இலங்கையின் உயர்தர கணித விஞ்ஞான

பிரிவிற்கான இணையதளம்

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GCE (A/L) Examination, March - 2019

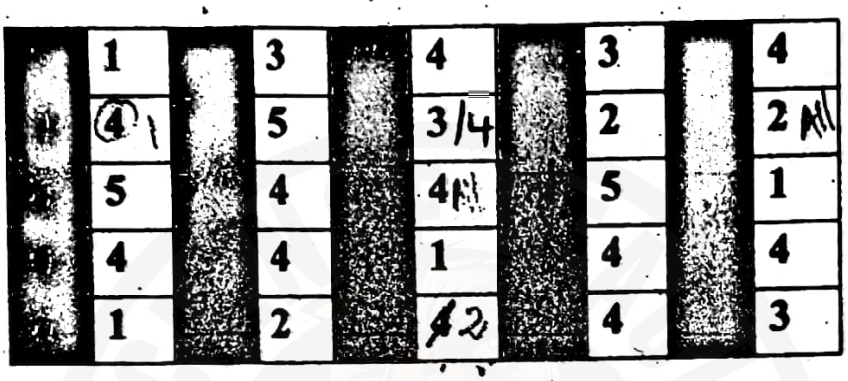
Conducted by Field Work Centre, Thondaimanaru

In Collaboration with

FWC **Provincial Department of Education Northern Province**

Grade: 12 (2020)	*Physics*	*Marking Scheme*

Part I



1	3	4	3	4
4	5	3/4	2	2
5	4	4	5	1
4	4	1	4	4
1	2	2	4	3

25x2=50

Structured Essay Part II (A)

1. a. A – main scale B – Thimble C – circular scale/ Thimple scale } All correct --(2)
D– Thimble head / Ratchet } Two correct—(1)

b. (i) 0.5 mm ——————————
(ii) 0.01 mm ——————————} Both correct ——————(1)

c. (i) To avoid deforming the object. ——————————(1)

(ii) When rotating the thimble head "click" sound must heard when spindle Touches the object. ——————————(1)

d. Without placing the object between anvil and spindle turn the ratchet until "click" sound is heard, after take the reading. ——————————(1)

e. negative zero error = 0.04 mm ——————————(1)

f. (i) 16 .50 mm ——————— 1 (ii) 16.54 mm ——————————(1)

g. Take the readings mutually perpendicular each other in three directions and calculate the average of the readings. ——————————(1)

10

2. a (i) When a body is fully or partially immersed in a liquid, it floats if the weight of the liquid displaced is equal to the weight of the body. ----------(1)

(ii) The bottom of the tube having small lead shots then the centre of gravity (G) of The system is displaced lower than buoyancy centre (H) then vertical stable equilibrium is possible. ----------(1)

b. (i) $U_1 = U_2$, Up thrust is equal to weight of the tube ----------(1)

(ii) $(V + l\,A)\,\rho g = (M + m)\,g$ ----------(1)

(iii) $V + l\,A = \frac{M}{\rho} + \frac{m}{\rho}$

$$l = \frac{1}{\rho A} m + \left(\frac{M}{\rho A} - \frac{V}{A}\right)$$ ----------(1)

(iv) external diameter of the tube , using external jaws of the vernier caliper ------(1)+(1)

(v) using narrow and long (boiling) tube ----------(1)

c. (i) $312.5 = \frac{1}{\rho A} \longrightarrow \frac{1}{\rho} = 1250\ cm^3\ kg^{-1}$

$$\rho = \frac{1000000}{1250} = 800\ kg\ m^{-3}$$ --------(1)

(ii) First find the maximum amount of mass that will not immerse the boiling tube in the liquid. Then, divide the maximum mass into equal portions to have sufficient number points. Finally, take the readings by loading the tube with divided mass in steps. .... (1)

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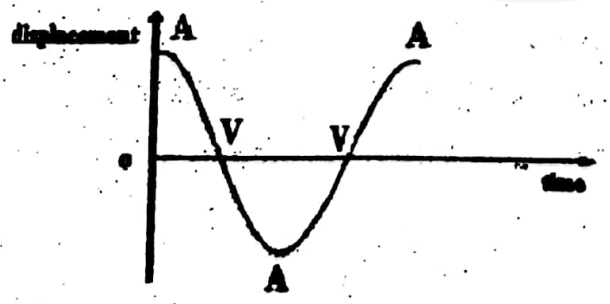
3. a.



denote A in correct positions ------(1)

denote V in correct positions ------(1)

b. Velocity of the pendulum maximum at centre of the oscillating path, when tension in the string is addition of the centripetal force (mv^2/r) and weight of the pendulum bob. ----- (2)

c. (i) Pendulum bob undergoes resonance. ---------- (1)

(ii) $5 = \frac{1}{n} \times 100$ $n = 20$ Hz ---------- (1)

d. (i) $f = \frac{1}{T} = \frac{1}{2\pi\sqrt{l/g}}$, $f = \frac{1}{2\pi}\sqrt{g/l}$ ——————— (1)

(ii) $f^2 = \frac{1}{4\pi^2} g \times \frac{1}{l}$, $f^2 = g/4\pi^2 \times 1/l$ ——————— (1)

$\frac{g}{4\pi^2} = \frac{1}{4}$

$g = (3.14)^2$

$= 9.86\ ms^{-2}$ ——————— (1)

e. Wood sphere , energy absorb both bob are equal but mass of the wood bob is small therefore oscillating height greater for wood bob. ——————— (1)

10

4. a. (i) On the sonometer box. ——————— (1)

(ii) The string vibrates with maximum displacement (amplitude) then easily identify the resonance state. ——————— (1)

(iii) Stationary and transverse waves (both correct) ——————— (1)

b. Bring the two pages closer together, while vibrating turning fork place on sonometer box gradually increase the distance between the pages until paper rider jumps off, finally measure the distance between the pages. ——————— (1)

c. $f = \frac{1}{2l_o}\sqrt{\frac{T}{m}}$ ——————— (1)

d. (i) $\frac{n_1}{2l}\sqrt{\frac{T}{m}} = \frac{n_2}{2l}\sqrt{\frac{T}{m}} \Rightarrow \frac{n_1}{n_2} = \sqrt{\frac{m_1}{m_2}}$

$\frac{m_1}{m_2} = 4$ ——— (1) $\frac{n_1}{n_2} = \frac{2}{1}$ ——————— (1)

(ii) AB : 2 BC : 1 (both correct) ——————— (1)

(iii) $\lambda_{max} = 100$ cm ——————— (1)

(iv) $v = \sqrt{\frac{40}{1\times10^{-3}}} = 200ms^{-1}$

$f = \frac{v}{\lambda max} = 200Hz$ ——————— (1)

10

Part II (B)

5.a. (i) The structure of their jaws, the magnitude of the forces exerted by the muscle fibers close to the jaws, the direction and the point of it's a application are determined the hardness of the bite.-------(1)

(ii) Resultant force of the forces M,T,B and R is zero in all directions, the total torque (moment) is zero about any axis. ---------- (1)

b. (i) $x_B B - x_R R = 0 \rightarrow R = (\frac{x_B}{x_R})B$ ----------(1)

$M = B + R = B(1 + x_B / x_R)$ ---------- (1)

(ii) $2B = 1 \times 3 \rightarrow B = 1.5N$ ----------(1)

(iii) $6 = B(1 + 2)$

$B = 2N \quad R = 4N$ therefore Jaw joint will be damaged ----------(1)

(iv) $2(x - 0.03) = 0.03 \times 3$

$2x - 0.06 = 0.09$

$x = 0.075m$ ----------(1)

c. $T\cos\theta - M\cos\theta = 0$

$T = M$ ----------(1)

$B = T\sin\theta + M\sin\theta$

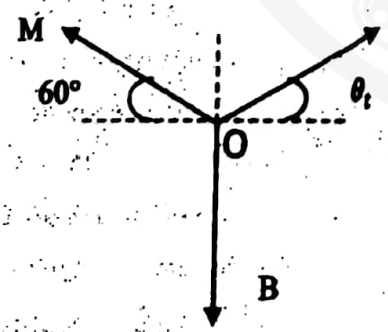
$B = 2T\sin\theta$ But $B > T$ ---------- (1)

$T < 2T\sin\theta$, $\sin\theta > \frac{1}{2}$

$\sin\theta > \sin 30°$

$\theta > 30°$ ----------(1)

d.



----------(1)

Using Lami's theorem at point O

$\frac{M}{\sin 90+\theta_t} = \frac{1.3M}{\sin(180-30)} = \frac{B}{\sin(120-\theta_t)}$ ---------- (1)

$M\sin 30 = 1.3M\cos\theta_t$

$\cos\theta_t = \frac{1}{2.6}$

$\cos\theta_t = 0.3846$

$\theta_t = 67°23^1$ ---------- (1)

$\frac{1.3M}{\sin 30} = \frac{B}{\sin(120-67°23^1)}$ ---------- (1)

$\frac{B}{M} = 2.6 \times \sin 52°37^1$

$= 2.6 \times 0.7946$

$= 2.066 / 2.07$ ---------- (1)

15

6. a. (i) Bernoulli's principle and Newton's second and third laws ---------- (1)

(ii) Plane have large wing, it has to fly fast, it needs a long runway for takeoff and landing.---- (1)

(iii) No external torque act on the system, therefore total angular momentum is conserved. Then the helicopter rotor spins around, the entire body of the helicopter tends to rotate slowly in the opposite direction. ---------- (1)

(iv) Warship should move maximum velocity along the direction of aircraft to takeoff. ----------(1)

b. (i) $Av\rho \times v = 80 \times 1.2 \times v^2$

$= 96v^2$ ---------- (1)

(ii) $21600 = 96v^2$

$v^2 = 225$

$v = 15ms^{-1}$ ----------(1)

(iii) $power = 1/2(\frac{m}{t})v^2 = 1/2Av\rho \times v^2$ ---------- (1)

$= 1/2 \times 80 \times 1.2 \times v^3$

$= 162000\,W / 162\,kW$ ---------- (1)

(iv) $f = 420 \times \frac{1}{60} = 7Hz$

$\omega_R = 2\pi \times 7 = 2 \times \frac{22}{7} \times 7 = 44$

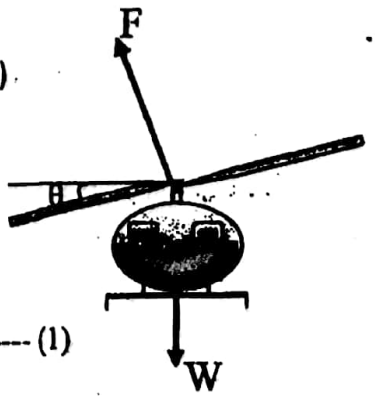
$I_R\omega_R = I_H\omega_H$

$\omega_H = \frac{I_R\omega_R}{I_H}$

$= 100 \times \frac{44}{8800}$

$= 0.5rads^{-1}$ ---------- (1)

c. (i)



F – lift force

W – weight of the helicopter

Both are correct ---------- (1)

(ii) rotational speed of rotor increase ---- (1)

(iii) $F\cos\theta = mg$

$F\sin\theta = \frac{mv^2}{r}$

$\text{Tan}\theta = \frac{v^2}{gr}$ ——————(1)

$\text{Tan}12^\circ 42^1 = \frac{v^2}{10 \times 100}$

$v^2 = 225.3$

$v = 15ms^{-1}$ ——————(1)

c. (i) $u - mg = m \times 1$

$u = m \times 11$

$= 2160 \times 11$

$= 23760N$ ——————(1)

(ii) $A\rho v^2 = 23760$

$v^2 = \frac{23760}{96} = 247.5$

$v = 15.73ms^{-1}$ ——————(1)

15

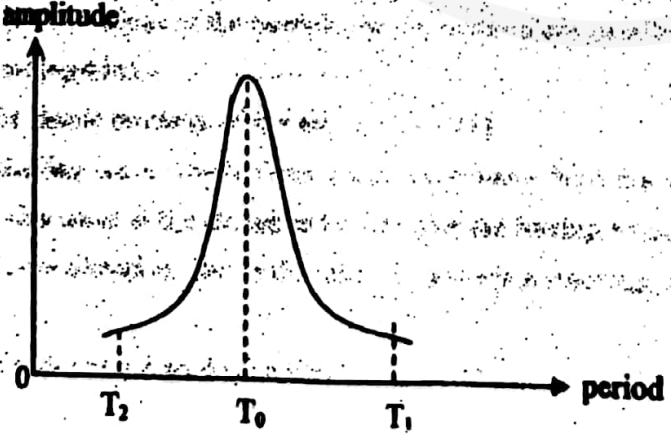
3.a.(i) The vibrations of the particles of the medium are parallel to the direction of the wave propagation. ——————(1)

(ii) The elastic property of the air. ——— (1)

(iii) Standing wave. The incident progressive wave from the vibration to the closed end and the reflected progressive wave at the closed end of the pipe are having equal frequency, equal amplitude and they move in the opposite direction. Hence the resultant wave is a standing wave. ——— (1)

(iv) it undergoes forced vibration. ——— (1)

(v)



for graph ——— (1)

for marking T_2, T_1, T_0 ——— (1)

b. (i) $f = \frac{1}{T} = \frac{1}{500\mu s} = \frac{10^6}{500} = 2000Hz$

$f^1 = \frac{1}{T} = \frac{1}{15000\mu s} = 66.7Hz$

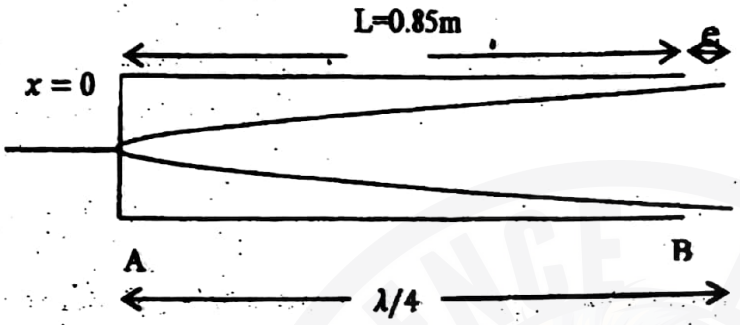
The range of audible frequency = 20Hz to 20,000Hz

The frequency range of the vibrator is within audible range. Hence vibrator produce audible sound.-(1)

(ii) change the period from the maximum value 15000μs to minimum value 500μs. ---------- (1)

(iii) maintain the period of the vibrator corresponding to the resonance and gradually move the plunger such that value of x increases from0 to 0.85m. if there is no more loud sound, then the fiat resonance obtained corresponds to fundamental. ---------- (1)

(iv)



---------- (1)

(v) $\frac{\lambda}{4} = L - x + kr$

$\lambda = 4(L - x + kr)$ ---------- (1)

$v = +\lambda$

$v = \frac{1}{T}4(L - x + kr)$

$\frac{VT}{4} = L - x + kr$

$x = \left(-\frac{v}{4}\right)T + (L + kr)$

↓ ↓ ↓ + ↓

y = m x + c ---------- (1)

(vi)

---------- (1)

(vii) $-\frac{v}{4} = -85.6 ms^{-1}$

$v = 342.4\, ms^{-1}$ ----------(1)

(viii) $L + kr = 0.862m$

$0.85 + kx0.02 = 0.862$

$k = \frac{0.862 - 0.85}{0.02} = 0.6$ ---------- (1)

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$$\text{Final Marks} = \text{MCQ Marks} + \frac{(10 \times 4 + 15 \times 2)5}{7}$$

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