

PROBLEM 1 – 10 points

A ball is initially at rest in your hand. You then accelerate the ball upwards, releasing it so that it goes straight up into the air. When it comes down, you catch it and bring it to rest again. Neglect air resistance.

Sketch a free-body diagram for the ball when it is

(a) accelerating upward in your hand.

(b) moving up after you release it.

(c) at rest, just for an instant, at the top of its flight.

(d) moving down before you catch it.

(e) slowing down after it makes contact with your hand again.

PROBLEM 2 – 10 points

Three identical objects are initially at rest. A constant net force F is applied to object 1 for a time period T , so that it accelerates through a distance D and reaches a speed v .

A constant net force $2F$ is applied to object 2 for a time period T (the same time as for object 1).

[2 points] (a) What is the speed of object 2 at the end of its acceleration period?

- v $\sqrt{2} v$ $2v$ $4v$

[3 points] (b) What is the distance traveled by object 2 during the acceleration period?

- $D/2$ D $\sqrt{2} D$ $2D$ $4D$ D^2

Show some work here:

A constant net force $2F$ is also applied to object 3, accelerating it through a distance D (the same distance as for object 1).

[2 points] (c) What is the speed of object 3 after accelerating through a distance D ?

- v $\sqrt{2} v$ $2v$ $4v$

[3 points] (d) How much time does it take object 3 to accelerate from rest through the distance D ?

- $T/4$ $T/2$ $T/\sqrt{2}$ T $2T$ \sqrt{T}

Show some work here: