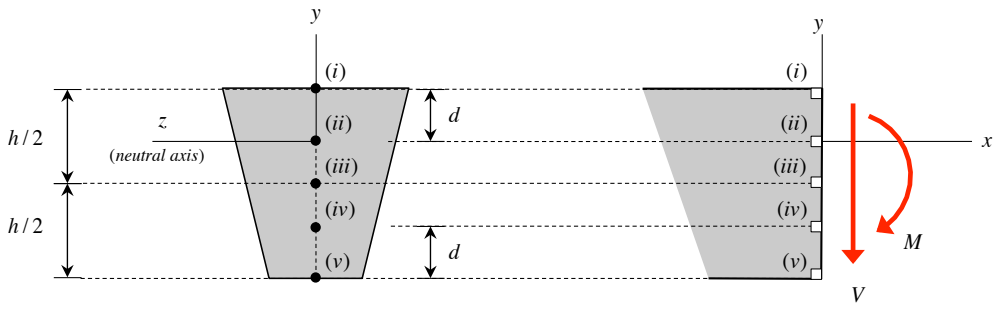
Q1

Conceptual question 10.3



cross section of beam ***SIDE view of beam***

A shear force V and bending moment M act at a cross section of a trapezoidal cross-sectioned beam. Consider the five points (i), (ii), (iii), (iv) and (v) on the beam cross section, as shown above. *Match up the state of stress at each of these five points with the stress elements (a) through (o) shown below.* If you choose "(o) NONE of the above", provide a sketch of the correct state of stress for your answer.

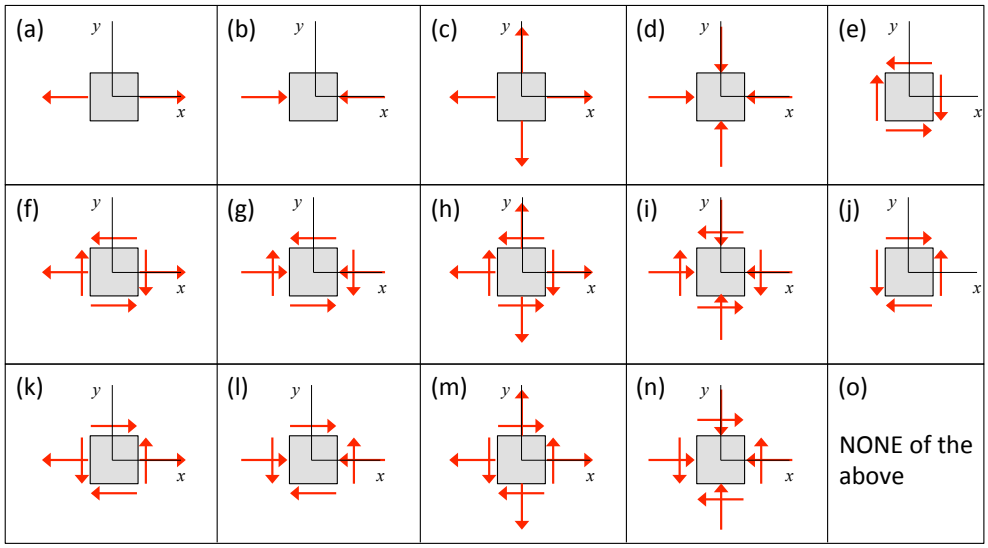
The state of stress at point (i) is (a) tensile in σ and $\tau=0$ (Shear stress free)

The state of stress at point (ii) is (e) neutral axis for σ & τ down

The state of stress at point (iii) is (g) compression in σ and τ down

The state of stress at point (iv) is (g) compression in σ and τ down

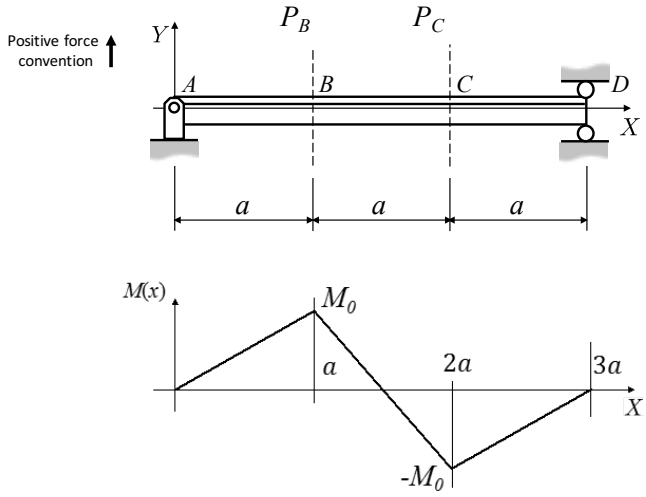
The state of stress at point (v) is (b) compression in σ and $\tau=0$ (Shear stress free)



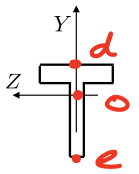
Q2

Conceptual question 10.6

A T-beam of length $3a$ is supported at the two ends and loaded by forces P_B and P_C. The line of action of the forces is indicated (dashed lines) but the direction is to be determined. The correct moment diagram is properly shown below.



Cross section of the T-beam



e further from o than d is from o
$\Rightarrow |\sigma_e| > |\sigma_d|$

At B: $\sigma_e > 0$, $\sigma_d < 0$

At C: $\sigma_e < 0$, $\sigma_d > 0$

(a) Indicate the cross section(s) where the maximum *tensile* stress is attained:

(i) $x = 0$
(ii) $x = a$ @ B and e
(iii) $x = 2a$
(iv) $x = 3a$

(b) Indicate the cross section(s) where the maximum *compressive* stress is attained:

(i) $x = 0$
(ii) $x = a$
(iii) $x = 2a$ @ c and e
(iv) $x = 3a$

(c) Indicate the value of the reaction at A, that is of A_y:

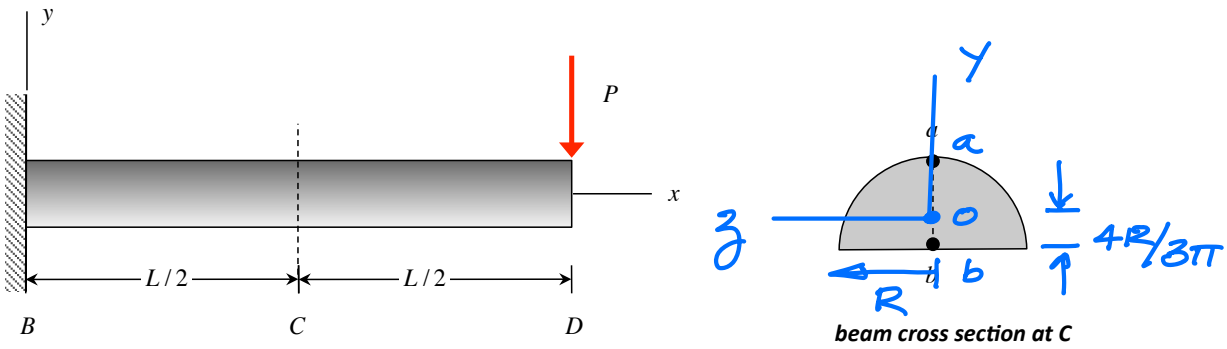
(i) $A_y = M_0/a$
(ii) $A_y = -M_0/a$
(iii) $A_y = 2M_0/a$
(iv) $A_y = -2M_0/a$
(v) $A_y = 3M_0/a$
(vi) $A_y = -3M_0/a$

(d) Indicate the value of the load at B, that is of P_B:

(i) $P_B = M_0/a$
(ii) $P_B = -M_0/a$
(iii) $P_B = 2M_0/a$
(iv) $P_B = -2M_0/a$
(v) $P_B = 3M_0/a$
(vi) $P_B = -3M_0/a$

Q3

Conceptual question 10.8



Consider the cantilevered beam above with the concentrated load *P* at end D. Consider the axial components of stress at points "a" and "b" (σ_a and σ_b, respectively) at location C along the beam. Circle the response below that most accurately describes the relative sizes of the magnitudes of these two stresses:

a) $|\sigma_a| > |\sigma_b|$

b) $|\sigma_a| = |\sigma_b|$

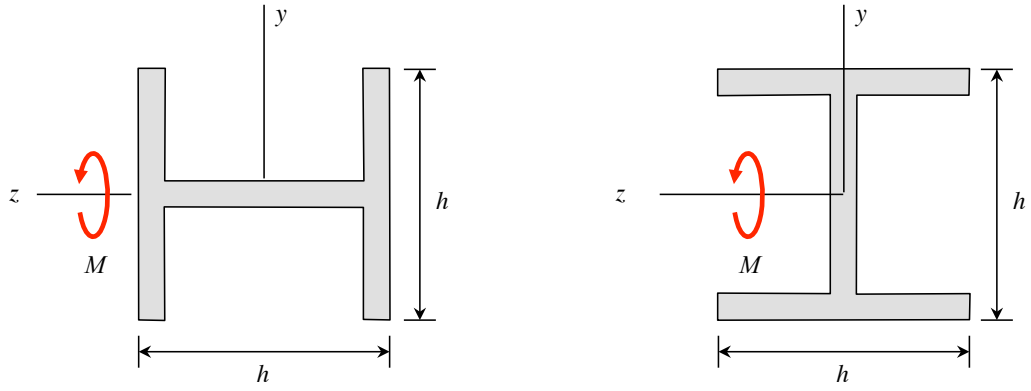
c) $|\sigma_a| < |\sigma_b|$

Point "a" is further from O than "b" is from "O"

$\Rightarrow |\sigma_a| > |\sigma_b|$

Q4

Conceptual question 10.9



cross section #1 ***cross section #2***

The cross sections of two beams are shown above, where cross section #2 is that of cross section #1 when rotated $90°$ about the x-axis. Both beams experience the same bending moment M at the cross section. Let σ_1 and σ_2 represent the magnitudes of the normal stress acting on cross section #1 and cross section #2, respectively. Circle the answer below that most accurately describes the relative sizes of σ_1 and σ_2:

a) $\sigma_1 < \sigma_2$

b) $\sigma_1 = \sigma_2$

c) $\sigma_1 > \sigma_2$

The 2nd area moment for #2 is greater than that of #1 (area further spread from neutral plane in #2 than #1):

$I_1 < I_2 \Rightarrow |\sigma_1| > |\sigma_2|$

g