ENGINEERING SCIENCE - CSEE 2008

Solutions from: Maktaba by TETEA

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1

i	ii	iii	iv	v	vi	vii	viii	ix	x
C	B	D	A	C	D	B	A	B	B

2. Stress = force/ area

-Area = $\pi (0.02)^2/4 = 3.14 \times 10^{-4}$

-stress = $45000/3.14 \times 10^{-3}$

$= 143.23 \times 10^6 N/M^2$

-strain = extension/original length

= 1.8/1000

= 0.0018

3. Recall that, $\alpha = (R_2 - R_1)/R_1(T_2-T_1)$

$= (61-53)/(53(50-20))$

$= 5.03 \times 10^{-3}/^0C$

4. Data given, v = 8cm, f= R/2 = 10/2 = 5cm, from 1/f = 1/v + 1/u

U = (vf)/ (v-f)

= (8 x 5)/ (8-5)

U = 13.3cm

Also, from magnification =v/u = h_i/h_o, $8/13.3=h_i/2$

Hence, size = 1.2cm

-Nature of image is diminished

5. Speed, v = 50km/h = 13.89m/s, radius = 30

From angular velocity = v/r

= 13.89/30 = 0.46rad/s

6(a).-resistivity, =RA/L

= (2.2 x 0.5 x 10^{-6})/2

= 5.5 x10^{-7}/^{0}C

(b)Length = RA/resistivity

= (2 x 0.5 x 10^{-6})/ (5.5 x10^{-7})

= 1.82cm

7. (a) Coefficient of linear expansion is the amount of heat required to increase the length of substance by 1K.

(b)Recall that, α= increase in length/ (original length x temp. change)

Increase in length = α x (original length x temp. change)

= 0.000012 x (2.5 x (90-10))

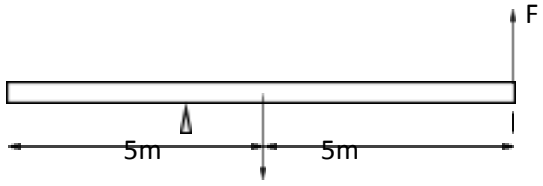
= 6 x 10^{-8}m

8. (a) Magnetic field is region around a magnet in which a body will experience an attraction or repulsion.

(b)Neutral point is the point where magnetic field is zero.

(c)Magnetic declination is the angle on the horizontal plane between magnetic north and geographical north.

9. Let the force be F



-From clockwise moments=anticlockwise moments.

(800 x 1)= (F x 5)

Force is 160N

10. From, f = 1/2l$\sqrt{(\frac{TL}{M})}$

$F_1/f_2 = \sqrt{(\frac{l2}{l1})}$ at constant tension

$F_2 = 360/ (100/80)^{1/2} = 322Hz$

(b) $f_1/f_2 = \sqrt{(\frac{T1}{T2})}$ at constant length

$F_2 = 360/ (40/90)^{1/2}$

$= 540Hz$

11. (a) work is the product of force and distance moved by the body.

(b)Energy is the capacity of doing a work.

(c)Power is the rate of doing work.

12(a) from mass = density x volume

$= 1025 \times 500 \times 10^{-6}$

$= 5.125$ kg

(b)Apply Boyle's law, $v_1p_1 = v_2p_2$, $v_2 = v_1p_1/p_2$

$= (500 \times 1)/4$

Pressure is $125cm^3$

13. (a)-Upward forces must be equal to sum of downward forces.

-clockwise moments equals to anticklockwise moments

(b)(i)Taking moments about R,

$(200 \times 0.3) + (300 \times 0.1) = (w \times 0.25) + (100 \times 0.4)$

$W = 200N$

Also, from upward forces = downward forces

$R = 200 + 300 + 200 + 100 = 800N$

14. (a) $PE = mgh$

$= 150 \times 9.81 \times 4$

$= 5886J$

(b)From, lose in PE = gain in KE

5886 ½ x 150 x v^2

(i)Velocity = 8.86 m/s

(ii) KE = 5886J

(iii) PE = 120 x 9.81 x 3

= 3531.6J

15(a). From the law, P = Mw + C

Where p = effort, w= load

-for p = 180N, w = 2000N, then, 180 = 2000M + C _____ (i)

Also for p = 300N, w = 5000N, then 300 = 5000M + C_____ (ii)

Solving the two equations simultaneously, M = 0.04, C = 100

Hence, law of machine is P = 0.04W + 100

(b) P = 0.04w + 100, but w = 10000, so

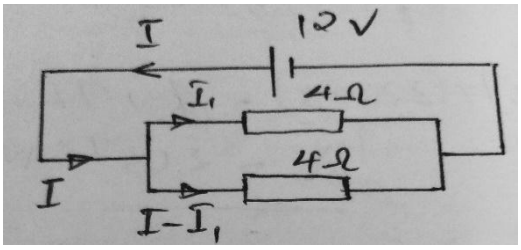
- Effort = 0.04(10000) + 100 = 500N
- MA = 10000/500 = 20
- Efficiency = 20/50 x 100% = 40%

(c)Limiting efficiency = 1/VR x 100%

= 1/50 x 100%

= 2%

16. Consider the circuit below;-



Total resistance = (4 x 4)/ (4 + 4) = 2Ω

Total current = 12/2 = 6A

-Current at each resistor = 12/4 = 3A.