Review 2 – two-dimensional motion – projectiles & circular motion - Newton’s Laws of Motion & Gravitation

**Projectiles**

For questions 1- 4: A 2-kg object is projected horizontally with a speed of 36 m/s from a 60-m tall tower.

Answer choices for questions 1-2:

A initial horizontal *Vi* C horizontal *a* E horizontal component of *V* while in flight

B initial vertical *Vi* D vertical *a* F vertical component of *V* while in flight

1. Which quantity or quantities is/are zero for the object?

2. Which quantity or quantities will change for the object while in flight?

3. How long will the object take to hit the ground?

4. How far from the base of the tower will the object land?

For questions 5 – 8: A 2-kg ball is thrown with a velocity of 25 m/s at an angle of 53o to the horizontal.

5. What is the vertical component of the ball’s initial velocity?

6. What is the vertical acceleration of the ball during flight?

7. How long was the ball in the air if the ball lands 60 m horizontally from where it was thrown?

8. What was the maximum height the ball reached?

For questions 9-11: An object of mass *M* is projected horizontally with a speed of *V* from a height of *H*. Tell whether the quantity would ***increase***, ***decrease***, or stay the ***same*** for each change?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | change | time in air | horizontal distance | vertical acceleration | horizontal acceleration |
| 9. | increase *M* |  |  |  |  |
| 10. | increase *V* |  |  |  |  |
| 11. | increase *H* |  |  |  |  |

**Circular Motion**

For questions 12-13: A 3-kg ball is swung in a horizontal circle at the end of a string that is 0.8 meters long at a constant speed of 2 m/s.

12. What is the centripetal acceleration of the ball?

13. What is the centripetal force on the ball?

14. A ball has a mass of *M*, a speed of *V*, and moves in a horizontal circle of radius *R*. The centripetal acceleration of ball P is *ac* and the centripetal force on ball P is *Fc*. The speed of the ball is increased to *2V* and the radius is kept the same. Which set gives the correct comparative values of acceleration and centripetal force for the ball after the change?

A *ac* and *Fc* B *2ac* and *2Fc* C *4ac* and *4Fc* D  and  E  and 

15. A ball has a mass of *M*, a speed of *V*, and moves in a horizontal circle of radius *R*. The centripetal acceleration of ball P is *ac* and the centripetal force on ball P is *Fc*. The radius of the ball’s path is increased to *2R* and the speed is kept the same. Which set gives the correct comparative values of acceleration and centripetal force for the ball after the change?

A *ac* and *Fc* B *2ac* and *2Fc* C *4ac* and *4Fc* D  and  E  and 

Review 2 – Newton’s Laws of Motion & Gravitation

**Newton’s Laws of Motion & Gravitation**

1. Tell whether the net force on the object is zero.

(a) An object is and remains motionless. (e) An object moves right at constant speed.

(b) An object starts to move from rest. (f) An object moves in a circle at constant speed.

(c) An object speeds up. (g) A dropped object falls freely.

(d) An object slows to a stop. (h) An object slides down a frictionless ramp.

2. A bat hits a moving ball. The bat exerts a force of 100 N to the right on the ball. What forces does the ball exert on the bat?

3. A 45-kg object is given a net force of 500 N. What is its acceleration?

4. What is the weight of a 20-kg object?

5. A truck is driving due north. A box is in the bed of the truck. When the truck suddenly stops, the box will move ? (N, S, E, W) which is explained by Newton’s ? law which is commonly known as the law of ? .

6. A 100-N object hangs motionless from the end of a rope. What is the tension in the rope?

7. A student weighs 200 N. If the student is in an elevator that is accelerating upward at 2.00 m/s2, what will be the mass of the student, the net force on the student, and the apparent weight of the student?

For questions 8-9: A box has a weight of 12 N. A person pushes right on the box with a force of 50 N. The floor exerts a friction of 20 N on the box.

8. What is the magnitude and direction of the normal force on the box?

9. What is the magnitude and direction of the net force on the box?

For questions 10-11: Two carts P and Q are motionless at the top of a frictionless ramp. The mass of cart P is twice the mass of cart Q. The carts are released and slide down the ramp. While sliding down the ramp

10. the net force on cart P will be ? the net force on cart Q.

11. the acceleration of cart P will be ? the acceleration of cart Q.

rope A

rope B

rope C

37o

P

●

For questions 12-14: An object hangs motionless from the

three ropes, A, B, and C. The tension in rope A is 150 N.

12. What is the net force on point P?

13. What is the tension in rope C?

14. What is the tension in rope B?

**Gravitation**

For questions 15-16: Planets X, Y, and Z orbit the same star. Planet X has a mass of *M* and orbits its star at a

distance of *R* meters. The force of gravity of the star on planet X is *F*.

15. Planet Y has a mass of *2M* and orbits the star at a distance of *R* meters.

The force of gravity of the star on planet Y is

A  B  C  D  E 

16. Planet Z has a mass of *M* and orbits the star at a distance of *2R* meters.

The force of gravity of the star on planet Z is

A  B  C  D  E 