Q3A

1.
AbCq3z
(a) $750/11$ m/s^2.
(b) $F/(20+M) = 2F/(20+3M)$, so $M = 20$ kg.
2.
(a) The max static friction is $F_M = \mu_s Mg$.
(b) If the box is moving, there is a kinetic friction force $= \mu_k Mg$, so the net force is $M(\mu_s - \mu_k)g$. Therefore, $a = (\mu_s - \mu_k)g$.

Q3B

1.
(a) $Ma = W - Mg$, so $W = M(a+g)$. $M = 55$, and $W/g = M(a/g+1) = 60$, so $a = (60/55-1)g = g/11 = 0.89$ m/s^2.
(b) $v = v_0 + at$ implies $v = -8 + 2 \times 0.89 = -6.22$ m/s. 6.22 m/s downward.
2.
(a) The frictional force must balance the gravitational force in the slope direction: $f = Mg \sin 30 = Mg/2$.
(b) The friction $Mg\mu_k \cos 30°$ balances the x-component of gravity is $Mg/2$, so $\mu_k = 1/\sqrt{3}$.

Q3C

1.
(a) $590/25 = 23.6$ m/s^2.
(b) $F/(M+25) = (3/2)F/(M+m+25)$, so $3M+75 = 2M+2m+50$, so $M = 2m-25 = -5$. Impossible.
2.
(a) $Mg\cos 30°$.
(b) The acceleration is $g/2$, so $0 = 2.3^2 + 9.8\Delta x = 2.3^2 - 2gH$. Therefore, $H = 0.27$ m.

Q3D

1.
(a) $a_A/a_B = m/M$.
(b) Obviously (or due to the equivalence principle) 1.
2.
(a) The acceleration in the positive x-direction is $g/2 + \mu_k\sqrt{3}g/2 = (1/2 + 0.1\sqrt{3})g = 6.6$ m/s^2. $-v_0 + 6.6 \times 2.5 = 0$, so $v_0 = 16.5$m/s.
(b) After coming to a halt, it never moves again (because $\mu_s > \tan 30°$), so the highest position is the wanted position. Its x-coordinate is $-(1/2)6.6(2.5)^2 = -20.6$ m.