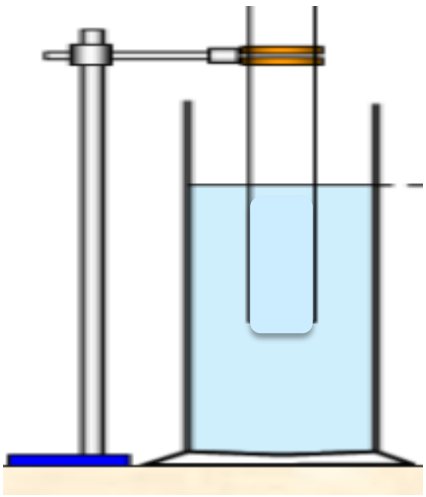

Fig (01)

a. The tube 'a' and tube 'b' to shown in figure (02) below, draw the displacement variation of the air and pressure variation of the air respeetively for the resonance state of the experiment. .

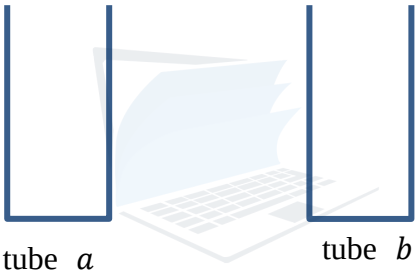

Fig (02)

b. Draw in figure (01) correctly any two instruments necessary for the experiment not given in figure (01) above.

c. What is the purpose of starting the experiment by completely immersing the tube in water?

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d. Maximum and minimum frequency of tuning forks are given to you mention the frequencies of X and Y.

X..... Y.....

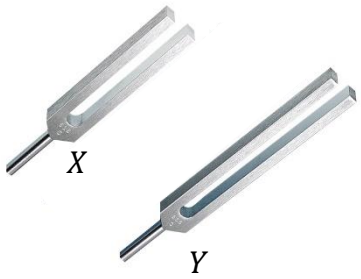

Fig (03)

e. What is the mean diameter of the resonance tube used in the laboratory?

.....

f. Find the wave length λ at the time of vibration in part (a) in terms of the effective length of tube l, and end correction of the tube e.

.....

.....

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g. Obtain the expression of velocity (v) of sound in air in terms of $l, e,$ and f where frequency of tuning fork f .

.....

.....

h. Rearrange the expression obtained in part (f) so as to draw a graph and specify the dependent and independent variable in the graph.

.....

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dependent variable:..... independent variable :.....

i. Draw the expected graph and label the axes.

j. Obtain velocity of sound $(v,)$ and end correction of the tube e in terms of gradient (m) and intercept (c) of the graph.

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k. The end correction $0.2\ cm$, and the velocity of sound $340\ m\ s^{-1}$ are known. Determine the minimum length of tube when tested using all the given tuning forks.

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தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்
இரண்டாம் தவணைப் பரீட்சை - 2022
Conducted by Field Work Centre, Thondaimanaru.
2nd Term Examination - 2022

பௌதிகவியல் - II B Physics - II B	Gr -12 (2023)	01	E	II B

Part - II

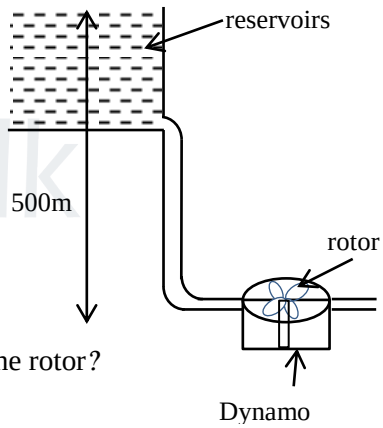
Essay

- **Answer only two questions.**

01) Most of Sri Lanka's electricity is derived from hydropower plants. Due to lack of consistent rainfall, the water level in the reservoirs is decreasing and the use of new electrical appliances also increase the demand for power consumption, this couses is a power shortage. At present the total power capacity is 152 GWh per annum (1 year – 365 days), To obtain this power electricity is generated in the following ways is being created

- ❖ 40% through hydropower
- ❖ 40% from coal power plant
- ❖ 20% from wind mills and solar cells,

A hydropower plant has its rotor at a depth of $500\ m$ below the reservoir surface water passes through a pipe of cross – sectional area $0.8\ m^2$ and strikes the rotor horizontally. The water exiting the impeller is in the same direction at *0.2* times the initial velocity. Density of water is $1000\ kg\ m^{-3}$



i) What is the velocity of the water leaving the pipe and reaching the rotor?

ii) What is the force acting on the rotor?

iii) If the diameter of the rotor is 2 m, what is the torque acting on it?

iv) What is the power transmitted by the rotor if the rotor rotates at constant rate of 25 rpm (take π =3)

v) Find the present day electrical energy consumption of Sri Lanka in J.

vi) If one dynamo can generate $16 \times 10^5 J$ of electrical energy per day then what is the number of dynamos required to obtain 40% of the electrical energy obtained from hydropower?

vii) 40% of electricity is generated using coal. $2 \times 10^3 kJ$ of electricity is generated by burning 1kg of coal find the mass of coal required per day.

viii) Assuming 10% electricity generation in Sri Lanka through solar power, the solar energy falling on the earth is $2\ kJ\ m^{-2}$. In this solar cell receives 50% of the energy and converts it into electricity. What is the area of solar cells required to generate this electricity?

ix) 5% of the total electricity consumption is derived from wind power generation. If one wind turbine can generate $20kJ$ of electricity per day then what is the required number of wind turbines?

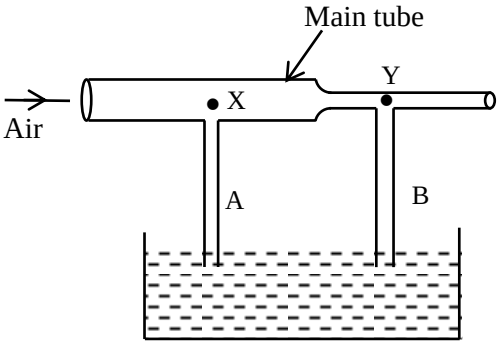
02) a) i) Bernoulli's equation can be written in usual symbols as $P + \frac{1}{2}PV^2 + hPg =$ constant where identify the terms $P, \frac{1}{2}\rho v^2$ and $h\rho g$.

ii) Give three conditions under which Bernoulli's theory is valid..

iii) Give two cases where the theory is applied.

iv) Explain how either of the two cases given in part a (iii) works.

b)



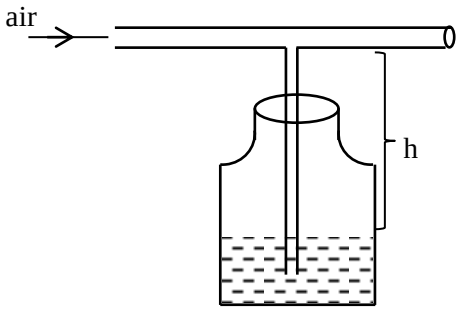
As shown in the figure, the liquid rises to the top of the tube A and B when the air is passed through the tube. But one of the student says that the liquid rise in tube B is higher than in tube A.

i) Do you agree with above statement? Give reason.

ii) Find the velocity V_y in Y, in terms of V_x, A_x, A_y using continuity of air in main tube. Where cross sectional areas of the main tube at point 'X' and point 'Y' are A_x are A_y respectively. Velocity of the air at point x and point y are V_x and V_y respectively.

iii) Take $V_x = V$ and find the liquid elevation in tube B in terms of $A_x, A_y, \rho_a, \rho, h, V$ (h - liquid elevation in tube A, ($\rho_a -$ density of air, $\rho -$ density of liquid)

c) Based on Bernoulli's theory, the student intends to make paint sprinkler. .



i) What is the minimum velocity of air required to flow through the tube to just spray the paint? Density of paint and air are ρ and ρ_a respectively.

ii) Find the minimum velocity of air, if density of Paint and air are $2500\ kg\ m^{-3}$ and $1 kgm^{-3}$ respectively, as well as the paint is at a depth of 10 cm from the delivery tube (take $\sqrt{2} = 1.4$)

iii) The student proposes that the paint container should not be tightly closed. Do you agree? Give reasons.

iv) Draw a diagram of a possible modification in this equipment to reduce the required velocity of air as the velocity of air predicted in C (ii) above is found to be too high.

03) Air musical instruments are played with the fingers closing or opening the holes in them to change the length of the tube. Our oral cavity is a single ended tube and the human ear functions like a single – ended air filled tube, here simultaneously the fundamental type and the overtones are formed. Different combinations of them are formed in different musical instruments, the sound coming out of our mouth are combinations of basic overtones determined by the position of the mouth, throat and tongue.

a)i) State any two factors on which the velocity of sound in a gas depends..

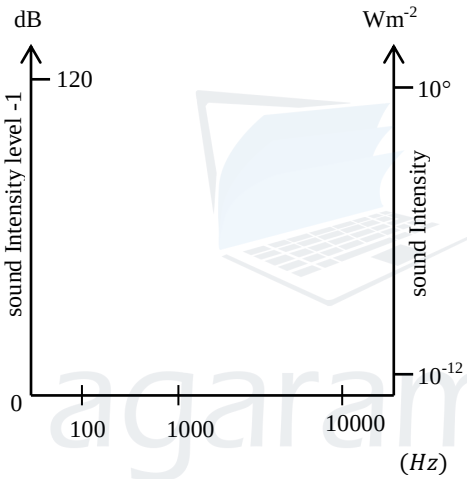
ii) Give and equation for the velocity of sound in a gas of molecular weight M and absolute temperature T.

iii) Draw the wave forms for the first three modes of vibration of one end closed tube. Let nodes (N) and antinodes (AN) denote them.

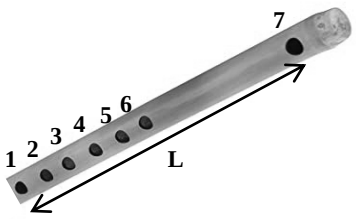
iv) Obtain the expression of the fundamental frequency f_0 in terms of length of the tube l and velocity of sound v.

v) If the length of the human ear canal is 2.5cm and the velocity of sound in the canal is $344ms^{-1}$ to calculate the high sensitivity frequency of the human ear.

vi) Mark this frequency on the hearing boundary graph is given below.



b) The flute is cosidered as an open tube at both ends and the loop flows back and forth when blown through the embouchure. When it is played, longitudinal standing waves are formed in the tube. The type of vbration created depends on the speed of blowing air. When the player blows too hard, the next three frequencies are generated $524Hz, 786Hz, 1048Hz$ respectively. Other frequencies between $524Hz - 786Hz$ and between. $786Hz - 1048Hz$ are not generated Here consider only the standing waves generated between the hole and the nozzle 7 (embouchure 7), Anti nodes are always formed in open holes. The speed of sound in air $366.8ms^{-1}$



i) Draw the wave form for the high note produced by the flute. Denote the closed holes and open holes.

ii) Draw the waveform for the low note produced by the flute. denote the closed holes and open holes.

iii) Draw the shape of the standing wave generated when only the first and sixth holes in the flute are open and find the wave length in terms of L.

iv) Calculate the fundamental frequency of the flute.

v) Find the length (L) of the flute.