Physics 1 Final Exam

Multiple choice: 3 points each

1. A car is in first gear. Compared to the same engine speed in RPMs in any other gear, which statement applies the best?

X. Angular velocity of the tires Y. Torque at the tires Z. Towing Capacity

a. X is maximum, Y is minimum, Z is maximum

b. X is minimum, Y is minimum, Z is maximum

c. X is maximum, Y is maximum, Z is minimum

d. X is minimum, Y is maximum, Z is maximum

1. What can be done to maximize a torque?
2. maximize the force acting on the rotating object
3. maximize the distance from the axis of rotation
4. use an angle of 90 degrees between the force and the radius
5. all of the above
6. A figure skater spinning slowly and then repositioning herself to spin more quickly demonstrates which property?
   1. Negative angular acceleration
   2. Decrease in angular velocity
   3. Conservation of angular momentum
   4. Increase in angular momentum
7. Which of the following cannot be used to indicate angular speed?
   1. RPM
   2. Rad/sec
   3. m/sec
   4. degrees per second
8. The tides are present on Earth because
9. the sun causes the Earth to orbit
10. the moon has a negligible gravitational effect on the earth except for in the oceans
11. there is a different force of gravity acting on either side of the earth resulting from the moon
12. tectonic plates shift as the Earth rotates causing the water levels to vary
13. An object is a given distance from the Earth such that the force of gravity on it is one quarter of its value on the surface of the Earth. How far above the **surface** of the Earth is the object?
    1. 1 Earth radius
    2. ½ Earth radius
    3. 2 Earth radii
    4. 4 Earth radii
14. A 75.0 Kg person stands on a scale that reads 500. Newtons. The person is pulling on a rope that is suspended from overhead. What is the tension in the rope?
15. 235 Newtons
16. 735 Newtons
17. There is no tension in the rope.
18. There is not enough information to determine the tension

10. Which of the following statements describes a geosynchronous satellite?

a. It remains fixed over a given location of the Earth above the equator

b. They can be used for a variety of purposes including communication, spying, weather monitoring, space observation

c. Their orbital period is equal to 24 hours

d. all of the above

11. When the velocity versus time graph is linear, the acceleration is

A. positive

B. negative

C. constant

D. changing

12. When acceleration is uniform and nonzero, the position verses time graph

A. is parabolic

B. is linear

C. is exponential

D. passes through the origin

**13.** “Objects at rest remain at rest; objects in motion remain at constant velocity unless they experience a net force.” Is an example of

* 1. Newton’s 1st Law of motion
  2. Newton’s 2nd Law of motion
  3. Newton’s 3rd Law of motion
  4. Newton’s 4th Law of motion

**14.** Why are crumple zones put in cars?

1. To reduce stopping distance in order to reduce the time a person is accelerating.
2. To reduce to force experienced by passengers in a collision by increasing collision time.
3. To reduce the damage done to cars in a collision by allowing your car to deform more.
4. To protect the vital engine parts from being damaged.

15. The law of conservation of momentum applies in which of the following situations?

1. Elastic collisions only.
2. Inelastic collisions only.
3. Systems in which no external forces are present.
4. Only when the law of conservation of energy applies.

**Short Answer:**

* 1. Write the corresponding rotational variable next to each linear one in the blank and include the SI units for each:

Linear Angular

Velocity V (m/sec) \_\_\_\_\_\_\_

Acceleration A (m/sec2) \_\_\_\_\_\_\_

Alteration of motion F (N) \_\_\_\_\_\_\_

Resistance to change M (kg) \_\_\_\_\_\_\_

Kinetic Energy ½ MV2 (J) \_\_\_\_\_\_\_

* 1. What happens to the reading of a car’s speedometer for a given speed when new tires are put on a car **having a higher radius** than the manufacturer installed tires? What happens to the force the tires can generate on the pavement as a result *(torque stays constant)*?
  2. A) Name three energy transformations that involve the creation of or the loss of mechanical energy.
  3. State the three types of collisions that we defined and how kinetic energy is affected in each.

Problems: Kinematics and Newton’s Laws Review.

1. A 2250 kg car has an engine that can apply a force of 10,000 Newtons to the tires. If the total resistive forces acting on the car add up to 1000 Newtons, what is the acceleration of the car?

1. A car accelerates at 3.0 m/sec2 from an initial speed of 10.0 m/sec over a time of 4.00 seconds. What is the total displacement of the car?
2. A sprinter accelerates out of the blocks at 12.0 m/sec2 from rest for a time of 0.50 seconds. How far is has the sprinter traveled at this time?

**Bonus:**  On Mars the length of one day is 24.6 hours and the mass of Mars is 6.39\*1023 kg. What is the altitude (height above the surface) of a geosynchronous satellite on Mars? Mars has a planetary radius of 3.39\*106 meters.