FWC

# G.C.E. A/L Examination July - 2019

## Conducted by Field Work Centre, Thondaimanaru

## In Collaboration with

## Provincial Department of Education, Northern Province.

| Grade :- 12 (2020) | Physics | Time :- 1.00 Hour |
|---|---|---|

**Part – I**

❖ **Select the most appropriate answer.**

*01.* The unit of intensity of sound is

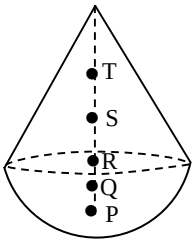
*1)* Hz *2.* dB *3.* $Wm^{-2}$ *4.* $Jm^{-2}$ *5.* W

*02.* The specific heat capacity C of a substance is given by the equation, $C = A + BT^2$, where T is temperature. The dimensions of A and B respectively are.

*1)* $L^2\ T^{-2}\theta^{-1}, L^2\ T^{-2}\ \theta^{-3}$ *2)* $LT^{-2}\ \theta^{-1},\ LT^{-2}\ \theta$ *3)* $L^2\ T^{-2}\theta,\ L^2\ T^{-2}\ \theta^{-1}$

*4)* $L^2\ T^2\theta^{-1},\ L^2\ T^2\ \theta$ *5)* $L^2\ T^{-2}K^{-1},\ L^2\ T^{-2}\ K$

*03.*




As shown in figure, a composite body is placed on a horizontal surface and given a small displacement. Depending on the position of the centre of gravity (G) of this composite body, its equilibrium position can be classified into three categories.

| | Position of G at stable equilibrium | Position of G at unstable equilibrium | Position of G at neutral equilibrium |
|---|---|---|---|
| 1) | P | R | Q |
| 2) | T | Q | R |
| 3) | P | R | S |
| 4) | S | R | P |
| 5) | Q | S | R |

*04.* When three different objects are placed on a rough inclined plane, they perform rotational motion without slipping.

Object A – Circular disc of mass 2m and radius r.

Object B – Circular disc of mass m and radius 2 r

Object C – Circular disc of mass m and radius r

The time taken to arrive the ground are $t_A$ , $t_B$ and $t_C$ respectively, then

1) $t_B > t_A > t_C$ 2) $t_C > t_A > t_B$ 3) $t_A = t_B > t_C$

4) $t_A = t_B < t_C$ 5) $t_A = t_B = t_C$

*05.* Consider the following statements about a particle performing simple harmonic motion.

A. The period depends on the amplitude of the particle.

B. The maximum velocity of the particle depends on the amplitude.

C. The acceleration of the particle is always in the direction of the motion.

1) A only true 2) B only true 3) A and B are true

4) A and C are true 5) A, B and C are all true

*06.* In which of the following situation electromagnetic waves are not created?

1) During lightning
2) During the operation of an electric cooker.
3) When spreading the ultrasonic sound waves.
4) When operating television
5) When an electric bulb is glowing

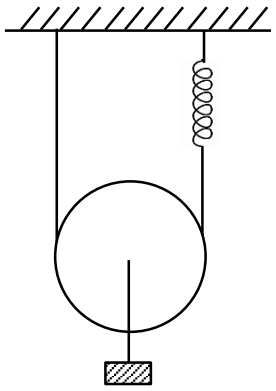
*07.* In a particular thermometer, the distance between $O^{\circ}C - l^{\circ}C$ markings is 5mm. If in a similar thermometer, the mercury bulb is doubled and the area of cross–section of the capillary tube is halved, what would be the distance between $O^{\circ}C - l^{\circ}C$ markings.

*1)* $1.25\ mm$ *2)* $5\ mm$ *3)* $10\ mm$ *4)* $20\ mm$ *5)* $40\ mm$

*08.* In a room of volume $10m^3$, the air is at $25^{\circ}C$ and its relative humidity is 90%. The air in the room is dried using a dehumidifier until the relative humidity of the air is reduced to 40% of its initial value without changing the temperature of the air. The absolute humidity of saturated water vapour at $25^{\circ}C$ is $30\ gm^{-3}$. Find the absolute humidity of the dried air in the room.

*1)* $27\ gm^{-3}$ *2)* $10.8\ gm^{-3}$ *3)* $15\ gm^{-3}$ *4)* $12\ gm^{-3}$ *5)* $15.2\ gm^{-3}$

*09.*



As shown in the figure, a light inextensible string is passing around a smooth light pulley and it is attached to a spring having spring constant K. When a mass is suspended to the pulley, the pulley moved downwards through a distance of x and attained equilibrium. The mass attached the pulley is given by.

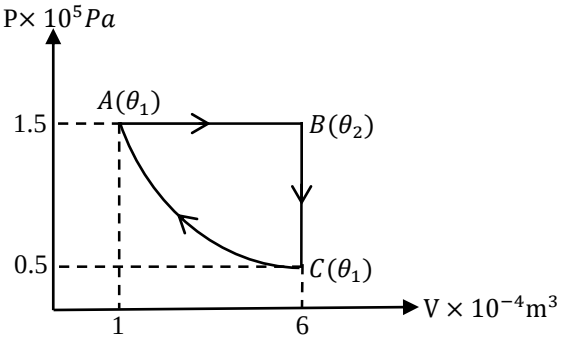
*1)* $\frac{Kx}{g}$ *2)* $\frac{2\,Kx}{g}$ *3)* $\frac{3\,Kx}{g}$

*4)* $\frac{4\,Kx}{g}$ *5)* $\frac{5\,Kx}{g}$

*10.* The range of vision of an old lady is found to be from 50 cm to infinity. For her to read a book held at a distance of 25 cm, the kind of lens and its focal length, she should wear is given by.

| | **Kind of lens** | **Focal length** |
|---|---|---|
| 1) | Convex | 50 cm |
| 2) | Concave | 50 cm |
| 3) | Convex | 25 cm |
| *4)* | Concave | 25 cm |
| *5)* | Convex | 75 cm |

*11.*



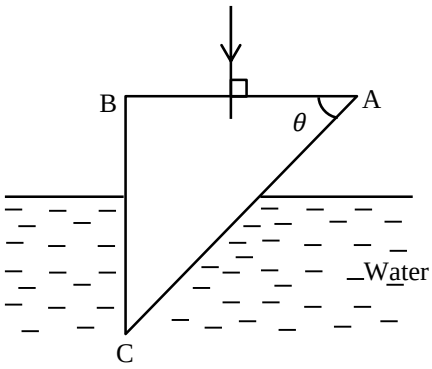

A ⟶ B Process, the temperature increases from, $\theta_1$ to $\theta_2$

B ⟶ C Process, the temperature decreases from $\theta_2$ to $\theta_1$ during this 70 J of heat is given out.

C ⟶ A is an isothermal process; the heat supplied during the process $A \longrightarrow B$ is

1) 120 J 2) 145 J 3) 95 J 4) 05 J 5) 20 J

*12.* As shown in the figure, a triangular prism ABC made of glass having refractive index 1.5 is immersed in water having refractive index $\frac{4}{3}$. A ray of light enters through the face A.B in a perpendicular direction. For the ray not to emerge out of face AC, the $\theta$ should have range of values give by,




*1)* $\sin\theta > \frac{8}{9}$ *2)* $\sin\theta < \frac{8}{9}$ *3)* $\sin\theta < \frac{3}{4}$

*4)* $\sin\theta > \frac{3}{4}$ *5)* $\sin\theta < \frac{9}{2}$

*13.* A heating coil rated $10^3$W is used to boil a liquid. It is found that the rate of vaporization as $1gs^{-1}$ When the heating coil is replaced with double power, the rate of vaporization found to be $2.25\ gs^{-1}$. The specific latent heat of vaporization of the liquid is,

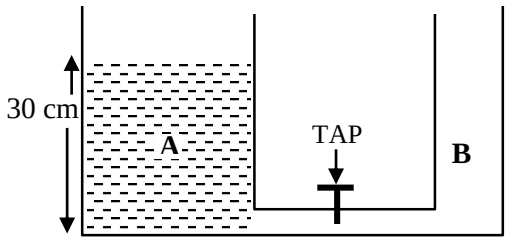
*1)* $2.25 \times 10^6$ J $kg^{-1}$ *2)* $8 \times 10^5$ J $kg^{-1}$ *3)* $3.36 \times 10^5$ J $kg^{-1}$

*4)* $1.6 \times 10^6$ J $kg^{-1}$ *5)* $8 \times 10^6$ J $kg^{-1}$

14. A telescope is set up in normal adjustment and a black line of length, $\ell$ is drawn on the objective lens. When the line is viewed through the eye-piece, the line found to have a length L. The angular magnification of the telescope is

1) $\frac{L}{\ell}$ 2) $\frac{\ell}{L}$ 3) $\frac{L}{\ell}-1$ 4) $\frac{\ell}{L}-1$ 5) $\frac{\ell}{L}+1$

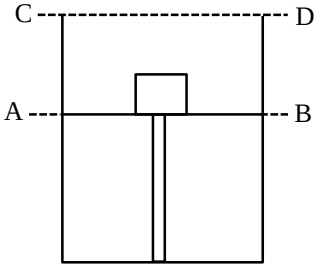
15.



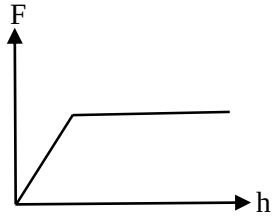

The cross-sectional area of vessel A is $50\ cm^2$ and it contains water to a height $30\ cm$. The vessel B has an area of cross-section of $25\ cm^2$. The two vessels are connected with a thin tube as shown in the figure, When the tap is slowly opened, and the water attained an equilibrium in both vessels. The reduction in the potential energy of the water is (Density of water is $1000\ kgm^{-3}$)

1) 7.5 J 2) 22.5 J 3) 0.75 J 4) 8.5 J 5) 75 J

16.




As shown in the figure, a rigid thin rod is fixed inside a vessel and a solid cube of density $\rho$ is attached on the top of the rod. Water having density $\rho_w$ ($>\rho$) is poured into the vessel. The graph which best shows the variation of force in the rod as water level rises from level AB to level CD is

1)
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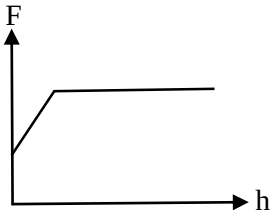


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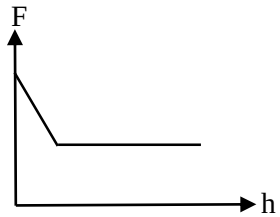
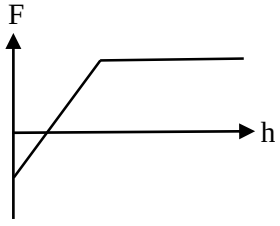
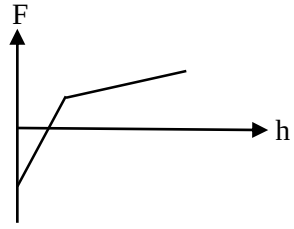
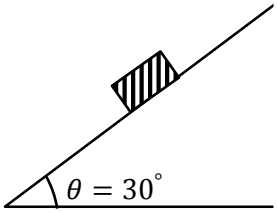



4)



5)


17. 


As shown in the figure, an object of mass m is placed on a rough inclined plane and it is in limiting equilibrium without slipping. When the inclination is increased to $60^\circ$,

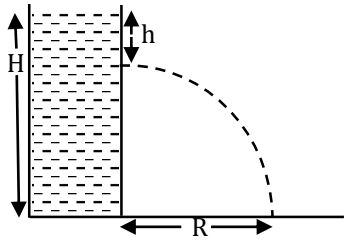
A) The coefficient of friction of the inclined plane is $\frac{1}{\sqrt{3}}$

B) When the inclination is $60^\circ$, the object will move with uniform acceleration of $\frac{g}{\sqrt{3}}$.

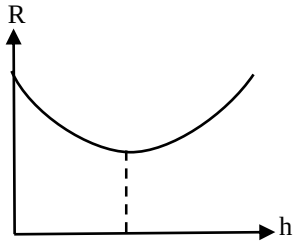
C) The frictional force do not change with the inclination of $30^\circ$ and $60^\circ$

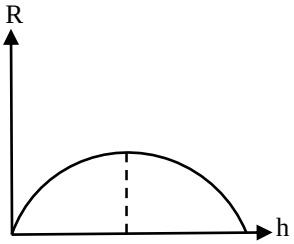
1) A only correct 2) B only correct 3) C only correct

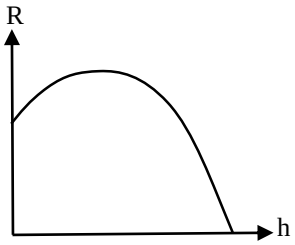
4) A and B are correct 5) A, Band C all are correct.

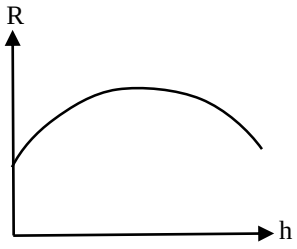
18. 

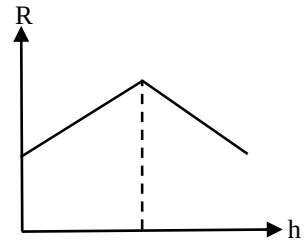

As shown in the figure, a tall vessel contains water up to a height H. There is a hole at a depth h from the water surface. Which of the following graphs best represents the variation of the horizontal range R attained by the water with h, as it comes out through the hole?

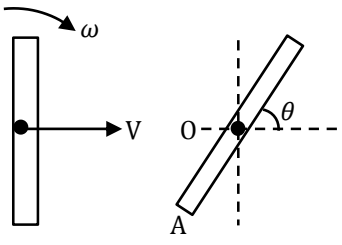
1) 


2) 


3) 


4) 


5) 

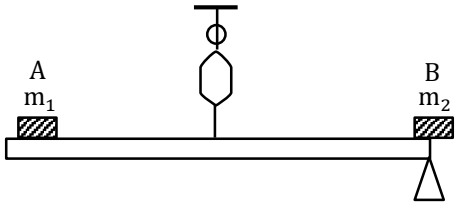

19. 


As shown in the figure, a rod of length $\ell$ rotates with an angular velocity, ω, about a horizontal axis passing through its mid-point $O$, and at the same time, the axis is moving horizontally with velocity V. Find the speed of lower end A of the rod at the moment the rod is making an angle $\theta$ with the horizontal.

1) $V + \ell\omega$ 2) $V + \frac{\ell}{2}\omega$ 3) $\left(V^2 + \frac{\omega^2\ell^2}{4} + \omega\ell\, V \sin\theta\right)^{\frac{1}{2}}$

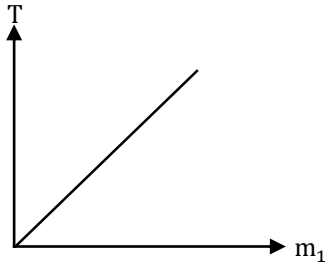
4) $\left(V^2 + \frac{\omega^2\ell^2}{4} + \omega\ell\, V \cos\theta\right)^{\frac{1}{2}}$ 5) $\left(V^2 + \frac{\omega^2\ell^2}{4} - \omega\ell\, V \sin\theta\right)^{\frac{1}{2}}$

*20.*

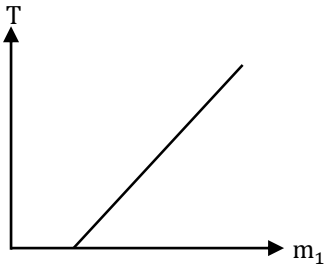



A uniform beam of mass M is suspended at its mid-point by a spring balance. Masses $m_1$ and $m_2$ $(m_2 > m_1)$ are placed on the beam at its end as shown in the figure, and it is supported by placing a wedge at the end B of the beam. The graph which shows the variation of the reading of the balance as the value of $m_1$ is varied is

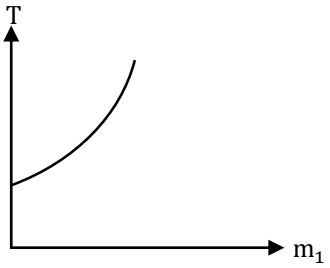
*1)*



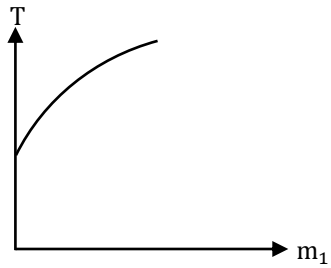

*2)*



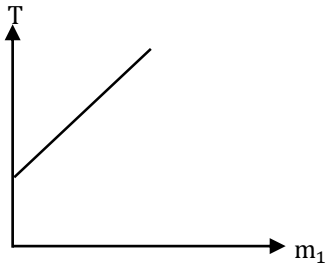

*3)*



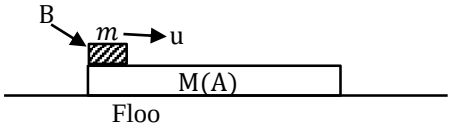

*4)*




*5)*

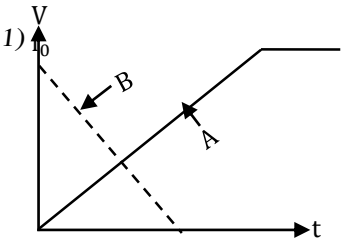



*21.*

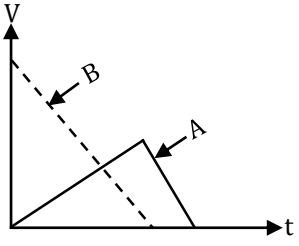



As shown in the figure, a wooden plank (A) of mass M placed on a rough horizontal floor and a block (B) of mass m on it, which is then projected with velocity U. If the friction between the surfaces cannot be ignored, which one of the following graphs best represents the velocity – time graphs for the plank and the block.

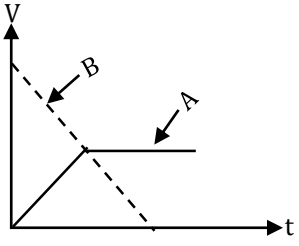
*1)*



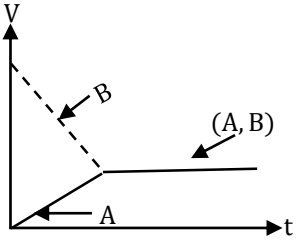

*2)*



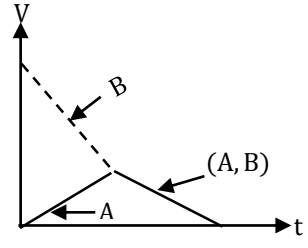

*3)*




*4)*




*5)*



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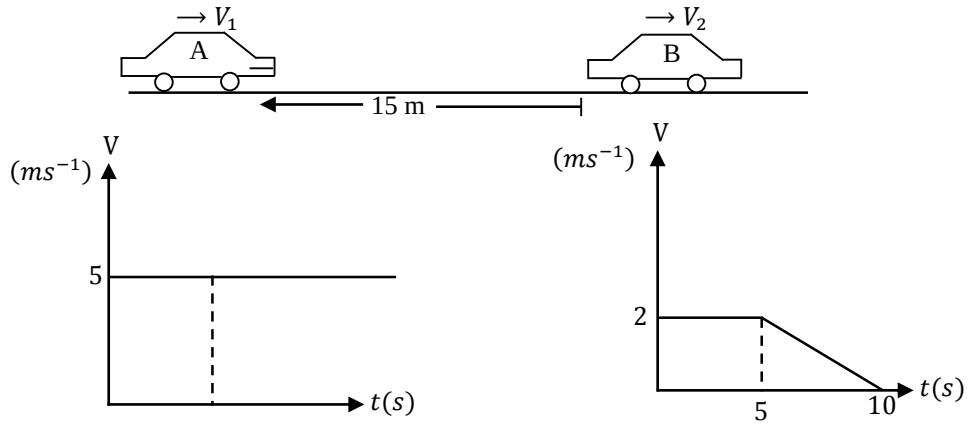
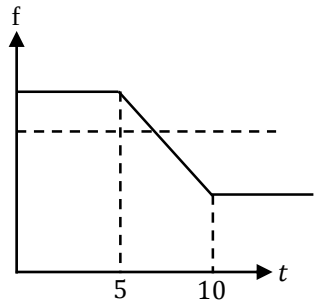
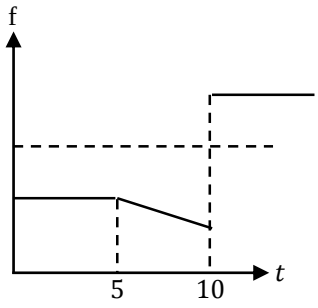



As shown in the figure, the velocity time graph of cars A and B are shown right below them. If car A is making a sound of frequency $f_0$, the variation of frequency (f) heard by the driver of B is best shown by.

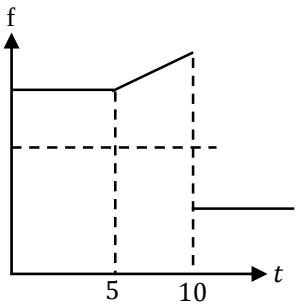
*1)*



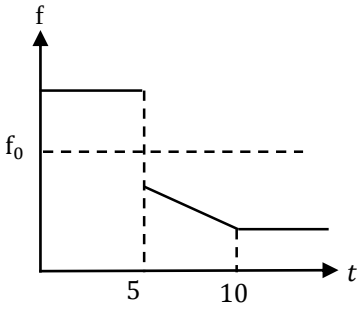

*2)*



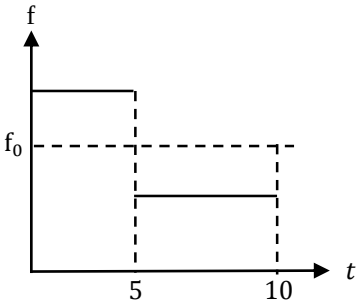

*3)*




*4)*




*5)*




*23.* Using two identical plano-convex lenses and water, 3 different lens combinations are made as shown in the figures.

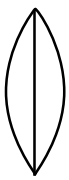


**Fig - I**

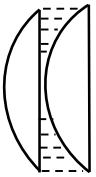


**Fig - II**

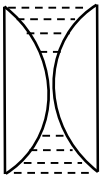


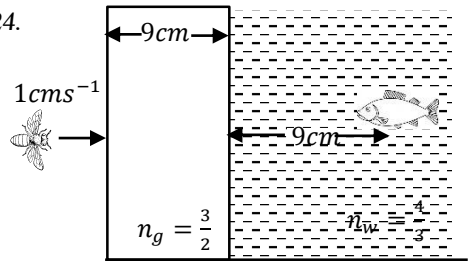
**Fig - III**

The focal length of the lens combination shown in figure I is 50 cm

The focal length of the lens combination shown in figure II is 60 cm

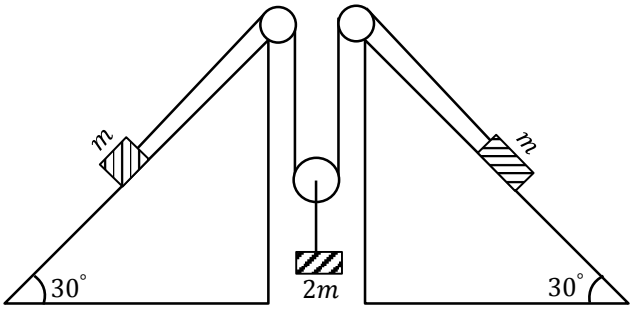
What is the focal length of the lens combination shown in figure III?

1) 75 cm 2) 25 cm 3) 100 cm 4) 50 cm 5) 90 cm

24. 


The thickness of the glass wall of an aquarium (fish tank) is 9 cm. For a fish, 9cm away from the glass wall, an insect appears to move with a speed of $1\ cms^{-1}$ in the direction as shown in the figure. What is the actual speed of the insect?

*1)* $2\ cms^{-1}$ *2)* $1\ cms^{-1}$ *3)* $0\ cms^{-1}$ *4)* $3\ cms^{-1}$ *5)* $0.75\ cms^{-1}$

25. 


The figure shows two fixed smooth inclined planes to which light smooth pulleys are attached. The acceleration of mass 2m is

*1)* $\frac{g}{4}$ downwards *2)* $\frac{g}{4}$ upwards *3)* $\frac{g}{3}$ downwards

*4)* $\frac{g}{3}$ upwards *5)* Zero

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# G.C.E. A/L Examination July - 2019

## Conducted by Field Work Centre, Thondaimanaru

## In Collaboration with

## Provincial Department of Education, Northern Province.

| Grade :- 12 (2020) | Physics | Time :- 2.00 Hours |
|---|---|---|

### Part – II A

### Structured Essay Questions

❖ **Answer all questions.**

*01.*

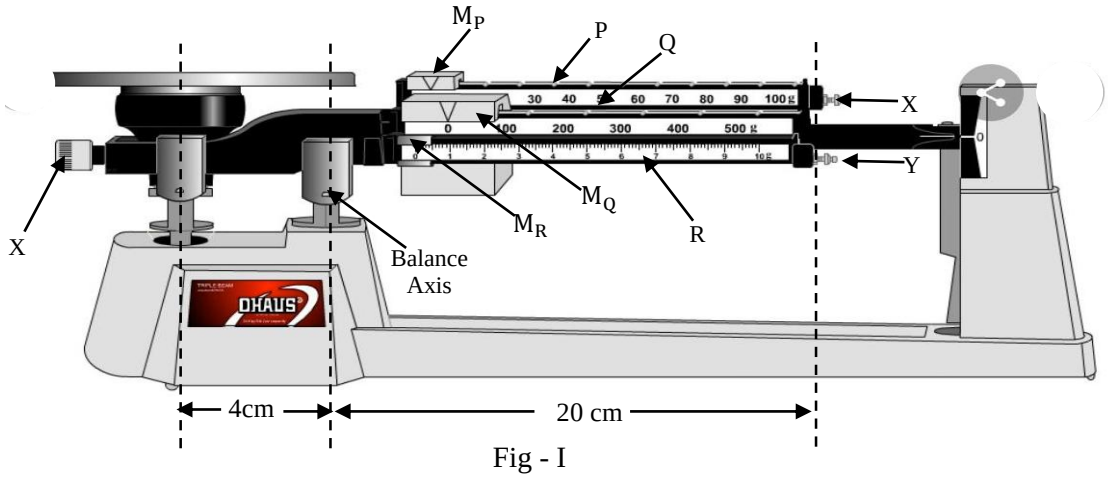



Fig - I

The figure I above, shows a simple diagram of a triple beam balance.

a) When masses are not suspended either at $x$ or $y$, using this balance,

i) What is the highest mass that can be measured?

……

ii) What is the least mass that can measured?

……

b) Before using triple beam balance, it has to be balanced.

i) How would you do this?

……

c) To obtain the mass of the object placed on the pan, the riders $M_P, M_Q,$ and $M_R$ to be correctly positioned. How each one is done?

i) Continuously:

……

ii) Separately in steps

……

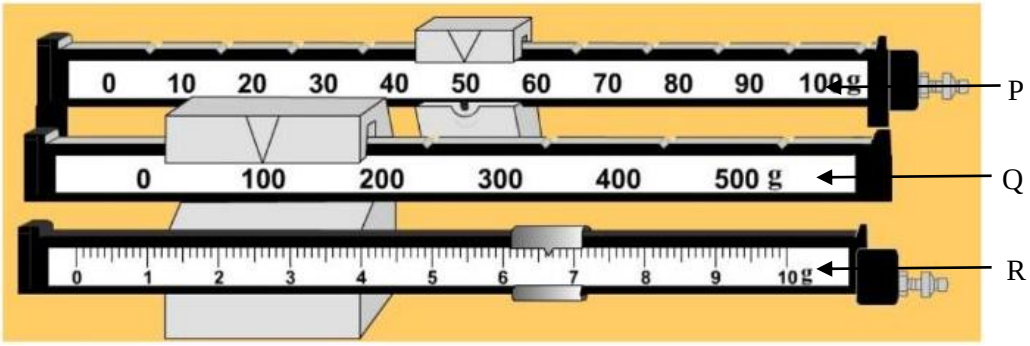



Fig - II

d)

i) When an object is placed on the pan and balanced by adjusting the riders, their positions are as shown in the figure II. Find the mass of the object.

……

ii) In the beam Q, if the distance between the $100g$ and $200g$ marks is 4 cm; what is the mass of the rider $M_Q$.

……

……

e) When the mass marked $500g$ is suspended either at X or Y ; what is the :

i) The highest mass that can be measured?

.....

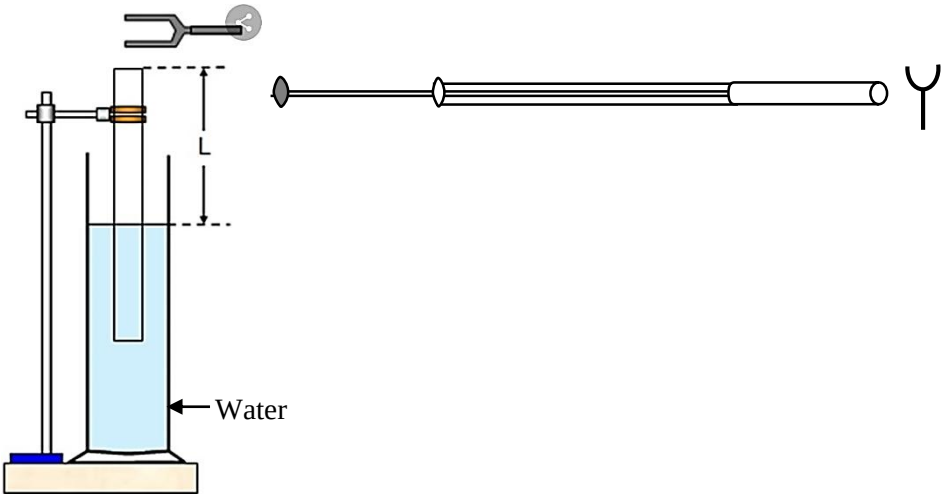
ii) The least mass that can be measured?

.....

iii) Actual mass of the mass marked as $500g$?

.....

02. Two students are using a tuning fork and a resonance pipe closed at one end to determine the speed of sound in air and the end correction.



Student A :- Different resonating lengths could be obtained by fully immersing a graduated glass tube in water containing in a measuring cylinder and then gradually raising it up.

Student B :- Different resonating lengths could be obtained by moving a plunger inside a graduated glass tube.

i) When the air inside the pipe is at resonance, what kind of wave is formed inside the pipe? Is it progressive wave or standing wave?

……..…

…….

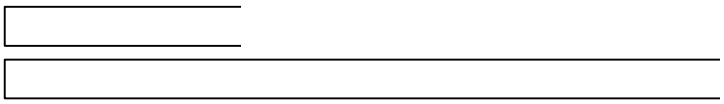
ii) The students have two tuning forks of frequencies 512 Hz and 288 Hz. Which one of them is most suitable to be used in this experiment? Give reason.

……

…….

iii) In this kind of experiment, for a certain tuning fork of frequency f, the first two resonance lengths were found to be $\ell_1$, and $\ell_2$ respectively.

a) Draw the wave patterns, for the above two kinds of vibrations, in the figures given below, and mark the lengths of the pipes end-correction, e, in them.



*1)* By considering the first resonance, give an expression for the speed, V, of sound in air in terms of $e, f$ and $\ell_1$.

……..……..……

……..……..…….

*2)* By considering the second resonance, given an expression for the speed, V, of sound in air in terms of $e, f$ and $\ell_2$.

……...

3) From these things, obtain an expression for V in $\ell_1, \ell_2$ and f.

……..……..…

…….…..…..

iv)

a) Although both A and B carried out the experiment at the same temperature, the value of speed obtained by A was found to be greater than that obtained by B. Give reason for this.

……

b) Why rubber mallet is used to strike tuning forks?

……

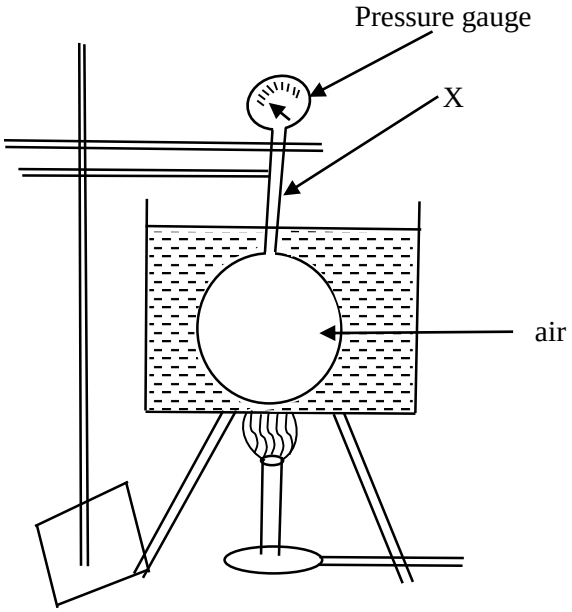
……

c) Nowadays electric vibrators are used in place of tuning forks. State an advantage of using this.

……

……

*03.*




The set up shown above is used for the verification of gas law at contort volume.
(Atmospheric pressure = $1 \times 10^5 pa$) (Pressure recorded by the pressure glue = Air pressure – atmospheric pressure)

a) The pressure law can be applied to a gas if and only if, two of its quantities are kept constant. What are those quantities?

*1)* ……...

*2)* ……...

b) What is the reason a narrow tube, X, is used in the above set up?

……...……

……...

c) To carry out the above experiment, two things are essentially needed. Draw those two things in the above diagram.

d) Explain, why the temperature of water should be raised slowly in this experiment?

……...……

……...

e) How would you confirm that the air in the bulb has attained a steady temperature?

……...……

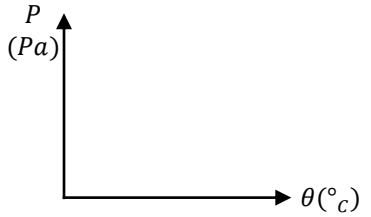
……...

f) State two important procedures that would be used to maintain the temperature of the water at a particular value.

i) ……

ii) ……

g) Draw a rough sketch for the veriation of gas pressure with temperature $\theta$.




h) At $127^{\circ}C$, an ideal gas reads a pressure of $1 \times 10^5\ Pa$. When its temperature is increased to $177^{\circ}C$, what would be the reading of the pressure gauge. (Atmosphenc pressure is $1 \times 10^5\ Pa$).

……

……

i) When carrying out this experiment, it is possible to obtain the pressure by reducing the temperature. But, students say, when it is measured like this there is a chance that the slope of the graph may get reduced. Do you accept this. Give explanation?

……

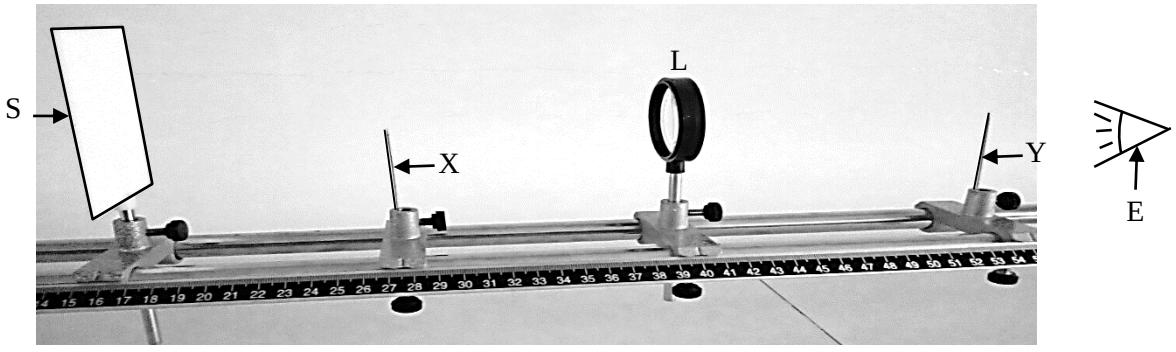
……

j) The air in the flask will not have same temperature as water. To clear this fault, suggest a step that can make the temperature of air and water be equal.

……

……

*04.*




The above figure shows the set up made by a student to determine the focal length of a convex lens by using a real image.

a)

i) When eye is placed at E and viewed the pin at X, its image was not seen by him. What may be the reason for not seeing the image?

……

ii) What is the use of screen S?

……

……

iii) When the eye is placed at E and viewed the image of X, it appeared. Mark the position of the image (Z) of X in the figure and mark the object distance u and image distance V in the diagram.

……..

iv) How could it be confirmed that the image Z of the pin X and the pin Yare coinciding with each other?

……..……

……..……

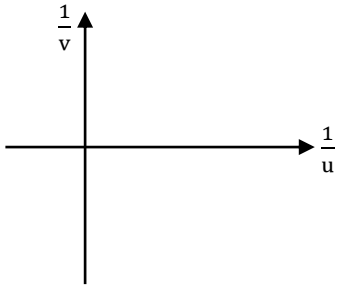
v) By changing the object distance U, the corresponding image distances V were obtained and a graph was drawn.

1) Write down the lens formula.

……..……

……...

2) To have a suitable graph, make $\frac{1}{u}$ as an independent variable, and draw the rough sketch of the graph.




3) Which part of the graph would be used to determine the focal length?

……...

b) Using this method, with the aim of determining the focal length $f_2$ of a concave lens, which is placed together in contact with the lens used in section (a) (focal length $f_1$) and by determining the focal length of the combination, using the above experiment, the focal length of the concave lens can be obtained.

i) If the focal length of the combination is f, write down the equation which relates $f_1$, $f_2$, and f.

……..……

ii) It is found that the intercept of the graph drawn in section (a) is *(– 20)* and the intercept of graph drawn in section (b) is *(– 10)*; determine the focal length *(* $f_2$ *)* of the concave lens.

……..……

……..…

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# G.C.E. A/L Examination July - 2019

## Conducted by Field Work Centre, Thondaimanaru

## In Collaboration with

## Provincial Department of Education, Northern Province.

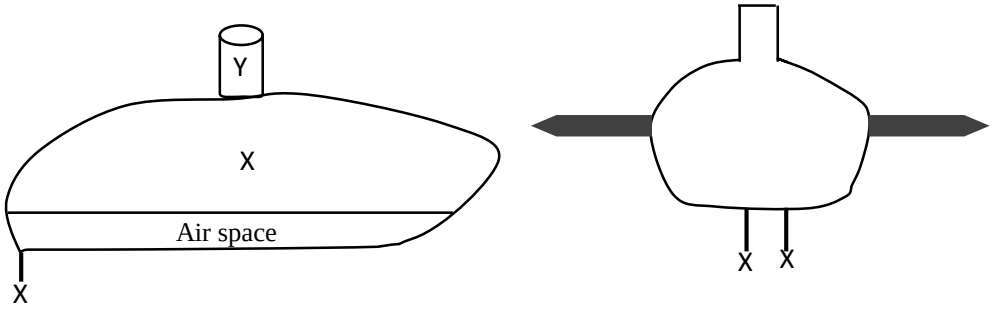
| Grade :- 12 (2020) | Physics | |
|---|---|---|

**Part – II - B**

**Essay Questions**

❖ **Answer any two questions.**

*01.*




The figure shown above is a simple model of a submarine. This has two important volume sections X and Y. The section X has volume $V_0\ m^3$, which includes the air space. When water is not pumped into air space the section X just submerge fully in water. The section Y is in a cylindrical shape having an area of cross section of $2\ m^2$ and height 5m. By pumping water into the air space, the section Y can be made to submerge fully and float in water. The mass of This kind of submarine is $10^5 kg$. Density of sea water is $1000\ kgm^{-3}$ (Ignore the force of resistance due to water in your calculations)

a)

1) State the law of flotation.
2) If the total mass of submarine is $10^5 kg$, find the volume $V_0$ of section X of the submarine.
3) i) What is the least mass of water that has to be pumped into the air space to make the submarine completely submerge?

   ii) The water-pumps which are installed at the back of the submarine are operated to pump out the water form the submarine. If the rate of pumping of water is $0.5m^3$ per minute; find the time taken to pump out the water from the submarine.

4) Find the downward acceleration of the submarine when the air space is filled with $20m^3$ of water.

b) There are two thrust propellers fixed at the back of the submarine. The submarine is moved forward by operating these propellers. The propellers move the submarine by pushing the water which is infront of it to its back. By assuming that the effective area of one propeller rotor as A and it pushes the water horizontally, answer the following questions.

When the submarine is stationary, if both propellers are pushing the water with same velocity V,

i) What is the volume of water pushed backward by one of the propeller in one second.

ii) What is the initial forward force acting on the submarine?

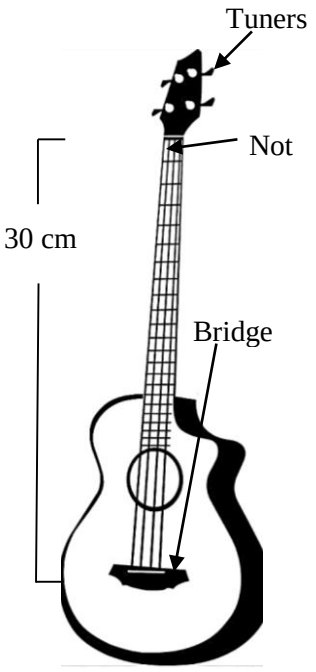
iii) If $A = 2m^2, V = 20\, ms^{-1}, \rho = 1000\, kgm^{-3}$, calculate the forward force, inchally acting on the submarine.

iv) Find the initial horizontal acceleration of the submarine, when it is fully submerged and floating in water.

v) Find the initial horizontal acceleration of the submarine when it is floating with its upper section (Y) is outside the water.

02. Musical instruments are classified into wind instruments, string instruments and percussion instruments. In such instruments, different notes are produced by altering the frequency. The string instruments. The string instruments are made by making strings to vibrate and wind instruments are made by making air to vibrate.

a) The figure given below is a guitar. This consists of four strings of equal length made with same material but of different area of cross-section. By plucking (strumming) these strings notes are created.




i) Give an expression for the velocity of the transverse waves which are produced in the string when made to vibrate, in terms of tension (T) in the string and its mass per unit length (m).

ii) Obtain the frequency of the fundamental note of the string in terms of its length $(\ell)$, tension (T) and mass per unit length (m).

iii) Which one of the string, when made to vibrate, will give out a high frequency note, if all the strings of the given guitar are kept under same tension? Give reason for it.

iv) From bridge to nut, the length of the thinnest string is 30 cm, area of cross-sction is $0.2mm^2$, the density of the material of the string is $4000\, kgm^{-3}$. The frequency of the fundamental note of this string is 650 Hz.

i) Find the velocity of the wave in the string when plucked at its middle.

ii) Find the tension in the string

iii) How far from the bridge, the finger should be placed, to produce a fundamental note of frequency 750 Hz (Assume that the string is attached to the bridge)

iv) What is the highest frequency of the fundamental note that can be produced if the range through which the finger can be moved is 10 cm – 25 cm from the bridge.

out with a velocity of $1000\ ms^{-1}$ which in turn impinge on the blades of the turbine (T) and makes it to rotate Assume that the whole kinetic energy of the steam will be converted into rotational kinetic energy in T. The electrical generator (G) which is coupled to the turbine generate electrical energy. The steam which impinged on the blade of turbo (T) is then passed into a tank (CT) where it is cooled to $50^{\circ}C$ water by sending water at $20^{\circ}C$, and then it comes out at $70^{\circ}C$. The hot water thus comes out can be used in the towns for their domestic needs. For all your calculation, assume that the system is thermally insulated to prevent any loss of heat to the surroundings and ignore any of steam condensed in S.T.

i) Give two benefits of Geothermal station.

ii) If the electric generator (G) generates 50 MW power,

a) Find the mass of steam impinge on the blades of the turbo (T) in 1 second.

b) Find the amount of heat required to produce steam $(150^{\circ}C)$ which impinge on the blades of turbo (T) in 1 second.

(For water, the specific heat capacity is $4000\ Jkg^{-1}K^{-1}$, the specific latent heat of vaporization at $150^{\circ}C$ is $2 \times 10^{6}\ Jkg^{-1}$).

c) From where the thermal energy required for this station is obtained?

d) The average thickness of the wall of the tank (ET) is 10 cm, the thermal conductivity of its material is $500\ Wm^{-1}\ k^{-1}$. If the temperature of the outer surface of the tank is at, $170^{\circ}C$ the inner surface of the tank is at $150^{\circ}C$, calculate the rate of conduction of heat per unit area at steady state.

e) Find the least area the tank (ET) should have for the geothermal station to function properly.

f) As the temperature close to the Earth's surface is found to be low, a decision has been made to get the supply of heat to the surface of the tank (ET) form a depth of 100m using thermally well insulated rods of area of cross-section $1m^2$ and of length 100m, made with the material of thermal conductivity $1000\ Wm^{-1}K^{-1}$. When the end of the rod is at a depth of 100 n, its temperature is $200^{\circ}C$; find the number of such rods to be used.

iii) Find the rate at which the water at $20^{\circ}C$ should flow into the cooling tank (CT) to cool the steam.

(Assume steam enters CT at a temperature of $150^{\circ}C$ and use the data provided in section II (b))