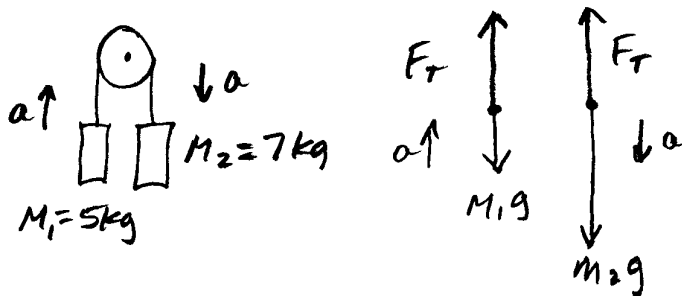**Quiz 15 – Newton's Second Law – 11-04-03**

Useful equations: $\Sigma F = ma$ $F_g = mg$

Two masses are connected by a rope and hang over a pulley. One mass is 5 kg and the other is 7 kg.

a) Draw FBDs and label them completely.
b) Solve for the acceleration without numbers.
c) Substitute values and solve for the acceleration numerically.
EC) Calculate the tension in the rope.

$$\Sigma F = Ma$$

$$① \quad F_T - M_1 g = M_1 a$$

$$② \quad M_2 g - F_T = M_2 a$$

$$M_2 g - M_1 g = M_1 a + M_2 a$$

$$(M_2 - M_1) g = (M_1 + M_2) a$$

b)
$$\boxed{a = \frac{(M_2 - M_1) g}{M_1 + M_2}}$$

$$a = \frac{(7kg - 5kg)\, 9.8 \frac{M}{s^2}}{5kg + 7kg}$$

c)
$$\boxed{a = 1.63 \frac{M}{s^2}}$$

$$F_T = M_1 a + M_1 g$$

$$= M_1 (a + g)$$

$$= 5kg \left(1.63 \frac{M}{s^2} + 9.8 \frac{M}{s^2}\right)$$

EC)
$$\boxed{F_T = 57.2 \, N}$$