S1. Ans. (d)
In the case for maximum elongation,
Stress = Elastic limit
$\delta\ \text{max} = \frac{\sigma\ \text{elastic} \times L}{\text{Young's modulus}} = \frac{8\times10^{8}\times1}{2\times10^{11}}$
$= 4\times10^{-3}$
$= 4\,mm$
i.e. maximum elongation is 4 mm.

S2. Ans. (a)
Thermal strain = Longitudinal strain
$= \alpha\,\Delta\,T$
⇒ Longitudinal strain,
$\delta = 10^{-5}\times\ 10^{2} = 10^{-3}$
⇒ Compressive stress = δ × Young's Modulus
$= 10^{-3}\times0.5\times10^{11}$
$= 0.5\times10^{8}$
⇒ Compressive force
$= 0.5\times10^{8}\times10^{-3} = 0.5\times10^{5}$
$= 5\times10^{4}\times\frac{10}{10}$
$= 50\times10^{3}\ N.$

S3. Ans. (c)
Stress $= \frac{F}{A} = \frac{T}{A} = \frac{W}{A}$

S4. Ans. (b)
In stretching of a spring only shape changes therefore shear modulus determines the stretching of spring. And $Y_{\text{copper}} < Y_{\text{steel}}$ so steel has more tensile strength than copper.

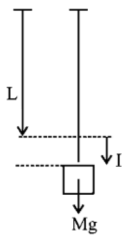
S5. Ans. (c)
Hint: Stress $= \frac{\text{Mg}}{\text{A}}$

Strain $= \frac{\Delta\text{L}}{\text{L}} = \frac{\text{L}_1-\text{L}}{\text{L}}$

young's modulus $= \frac{\text{Stress}}{\text{Strain}} = \frac{\text{MgL}}{\text{A}(\text{L}_1-\text{L})}$

S6. Ans. (c)
Hint: $\text{U} = \frac{1}{2}\times\text{stress}\times\text{strain}\times\text{vol}^{\text{m}}$

$= \frac{1}{2}\times\frac{\text{F}}{\text{A}}\times\frac{\Delta\text{l}}{\text{L}}\times\text{AL}$



$= \frac{1}{2}\times\text{Mg}\times\Delta\text{l} = \frac{1}{2}\text{Mgl}$

S7. Ans. (c)
Hint: From Hooke's Laws

$\text{F} = \frac{\text{YA}\Delta\ell}{\ell}$

or $\text{F} = \frac{\text{YA}^2\Delta\ell}{(\text{A}\ell)} = \frac{\text{YA}^2\Delta\ell}{\text{V}}$

$\text{F}\propto\text{A}^2 \Rightarrow \text{F}\propto(3\text{A})^2$

$\frac{\text{F}^1}{\text{F}} = 9 \Rightarrow \text{F}' = 9\text{F}$

S8. Ans. (c)
Hint: $\text{B} = \frac{\text{P}}{-\frac{\Delta\text{v}}{\text{v}}}$ ....(i)

where B = bulk modulus

Volume of spherical body $\text{V} = \frac{4}{3}\pi\text{R}^3$

fractional change in volume

$\frac{\Delta\text{V}}{\text{V}} = \frac{3\Delta\text{R}}{\text{R}}$

Substituting the value of $\frac{\Delta\text{V}}{\text{V}}$

$\text{B} = \frac{\text{P}}{-\frac{3\Delta\text{R}}{\text{R}}}$

$\frac{\Delta\text{R}}{\text{R}} = (-)\frac{\text{P}}{3\text{B}}$

where (-ve) sign is decrease in radius.

S9. Ans. (b)
Hint: Bulk modulus (B) $= \frac{\Delta\text{p}}{-\frac{\Delta\text{V}}{\text{V}}}$

$= \frac{-\Delta\text{p}}{\frac{\text{V}_2}{\text{V}_1}-1} \Rightarrow \text{B} = \frac{\text{p}}{1-\frac{\rho}{\rho'}} \Rightarrow 1-\frac{\rho}{\rho'} = \frac{\text{p}}{\text{B}}$

$1-\frac{\text{p}}{\text{B}} = \frac{\rho}{\rho'}$

$\frac{\rho'}{\rho} = \frac{1}{1-\frac{\text{p}}{\text{B}}}$

S10. Ans. (b)

Hint: As we know

$B = \frac{P}{\frac{\Delta V}{V}}$

So, $\frac{\Delta V}{V} = \frac{P}{B}$

Now P = ρgh and compressibility 'K'= $\frac{1}{B}$

So $\frac{\Delta V}{V} = \rho gh(K)$

$= 10^3 \times 9.8 \times 2700 \times 45.4 \times 10^{-11}$

$= 1.201 \times 10^{-2}$

S11. Ans. (b)

Hint: $Y = \frac{\frac{F}{A}}{\frac{\Delta\ell}{\ell}} \Rightarrow \Delta\ell = \frac{F\ell}{AY}$

But V = Aℓ So A = $\frac{V}{\ell}$

Therefore $\Delta\ell = \frac{F\ell^2}{VY} \propto \ell^2$

S12. Ans. (b)

Hint: $Y = \frac{\frac{F}{A}}{\Delta\ell/\ell} \Rightarrow \Delta\ell = \frac{F\ell}{YA} = \frac{F\ell}{Y\pi r^2} \Rightarrow \Delta\ell \propto \frac{\ell}{r^2}$

Therefore extension will be maximum for ℓ = 50 cm & diameter = 0.5 mm