

- (C) $25 / 10^4 \text{ kg m}^{-1}$ (20)
 (C) 180 N (21)
 (D) 20 (22)
 (D) (2) (23)
 (D) 160 Hz (24)
 (C) 160 g (25)

السؤال الثاني:

مسألة أول:

- $L = 40 \text{ cm} = 0.4 \text{ m}$
 $m = 200 \text{ g} = 0.2 \text{ kg}$
 تواتر صوتة $f_1 = 80 \text{ Hz}$
 $\lambda = 40 \text{ cm} = 0.4 \text{ m}$
 $L = k \frac{\lambda}{2}$ (1)
 $\Rightarrow k = \frac{2L}{\lambda} = \frac{2 \times 0.4}{0.4}$
 ○ $k = 2$
 $v = \lambda f = 0.4 \times 80$ (2)
 $v = 32 \text{ m/s}$
 $L = k \frac{\lambda}{2} = k \frac{v}{2f}$ (3)
 $f = \frac{kv}{2L} = k f_1$
 $k = 2$ درويج الثاني:
 $f_2 = 2(80) = 160 \text{ Hz}$
 $k = 3$ درويج الثالث:
 $f_3 = 3(80) = 240 \text{ Hz}$

مل ورقة عمل الاختراوات
 والواجب:

- السؤال الأول:
- (A) 2 m (1)
 (B) 4 m (2)
 (D) 5 m (3)
 (C) 4 cm (4)
 (D) 0 cm (5)
 (C) 0° (6)
 (B) 0.2 m (7)
 (B) 128 m/s (8)
 (A) 900 Hz (9)
 (C) 0.8 m (10)
 (B) 1800 Hz (11)
 (B) 128 m/s (12)
 (A) 60 cm (13)
 (B) 32 m/s (14)
 (A) 50 Hz (15)
 (C) 95 cm (16)
 (D) 20 m/s (17)
 (C) 900 Hz (18)
 (B) 80 m/s (19)

$$x_3 = \frac{5\lambda}{4} = \frac{5 \times 0.4}{4}$$

$$x_3 = 0.5 \text{ m}$$

$$Y_{\text{max}/n} = 2Y_{\text{max}} \left| \sin\left(\frac{2\pi x}{\lambda}\right) \right| \quad (4)$$

$$Y_{\text{max}} = 2 \text{ cm} = 0.02 \text{ m}$$

ملاحظة أولي

$$\lambda = 20 \text{ cm} = 0.2 \text{ m}$$

$$Y_{\text{max}/n} = 2 \times 2 \times 10^{-2} \times \left| \sin\left(\frac{2\pi \times 0.5}{0.2}\right) \right|$$

$$Y_{\text{max}/n} = 4 \times 10^{-2} \left| \sin(\pi) \right|$$

⊖

$$Y_{\text{max}/n} = 0 \text{ m}$$

$$x = 10 \text{ cm} = 0.1 \text{ m} : \text{ملاحظة ثانية}$$

$$Y_{\text{max}/n} = 2 \times 2 \times 10^{-2} \left| \sin\left(\frac{2\pi \times 0.1}{0.2}\right) \right|$$

$$Y_{\text{max}/n} = 4 \times 10^{-2} \left| \sin\left(\frac{\pi}{2}\right) \right|$$

$$Y_{\text{max}/n} = 0.04 \text{ m}$$

⊖ : مسألة الثانية

$$\omega = 2000 \text{ rad/s}$$

$$\omega = 2\pi f \Rightarrow f = \frac{2000}{2\pi}$$

$$f = \frac{100 \times 20}{2\pi} = \frac{64\pi \times 20}{2\pi}$$

$$f = 640 \text{ Hz}$$

$$L = 25 \text{ cm} = 0.25 \text{ m}$$

$$\mu = 0.4 \text{ g/m} = 4 \times 10^{-4} \text{ kg m}^{-1}$$

$$K = 2 \text{ عقزلي}$$

$$K=4$$

$$f_4 = 4(80) = 320 \text{ Hz}$$

ⓓ عدد الفراز ثلاثة



$$x = K \frac{\lambda}{2} : \text{أبعاد العقد}$$

$$K=0 : \text{عقدة أولي}$$

$$x_1 = 0 \text{ m}$$

$$K=1 : \text{عقدة ثانية}$$

$$x_2 = \frac{\lambda}{2} = \frac{0.4}{2} = 0.2 \text{ m}$$

$$K=2 : \text{عقدة ثالثة}$$

$$x_3 = 2 \frac{\lambda}{2} = \lambda = 0.4 \text{ m}$$

$$K=3 : \text{عقدة رابعة}$$

$$x_4 = 3 \frac{\lambda}{2} = \frac{3 \times 0.4}{2} = 0.6 \text{ m}$$

أبعاد البطن:

$$x = (2K + 1) \frac{\lambda}{4}$$

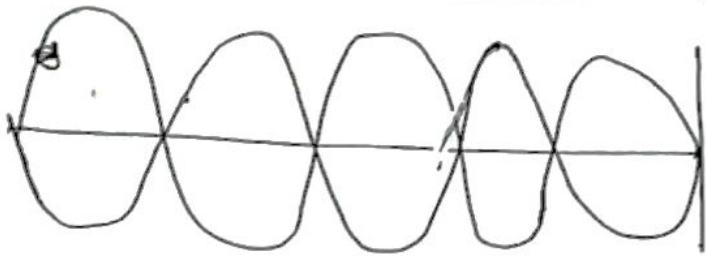
$$K=0 : \text{البطن الأول}$$

$$x_1 = \frac{\lambda}{4} = \frac{0.4}{4} = 0.1 \text{ m}$$

$$K=1 : \text{البطن الثاني}$$

$$x_2 = \frac{3\lambda}{4} = \frac{3 \times 0.4}{4} = 0.3 \text{ m}$$

$$K=2 : \text{البطن الثالث}$$



$x = k \frac{\lambda}{2}$: أبعاد العقد

$k = 0$ عقدة أولى :

$$x_1 = 0 \text{ m}$$

$k = 1$ عقدة ثانية :

$$x_2 = 1 \left(\frac{\lambda}{2} \right) = \frac{\lambda}{2} = 1.6 \text{ m}$$

$k = 2$ عقدة ثالثة :

$$x_3 = 2 \left(\frac{\lambda}{2} \right) = \lambda = 3.2 \text{ m}$$

$k = 3$ عقدة رابعة :

$$x_4 = 3 \left(\frac{\lambda}{2} \right) = 3(1.6) = 4.8 \text{ m}$$

$k = 4$ عقدة خامسة :

$$x_5 = 4 \left(\frac{\lambda}{2} \right) = 2\lambda = 6.4 \text{ m}$$

$k = 5$ عقدة السادسة :

$$x_6 = 5 \left(\frac{\lambda}{2} \right) = 5(1.6) = 8 \text{ m}$$

$x = (2k+1) \frac{\lambda}{4}$: أبعاد البطن

$k = 0$ البطن الأول :

$$x_1 = \frac{\lambda}{4} = 0.8 \text{ m}$$

$k = 1$ البطن الثاني :

$$x_2 = 3 \frac{\lambda}{4} = 2.4 \text{ m}$$

$k = 2$ البطن الثالث :

$$x_3 = 5 \frac{\lambda}{4} = 4 \text{ m}$$

$k = 3$ البطن الرابع :

$$v = \sqrt{\frac{F_T}{\mu}}$$

$$v^2 = \frac{F_T}{\mu}$$

$$F_T = v^2 \times \mu$$

$$L = k \frac{\lambda}{2} = k \frac{v}{2f}$$

$$v = \frac{2Lf}{k}$$

$$F_T = \left(\frac{2Lf}{k} \right)^2 \times \mu$$

$$F_T = \left(\frac{2 \times 0.25 \times 640}{2} \right)^2$$

$$\times 4 \times 10^{-4}$$

$$F_T = (160)^2 \times 4 \times 10^{-4}$$

$$F_T = 10.24 \text{ N}$$

مسألة الثالثة :

$$L = 8 \text{ m}$$

$$m = 4 \text{ g} = 0.004 \text{ kg}$$

$$f = 50 \text{ Hz} \quad k = 5 \text{ منازل}$$

$$L = k \frac{\lambda}{2} \quad (1)$$

$$\lambda = \frac{2L}{k} = \frac{2 \times 8}{5}$$

$$\lambda = 3.2 \text{ m}$$

$$x = k \frac{\lambda}{2} \quad (2) \text{ أبعاد العقد}$$

$$x = (2k+1) \frac{\lambda}{4} \text{ أبعاد البطن}$$

$$\delta = 4 \left(\frac{\lambda}{2} \right) = 2\lambda$$

$$\delta = 2(3.2) = 6.4 \text{ m}$$

$$f = k f_1 \quad (6)$$

$$k = 2$$

مردود ثاني :

$$f = 2 f_1 = 2(50) = 100 \text{ Hz}$$

$$k = 3$$

مردود ثالث :

$$f = 3 f_1 = 3(50) = 150 \text{ Hz}$$

$$k = 4$$

مردود الرابع :

$$f = 4 f_1 = 4(50) = 200 \text{ Hz}$$

$$v = \sqrt{\frac{F_T}{\mu}} = \sqrt{\frac{F_T L}{m}} \quad (7)$$

$$v^2 = \frac{F_T L}{m}$$

$$v = \frac{2L f}{k}$$

$$\Rightarrow \left(\frac{2L f}{k} \right)^2 = \frac{F_T L}{m}$$

$$\left(\frac{4L f^2}{k^2} \right) = \frac{F_T}{m}$$

$$F_T = \frac{4L f^2 m}{k^2}$$

$$k = 5 \Rightarrow f_5 = 5 f_1 = 250 \text{ Hz}$$

$$F_T = \frac{4 \times 8 \times (250)^2 \times 4 \times 10^{-3}}{(5)^2}$$

$$F_T = \frac{32 \times 625 \times 10^2 \times 4 \times 10^{-3}}{25}$$

$$F_T = 320 \text{ N}$$

$$x_4 = 4 \frac{\lambda}{4} = 5.6 \text{ m}$$

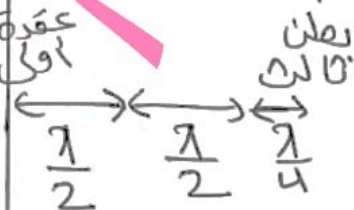
البطن الخامس : $k = 4$

$$x_5 = 5 \frac{\lambda}{4} = 9.2 \text{ m}$$

$$N = \frac{L}{\lambda} = \frac{0.4}{0.4} \quad (3)$$

$$N = 1$$

(4) من الرسمة السابقة



أي بعد بين العقدة الأولى والبطن الثالث

$$\delta = \frac{\lambda}{2} + \frac{\lambda}{2} + \frac{\lambda}{4} = \frac{5\lambda}{4}$$

$$\delta = \frac{5 \times 3.2}{4} = 4 \text{ m}$$

(5) البعد بين البطن الأول والثاني

$$\frac{\lambda}{2}$$

$$\frac{\lambda}{2} = \text{الثاني والثالث} = =$$

$$\frac{\lambda}{2} = \text{الثالث والرابع} = =$$

$$\frac{\lambda}{2} = \text{الرابع والخامس} = =$$

بعد بين البطن الأول والثاني

$$\frac{331}{160} = \sqrt{\frac{0+273}{t_2+273}}$$

$$2,06875 = \sqrt{\frac{273}{t_2+273}}$$

$$t_2+273 = \frac{273}{4,28}$$

$$t_2+273 = 63,785$$

$$T_2(^{\circ}K) = 63,785^{\circ}K$$

$$\bullet v_{O_2} = 40 \text{ m s}^{-1} \quad (5)$$

$$L = (2k-1) \frac{v_{O_2}}{4f}$$

$$f = \frac{(2k-1) v_{O_2}}{4L}$$

مردود رابع:

$$f_4 = 4 \times \frac{40}{4 \times 2}$$

$$f_4 = 20 \text{ Hz}$$

$$f_1 = 2 f_1 \quad (6)$$

لوزنار
مختلف
طرفين

$$f_1 = \frac{f_1}{2} = \frac{20}{2} = 10 \text{ Hz}$$

$$L = k \frac{\lambda}{2} = k \frac{v}{2f_1}$$

$$v = V = 160 \text{ m s}^{-1}$$

$$k=1$$

$$L = (1) \times \frac{160}{2 \times 10} = 8 \text{ m}$$

المسألة الرابعة:

موزنار ذو وضع نهاييه مغلقه

موزنار مختلف الطرفين:

$$v = 160 \text{ m/s}$$

$$f_1 = 20 \text{ Hz}$$

$$v = \lambda f \quad (1)$$

$$\lambda = \frac{v}{f} = \frac{160}{20} = 8 \text{ m}$$

$$L = (2k-1) \frac{\lambda}{4} \quad (2)$$

$$L = (2k-1) \frac{v}{4f}$$

$$L = (1) \times \frac{160}{4 \times 20} = 2 \text{ m}$$

$$\frac{v_{O_2}}{v_{H_2}} = \sqrt{\frac{M_{H_2}}{M_{O_2}}} \quad (3)$$

$$M_{H_2} = 2 \text{ g mol}^{-1}$$

$$M_{O_2} = 32 \text{ g mol}^{-1}$$

$$v_{H_2} = 160 \text{ m s}^{-1}$$

$$\frac{v_{O_2}}{160} = \sqrt{\frac{2}{32}} = \frac{1}{4}$$

$$v_{O_2} = \frac{160}{4} = 40 \text{ m s}^{-1}$$

$$t_1 = 0^{\circ}C \Rightarrow v_1 = 331 \text{ m s}^{-1} \quad (4)$$

$$t_2 = ? \Rightarrow v_2 = 160 \text{ m s}^{-1}$$

$$\frac{v_1}{v_2} = \sqrt{\frac{T_1}{T_2}}$$