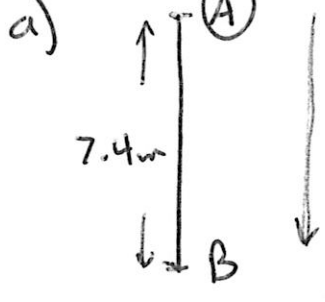
13 It is best to view this question as two systems; One where the ball moves from (A) to (B) and one where the ball moves from (B) to (C). The (A) to (B) system contains more mechanical energy because it covers a larger distance (7.4m) than the (B) to (C) system. (5.2m).

- Solve one system at a time!

a)



← Total Energy at A = $KE_A + PE_A$

← Total Energy at B = $KE_B + PE_B$

No air resistance means no nonconservative force acting on the system so → Total Energy at (A) = Total Energy at (B)

$$KE_A + PE_A = KE_B + PE_B$$

$V_A = 0$ $\quad \frac{mV_A^2}{2} + mgh_A = \frac{mV_B^2}{2} + mgh_B$ $\quad h_B = 0$

$$\sqrt{2gh_A} = V_B$$

$$\sqrt{2(9.8)(7.4)} = V_B$$

$$V_B = 12 \text{ m/s}$$

b) The system (B) to (C) is similar to (A) to (B) except it contains less mechanical energy because energy was lost when the ball collided with the ground (heat, sound, etc). We would expect the rebound speed to be less than 12 m/s

Total Energy at B = Total Energy at C

$KE_B + PE_B = KE_A + PE_A$

$h_B = 0$ $V_A = 0$

$\frac{mV_B^2}{2} = mgh_A$

$V_B = \sqrt{2gh_A}$

$= \sqrt{2(9.8)(5.2)}$

$= 10$

$V_B = 10$ m/s

↓

A basketball never bounces up with the same speed it hits the floor with!

c) We could add up the total energy in the (B) to (C) system and subtract it from the (A) to (B) system but the difference in Potential energies (max) will work.

$PE_A - PE_C$ = Energy lost in bounce

$mgh_A - mgh_B$ = Δ Mechanical energy

$mg(h_A - h_B)$ =

$(0.62)(9.8)(7.4 - 5.2)$ = 13 J