TUTORIAL QUESTIONS_DEFORMATION OF SOLIDS

Question 1

A

Question 2

C

Question 3

$F = kx$
$10 = k\ (40 \times 10^{-3})$
$k = 250\ Nm^{-1}$

Total extension = 40 mm, each spring extension would be 20 mm
So total energy stored = $\frac{1}{2}\ (250)(20 \times 10^{-3})^2 + \frac{1}{2}\ (250)(20 \times 10^{-3})^2 = 0.10$ J
Answer: B

Question 4

$F = kx$
$6 = k\ 0.03$
$k = 200\ Nm^{-1}$
Additional strain energy = $\frac{1}{2}\ (200)(0.04)^2 - \frac{1}{2}\ (200)(0.03)^2$
= 0.07 J (Answer: C)

Question 5

$F = (400)(20 \times 10^{-3})$ = **8.0 N (Answer: A)**

Question 6

$E = kL/x$, $k = Ex/L$
So when length is halved, k would be doubled.
K' = 2K

Question 7

$F = \frac{1}{2}\ kx$
$F = ma$
$ma = \frac{1}{2}\ kx$
a is directly proportional to x. (Answer: A)

Question 8

a.) $F = kx$, $50 = k(0.1)$, $k = 500\ Nm^{-1}$
max. energy stored = ½ (500)(0.15)^2 + ½ (500)(0.15)^2 = **11.25 J**

b.) $mgh = 11.25$
$h = 11.25 / (0.6 \times 10)$ = **18.75 m**

Question 9

a.) $F = kx$
$0.6 = (6)x_1$, x_1 = **0.1 m**
$0.6 = (3)x_2$, x_2 = **0.2 m**

b.) $k_{total} = (1/k_1 + 1/k_2)^{-1}$ = **2 Nm^{-1}**

c.) strain energy = ½ (2)(0.3)^2 = **0.09 J**

Question 10

a.) mgh = (5 x 9.81 x 0.02) = **0.981 J**

b.) energy stored = ½Fx = ½(5 x 9.81)(0.02) = **0.491 J**

c.) **Energy lost as heat during the extension of the rubber cord.**

Question 11

a.) $F = kx$
%k = %F + %x
= [(0.02/4.00) + (0.1/(17.95 – 13.60))] x 100%
= **2.8 %**

b.) $k = (4/(17.95 – 13.60)x\ 10^{-2}) = 91.95\ Nm^{-1}$
$\Delta k = (2.8/100)(91.95) = \pm 2.57 = \pm 3$ (1 s.f.)
k = **92 ± 3 Nm^{-1}**

c.) %x = %F + %k
= [(0.02/2.00) + (3/92)] x 100%
= **4.3 %**

Question 12

(i) spring constant = (3.8/2.1) = 1.8 N cm^{-1}

(ii)

1. $\Delta EP = mg\Delta h$
   $= (3.8) \times (1.5 \times 10^{-2})$
   $= 0.057$ J

2. $ES = \frac{1}{2} kx^2$
   $\Delta ES = \frac{1}{2} \times 1.8 \times 10^{-2} (0.036^2 - 0.021^2)$
   $= 0.077$ J

3. work done = 0.077 – 0.057
   = 0.020 J

Question 13

Material	E / Pa	Breaking stress / Pa	Cross-sectional area / 10^{-4} m^2	Breaking force / N
Steel	2.0×10^{11}	9×10^8	1.0	9×10^4
Nylon	7.0×10^7	0.6×10^8	5.0	3×10^4
X	1.1×10^{11}	5×10^8	0.2	1×10^4
Y	5.5×10^{10}	1×10^9	0.2	2×10^4

A.) Refer table
B.) Steel, X, Y, nylon
C.) Nylon, X, steel, Y
D.) X, 1×10^4
E.) Steel , 9×10^4
F.) Refer diagram
G.) Refer diagram