NAME: _____ **PERIOD:** _____ **DATE:** _____

Physics of Iron Man 2

Hollywood movies tend to bend the laws of physics for dramatic effect. We will analyze the movie "Iron Man 2" to explore situations where matter, energy and the laws of physics are changed to suit a storyline.
NOTE: Points will be deducted for incorrect or missing unit.
1. As Iron Man jumps out of the back of the plane he is approximately 12,500 feet AGL (above ground level). What is this height in meters?

2. How long will it take Iron Man to fall to the ground if his rockets fail?

3. How fast is Iron Man traveling (final velocity) when he hits the ground?

4. When Iron Man drops into the party, how much force would he generate when he strikes the ground? (Required info: Iron Mans suit weighs 240lbs,Tony Stark weighs 155lbs and each pound is 0.45kg) **HINT: 1st convert each weight to kg**

5. Ivan Vanko (Whiplash) smashes his TV with his electrified whips. If the velocity of the whip is 5m/s and the radius from his shoulder to the end of the whip is 3m, what is the centripetal acceleration of the whip end?

6. Mickey Rourke, who plays Ivan Vanko, weighs 169.1 lbs. How much is this in kg?

7. During the Monaco Grand Prix race, Tony is seen driving a Formula 1 car. The fastest lap ever at the Monaco Grand Prix was set by Kimi Räikkönen in qualifying for the 2006 Grand Prix, at 1m 13.532s. The distance around the track is 3.340 km. How many miles is this?

8. The Monaco Grand Prix is 78 laps. How long would it take Kimi Räikkönen to complete the race is he traveled the entire race at his record lap time?

9. The Monaco Grand Prix track has many turns. When making these turns, which force is keeping the car from leaving the course and crashing?

10. Name one other **force**, other than the force you listed in question #9, acting on the formula 1 car and how this force is affecting the car's motion.

11. The **average speed** of a Formula 1 car is 101.769 mph. How many kilometers per hour is this?

12. Covert your answer in question #11 to m/s

13. The Grand Hotel hairpin turn at Monaco has a radius of 6m. Use the velocity you calculated in question #12 to calculate the **centripetal acceleration** experienced by the car when making the Grand Hotel Hairpin turn.

14. The minimum weight of a Formula 1 is 600kg including the driver. Use the answer in question #13 plus this information to calculate the **centripetal force** of the car during the turn.

15. When Lt. Col. James 'Rhodey' Rhodes attempts to make Tony "shut down" his Iron Man suit, Tony strikes Rhodey with a barbell with ½ the weights. The bar weighs 20kg and each of the 2 weights is 45kg. If Tony swings the barbell at 21.4m/s$_2$ then how many **Newtons** of force strike Rhodey?

16. When Dr. Fury of the Strategic Homeland Intervention, Enforcement and Logistics Division (S.H.I.E.L.D.) appears, he is heard to say to Tony "*Sir, I'm gonna have to ask you to exit the donut*". The place in the Randy's Donuts sign where Tony is sitting is approximately 20 ft (6.1m) off the ground. If Tony jumped how long would it take him to hit the ground?

17. What would Tony's velocity be as he strikes the ground after jumping from the Randy's Donuts sign?

18. After his meeting with Dr. Fury, Tony is seen driving his Audi R8 V10 Spyder which has a top speed of 195 miles per hour. How many meters per second is this?

19. During the remodel of Tony Stark's lab, he is seen breaking concrete with a 12lb sledgehammer. If he generates 20N of force then how fast is the acceleration of the sledgehammer? HINT: you'll need to convert 12lbs to kg first.

20. During his presentation at the Stark Expos, Justin Hammer's robot drones are taken over by Ivan Vanko. They begin shooting machine gun fire at Iron Man. If these 7.63 x 39 bullet cartridges can cover 9400m in 4 seconds then what are there velocities?

21. Vanko's drones are chasing Iron Man. Explain which of Newton's Laws allows the rockets to move toward Iron Man when fired by the drones.

22. When Iron Man flies into the Earth sphere at the Expo the drones are unable to turn and fly straight into the sphere. Why? Explain.

23. Name one situation in the movie where Newton's 1_{st} Law was broken. (An object at rest remains…)

24. Name one situation where Newton's 2nd law was broken. (F=ma)

25. How can you relate what you learned this semester about motion with things you witnessed in Iron Man 2?