## Unit 6 Projectile Motion Problem Set 3

Make simple picture labeled with information from the problem, a force diagram, and motion map. If the motion map and force diagram are exactly the same another problem then you can skip making it, put a note saying, which problem to look at. Ignore Air Resistance for these problems unless otherwise stated.

1. Courtney kicks a soccer ball a LONG way with a $\mathrm{V}_{\mathrm{i}}$ of $57.0 \mathrm{~m} / \mathrm{s}$ at $35^{\circ}$ above the horizontal.
A. How high above the ground does the ball get?
B. How long is the ball in the air?
C. How far from Courtney does the ball hit the ground?
2. Elizabeth's paper football is sliding across the top of a table which is 0.966 meters high. If the paper football slides off the table and hits the floor a distance of 3.25 meters from the base of the table. It's in meters since this happens in ENGLAND!
A. How long did it take for the paper football to hit the floor?
B. With what horizontal velocity was the paper football moving when it left the table top?
3. Sarah's unoccupied car is sent off the top of a cliff during a movie scene. The car is moving at $50 \mathrm{~km} / \mathrm{hr}$ at the instant it leaves the cliff. The cliff is 52.0 meters high. Her car was unoccupied be cause she was eating some CAMBELL'S soup.
A. How long is the car in the air?
B. How far from the base of the cliff does the car hit the ground?
4. Nevada's football is kicked from the top of a cliff in Utah at $42 \mathrm{~m} / \mathrm{sec}$ at an angle of $42.0^{\circ}$ with respect to the horizontal. The cliff is 66.0 meters high. How far from the base of the cliff does the football hit the ground? (SHOW ALL WORK!)
5. A pilot flying at (k)night, Ryan, wishes to drop bales of hay from his plane to a herd of cattle, which has been stranded on high ground during a severe flood. The speed of the plane is $185 \mathrm{~km} / \mathrm{hr}$. The plane is flying horizontally at 450 meters above the ground.
A. How many seconds prior to the time he is directly above the cattle should he release the bales? (We will assume the bales miss the cattle even if his timing is exactly correct.)
B. What is his horizontal distance from the cattle when the bales are released?
6. A cannonball is launched at $48 \mathrm{~m} / \mathrm{s}$ at $65^{\circ}$ from the horizontal, by Dr. Evil toward's Austin Powers shag-a-delic new house. It would have been a "LASER" but ... you know Mini Me and all that....
A. How long is it in the air?
B. How high does it go?
C. What is the range?
7. A stone is thrown horizontally at $22 \mathrm{~m} / \mathrm{s}$ from the top of a $150-\mathrm{m}$ cliff, by Emily S. (She does not live in a glass house so it is okay that she did this.)
A. How long is it in the air?
B. How high is the stone after 1.5 sec ? (Give the distance from the foot of the cliff.)
C. What is the range?
8. A cannonball is projected at $29 \mathrm{~m} / \mathrm{s}$ at an angle of $40.0^{\circ}$ from the horizontal, by Evan at Hannah's house. The cliff from which it is fired is 85 meters high.
A. How long is it in the air?
B. How high does it go?
C. What is the range?
9. Christina throws a BASS horizontally from the top of waterfall with a speed of $150 \mathrm{~km} / \mathrm{h}$. It strikes the pond 6.5 s later.
A. How far has it fallen vertically?
B. How far has it traveled horizontally?
C. Find the magnitude and direction of its resultant velocity at the instant before it hits the ground.
10. Zach's toy car is sliding across the top of a table, which is 0.875 meters high. If the car slides off the table and hits the floor a distance of 4.56 meters from the base of the table,

## A. How long did it take for the car to hit the floor? <br> B. With what horizontal velocity was the car moving when it left the table top?

11. If a softball player, Sydney, can throw a ball a maximum distance of 70.0 meters horizontally, what is the maximum vertical height to which he can throw it? (Figure out $\mathrm{V}_{\mathrm{i}}$, then make it the Vyi for the second part of the problem.) $\quad$ Range $=\left(V_{i}^{2} \sin (2 \theta)\right) / g \quad \theta=45^{\circ}$ for max distance.
12. A baseball leaves the bat at a height of 4.0 ft above the ground, traveling at an angle of $45^{\circ}$ with the horizontal, and with a velocity such that the horizontal range would be 400 ft . At a distance of 360 ft from home plate is a fence 30 ft high. Will the ball be a home run? $\left(\mathrm{g}=32 \mathrm{ft} / \mathrm{s}^{2}\right)$
13. A trench motor fires a projectile at an angle of $53^{\circ}$ above the horizontal with a muzzle velocity of $85 \mathrm{~m} / \mathrm{s}$. A tank is advancing directly toward the mortar on level ground at a speed of $3.0 \mathrm{~m} / \mathrm{s}$. What should be the distance from mortar to tank at the instant the mortar is fired in order to score a hit? (One way to think of this problem is to treat one object as not moving (Relative Velocities). For instance if you have two cars that are driving at 50 m.p.h. and 65 m.p.h., you can treat one as having $V=0$ m.p.h. and the other as having $a V=(65 \mathrm{~m} . \mathrm{p} . \mathrm{h} .-50 \mathrm{~m} . \mathrm{p} . \mathrm{h})=.15 \mathrm{~m} . \mathrm{p} . \mathrm{h}$.
