Review Problems, Physics 102, Final Exam, Spring 2025

1. The stone is thrown from the ground with an initial velocity of 50 m/s at an angle of 35°. The horizontal and vertical components of its velocity 4 seconds later are closest to:

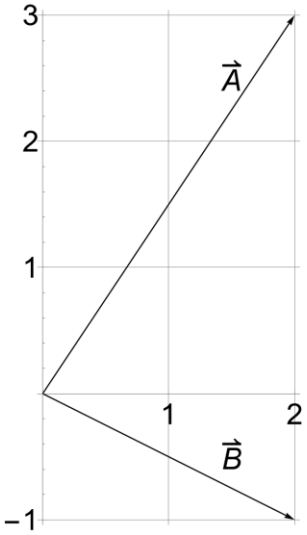
A) v_x = 41 m/s, v_y = 9 m/s

B) v_x = 25 m/s, v_y = 18 m/s

C) v_x = 41 m/s, v_y = -5 m/s

D) v_x = 25 m/s, v_y = -8 m/s

E) v_x = 41 m/s, v_y = -10.5 m/s



The above figure which shows two vectors **A** and **B** is used in the following four problems.

2. Find the magnitude of 3**A**+6**B** (select the closest answer)

A) 6

B) 12

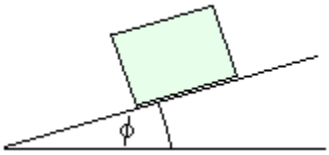
C) 18

D) 24

E) 30

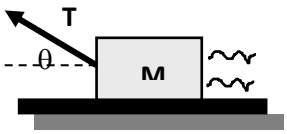
3. A 2-kg block, initially at rest, slides down an inclined plane with constant velocity. Angle of incline is 35^0. Find the coefficient of kinetic friction.

A) 0.2
B) 0.5
C) 0.7
D) 0.8
E) 0.9



4. A 38-kg crate is pulled along a horizontal, frictionless floor by a cord that exerts a 180-N tension force at an angle $\theta = 30^0$ as shown . The normal force on the block is closest to

A) 110 N
B) 146 N
C) 185 N
D) 211 N
E) 282 N

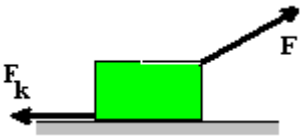


5. A basketball is rolling without slipping along a horizontal surface with total kinetic energy 20 J. How much energy (in Joules) is due to the rotational kinetic energy of the ball about its center of mass? Basketballs are hollow shells. ($I = 2/3\ mr^2$.)

A) 10
B) 8
C) 13.3
D) 4
E) 12

6. A 5-kg block is pulled across a horizontal plane. A pulling force F has a magnitude of 24 N and makes an angle of 28^0 with a horizontal. A 8 N friction force opposes its motion. The block's acceleration is

a. 0.55 m/s^2
b. 2.64 m/s^2
c. 4.29 m/s^2
d. 6.75 m/s^2
e. 8.00 m/s^2



7. A car has a mass of 1200 kg and is moving a 60 mi/h. The driver enters a low-speed zone and applies the brakes, resulting in a net backward force of 1800 N. The brakes are held for 10 s. How far does the car travel during this period?

a. 193 m
b. 175 m
c. 148 m
d. 120 m
e. 75 m

8. Two small objects, with masses *m* and *M*, are originally a distance *r* apart, and the magnitude of the gravitational force on each one is *F*. The masses are changed to 2*m* and 2*M*, and the distance is changed to 4*r*. What is the magnitude of the new gravitational force?

A) *F*/16
B) *F*/4
C) 16*F*
D) 4*F*
E) *F*/2

9. A 1.0-kg ball moving at 2.0 m/s perpendicular to a wall rebounds perpendicular from the wall at 1.5 m/s. The impulse of the ball is:

A) zero
B) 0.5 N·s away from the wall
C) 0.5 N·s toward the wall
D) 3.5 N·s away from wall
E) 3.5 N·s toward the wall

10. A 4-kg object moves to the right at 8.0 m/s. It collides with a 6-kg object moving at 5 m/s to the left. The collision is perfectly inelastic. What is the speed of the 4 kg object after the collision?

A) 0 m/s
B) 0.2 m/s
C) 4.2 m/s
D) 6.2 m/s
E) 8.2 m/s

11. A Ferris wheel rotating at 20 rad/s decelerates with a constant accelration of 5 rad/s^2. How many revolutions will it make before coming to rest?

A) 4.0
B) 2.8
C) 6.4
D) 3.2
E) 1.5

12. A wheel of radius 2 cm has a 4-m cord wrapped around its periphery. Starting from rest, the wheel is given a constant angular acceleration of 1 rad/s^2. The cord will unwind in

A) 125 s
B) 85 s
C) 66 s
D) 20 s
E) 15 s

13. When a ceiling fan rotating with an angular speed of 2.0 rev/s is turned off, a frictional torque of 0.98 Nm slows it to a stop in 4.5 s. What is the moment of inertia of the fan?

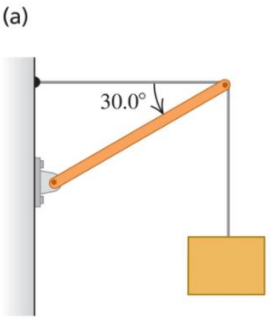
A) 0.35 kgm^2
B) 0.55 kgm^2
C) 0.85 kgm^2
D) 1.35 kgm^2
E) 2.35 kgm^2

14. An electric motor can accelerate a 2.0-kg grinding wheel in a form of a solid disk of radius 0.20 m from rest to 700 rev/min in 14 s. Find the torque generated by the motor.

A) 0.07 N·m
B) 0.11 N·m
C) 0.21 N·m
D) 0.33 N·m
E) 0.46 N·m

15. Find (a) the tension T in the horizontal cable and (b) the magnitude and direction of the force exerted on the strut by the pivot in the arrangement in figure below. Let W be the weight of the suspended crate full of priceless art objects. The strut is uniform and also has weight W.

Ans. **(a) T= 2.60W; (b) F= 3.27W** and **θ=37.6°**



16. A tire on a car is turning initially at 500 radians/s. The car brakes and slows to a stop in 20 s. What is the acceleration in Radians/s^2?

a. -500

b. 0

c. 25

d. 700

e. -25

17. How much work is required to accelerate a 1000 kg car from 20 m/s to 30 m/s?

A) $0.5x10^5$ J
B) $1.2x10^5$ J
C) $2.5x10^5$ J
D) $3.8x10^5$ J
E) $4.5x10^5$ J

18. A 1600 – kg car starts from rest at the top of the long driveway that is inclined at 15^0 with the horizontal. If the average friction force of 1500 N impedes the motion, what is the car's acceleration?

a. 0.76 m/s^2
b. 1.05 m/s^2
c. 1.87 m/s^2
d. 1.60 m/s^2
e. 2.75 m/s^2

19. An automobile traveling along a straight road increases its speed from 30.0 m/s to 50.0 m/s in a distance of 180 m. If the acceleration is constant, how much time elapses while the auto moves this distance?

a. 6.00 s
b. 4.50 s
c. 3.60 s
d. 4.00 s
e. 9.00 s

20. A robotic lander with an earth weight of 3420 N is sent to mars, which has radius of R_M =3.40 x10^6 m and mass m_M =6.42 x10^{23} kg. Find the weight F_g of the lander on the Martian surface and the acceleration there due to gravity, g_M

Ans. 1.30 x10^3 N; 3.7m/s^2

21. A car moving initially at 36 km/h, travels 174 m in 8 s along a straight line with constant acceleration. The acceleration of the car is:

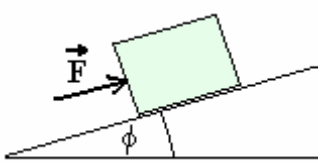
A) 0. 0 m/s^2
B) 0.5 m/s^2
C) 1.0 m/s^2
D) 3. 0 m/s^2
E) 6. 0 m/s^2

22. An airplane propeller starts to turn from rest and speeds up to 2 radians/s after turning 6 Radians. How long does it take, in s .

a. 6
b. 4
c. 3
d. 2
e. 1

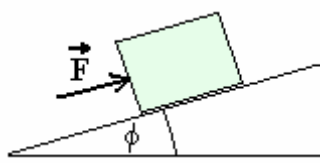
23. A 20 N force **F**, parallel to the incline is required to push a certain crate at acceleration of 1.6 m/s^2 up an incline that is $\Phi = 28^0$ above the horizontal. What is the mass of the crate?

A) 2.31kg
B) 3.49kg
C) **3.22kg**
D) 5.84kg
E) 6.04 kg



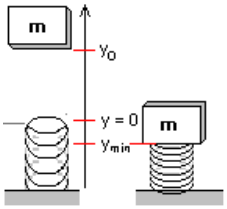
24. A 1.0-kg block is pushed up a rough 22^0inclined plane by a force of F=7.0 N acting parallel to the incline. The acceleration of the block is 1.4 m/s^2 up the incline. Determine the magnitude of the force of friction acting on the block.

A) 1.9 N
B) 2.2 N
C) 1.3 N
D) 1.6 N
E) 3.3N



25. A 5-kg ball is dropped from a height y_0 above the top of a vertical spring whose spring constant is 2000 N/m. The spring is compressed 0.4 m. The height y_0 is closest to

Ans. 2.86 m



26. A 1.5-kg block sliding on a rough horizontal surface is attached to one end of a horizontal spring (k = 200 N/m) which has its other end fixed. If this system is displaced 20 cm horizontally from the equilibrium position and released from rest, the block first reaches the equilibrium position with a speed of 2.0 m/s. What is the coefficient of kinetic friction between the block and the horizontal surface on which it slides?

Ans. 0.34

27. A solid ball of mass of 0.25 kg rolls without slipping 4 m down an incline that makes an angle of 25^0 a with a horizontal. If it starts from rest, what is its kinetic energy at the bottom of the incline?

A) 1 J
B) 2 J
C) 4 J
D) 6 J
E) 8 J