EXERCISE – III

SUBJECTIVE PROBLEMS

1. A

$a = 1.2 \times 10^{-2}$

$V = a^3 = (1.2)^3 \times 10^{-6}$

$= 1.728 \times 10^{-6}$

$= 1.7 \times 10^{-6}$

2. a/(n+1)

L.C. = M.S.D. - V.S.D.

$= a - \frac{an}{n+1}$ $= \frac{a(n+1-n)}{n+1}$

$= \frac{a}{n+1}$

3. D

$\rho = \frac{m}{v} = \frac{m}{\pi r^2 l}$

$= 100\frac{\Delta\rho}{\rho} = 100\frac{\Delta m}{m} + 200\frac{\Delta r}{r} + 100\frac{\Delta l}{l}$

$= 100x\frac{0.003}{0.3} + 200x\frac{0.005}{0.5} + \frac{100x0.06}{6}$

$= 1+2+1 = 4\%$

4. $d = 0.050\,cm \pm 0.001cm$

$F = 50N$

$l = 0.125\,cm \pm 0.001cm$

$L = 110.0\,cm \pm 0.1cm$

Now $\frac{F}{A} = \frac{Yl}{L}$

$\Rightarrow Y = \frac{Fl}{Al} = \frac{50 \times 1.10}{\frac{3.14}{4}(5x10^{-4})^2}$

$Y = 2.24 \times 10^{11} N/m^2$

Now

$Y = \frac{FL}{\frac{\pi d^2}{4} l}$

$\frac{\Delta Y}{Y} = \frac{\Delta L}{L} + 2\frac{\Delta d}{d} + \frac{\Delta l}{l}$

$= \frac{1}{1100} + \frac{2}{50} + \frac{1}{125}$

$\Delta Y = Y\left(\frac{1}{1100} + \frac{1}{25} + \frac{1}{125}\right)$

$= 6.47 \times 10^9\ N/m^2$

5. $L.C. = \frac{1mm}{100div} = 0.01mm$

Reading = L.S.R. + C.S.R. x L.C.

$= 1mm + 47 \times 0.01$

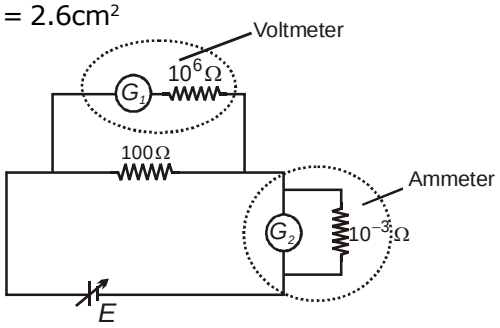
$= 1.47mm$

C.S.R. = $2\pi rl = \pi dl$

$= 3.14x\frac{1.47}{10}x5.6$

$= 2.6cm^2$

6.



7. D

$V = f\lambda = 2f(\ell_2 - \ell_1)$

$\Delta V = 2f(\Delta\ell_2 + \Delta\ell_1)$

$= 2 \times 512 (0.1+0.1)$

$= 512 \times 0.4$

$= 204.8$ cm/s

8. L.C. = 0.1 mm

Reading = 10 + 1 x 0.1

= 10.1 mm

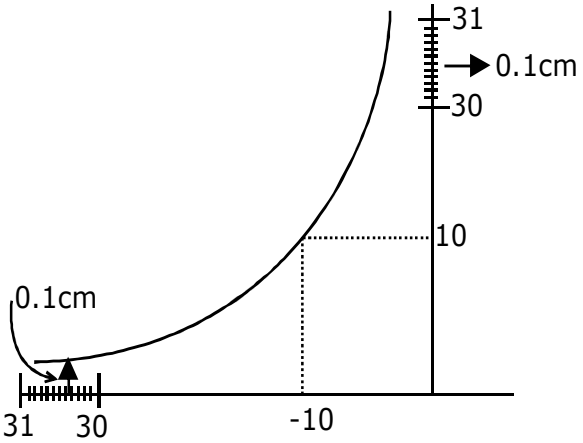
$\rho = \frac{m}{v} = \frac{2.736}{(10.1)^3}$

$= \frac{2.736\,gm}{1.03cm^3}$

$= 2.6563\ g/cm^3$

$= 2.66 g/cm^3$

9. C



$$\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$$

$$=\frac{1}{10}+\frac{1}{10}=\frac{1}{5}$$

f = 5 cm
L.C. 0.1 cm

$$\frac{\Delta f}{f^2}=\frac{\Delta V}{V^2}+\frac{\Delta u}{u^2}$$

$$\Rightarrow \Delta f = 25\left(\frac{0.1}{100}+\frac{0.1}{100}\right)=0.05$$

10. C

$$\text{L.C.} = \frac{0.5\text{mm}}{50\,\text{division}} = 0.01\text{ mm}$$

Z.E. = 0 + 5 x 0.01
= 0.05
Reading = 2 x 0.5 + 25 x 0.01- Z.E.
= 1 + 0.25 - 0.05
= 1.20

11. D

$$\frac{\Delta g}{g}=\frac{\Delta l}{l}+\frac{2\Delta T}{T}$$

Δl is least in (D) (i.e 1mm)
and

$\frac{\Delta T}{T}=\frac{0.1}{50}$ is also least in D

So least error is in D.
We can also see that amplitude is also less so it is more closes to S.H.M.

12. B

13. (A) P, Q; (B) R, S; (C) R, S; (D) R, S

14. B

$$\frac{F}{A}=Y\frac{l}{L}$$

$$\Rightarrow Y=\frac{FL}{Al}=\frac{mgL}{Al}$$

$$Y=\frac{1\,x\,9.8\,x\,2}{\frac{\pi\,x\,d^2}{4}+0.4\,x\,10^{-3}}$$

$= 2 \times 10^{11}\ N/m^2$

$$\frac{\Delta Y}{Y}=\frac{\Delta l}{l}+2\frac{\Delta d}{d}$$

$$=\frac{0.05}{0.8}+2x\frac{0.01}{0.4}$$

$$=\frac{0.09}{0.8}=\frac{9}{80}$$

$$\Delta Y=\frac{9Y}{80}=\frac{9x2}{80}x10^{11}=0.225x10^{11}$$

$$\Rightarrow Y=(2\pm 0.2)x10^{11}$$

15. B

$$g=\frac{4\pi^2 l}{T^2}$$

$$E=\frac{\Delta g}{g}=\frac{\Delta l}{l}+\frac{2\Delta T}{T}$$

$$E_I=\frac{0.1}{64.0}+\frac{2x0.1}{128}$$

$$E_{II}=\frac{0.1}{64.0}+2x\frac{0.1}{64}$$

$$E_{III}=\frac{0.1}{20}+2x\frac{0.1}{36}$$

Clearly $E_1 < E_2 < E_3$.

16. C,D

17. A,C

18. D

19. C

20. $Y=\frac{4MgL}{\pi \ell d^2}$

$$\frac{\Delta Y}{Y}=\frac{\Delta M}{M}+\frac{\Delta g}{g}+\frac{\Delta L}{L}+\frac{\Delta \ell}{\ell}+\frac{2\Delta d}{d}$$

$\Delta \ell = \Delta d$ (same instrment)

so $\frac{\Delta \ell}{\ell}=\frac{2\Delta d}{d}$ hence both contribute same in error