Midterm 1, Chapters 1-10

Take a deep breath, read carefully and answer the questions by filling the letter bubbles of the correct answer IN THE SCANTRON.

1. The tendency of an object to resist changes in velocity is called
   A) speed
   B) velocity
   C) inertia
   D) acceleration

2. The grater the mass the greater the _____
   A) speed
   B) velocity
   C) inertia
   D) acceleration

3. Acceleration is the change in
   A) mass
   B) velocity
   C) inertia
   D) force

4. In order to produce an acceleration you need _____
   A) mass
   B) velocity
   C) a zero net force
   D) a not zero net force

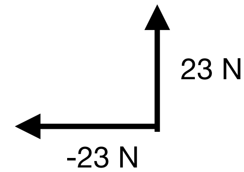
5. Which ones are examples of vector quantities
   A) 10 grams
   B) 1 N up
   C) 40 km/s South
   D) 3 cm
   E) A and D
   F) B and C

6. Force, acceleration and velocity are all examples of
   A) vector quantities
   B) scalar quantities

7. Mass, volume and speed are all examples of
   A) vector quantities
   B) scalar quantities

8. If you apply 10 N of force upwards and 5 N of force downwards, what is the resultant force?
   A) 15 N up
   B) 5 N down
   C) 10 N down
   D) 5 N up

9. What is the resultant magnitude when adding the vectors below?

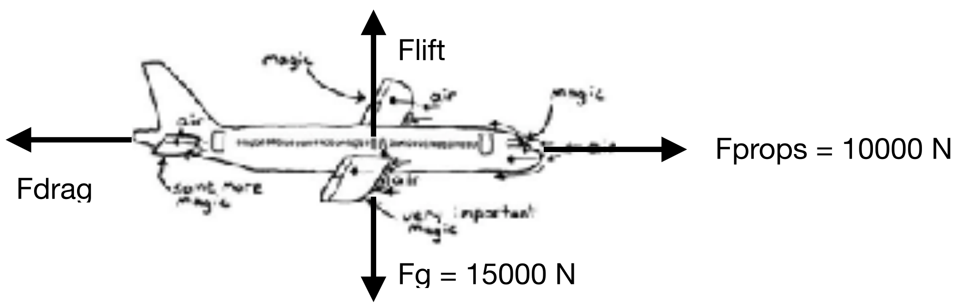


A) $\sqrt{46}$ C) $23\sqrt{2}$
B) $\sqrt{23}$ D) $\sqrt{2}$

10. We say a system is in static equilibrium if the
    A) net force = 0 and is moving
    B) net force = 0 and is not moving
    C) net force ≠ 0 and moving
    D) net force ≠ 0 and not moving

11. We say a system is in dynamic equilibrium if
    A) net force = 0 and is moving
    B) net force = 0 and is not moving
    C) net force ≠ 0 and moving
    D) net force ≠ 0 and not moving

12. If the plane below has an acceleration = 0, then



    A) Flift = 10000, Fdrag = 15000
    B) Flift = 12500, Fdrag = 12500
    C) Flift = 15000, Fdrag = 10000
    D) Flift = 0, Fdrag = 15000

13. If a cyclist finished a 100 km leg of the Tour de France in 3 hours, what was her average velocity?
    A) 33 km/h C) 33 m/s
    B) 3.3 km/h D) 100 km/h

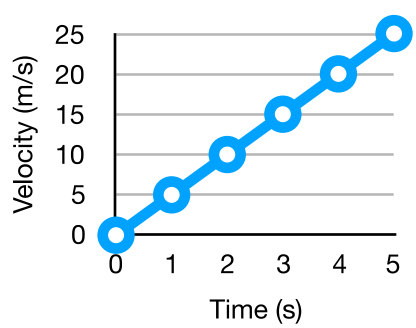
14. A car breaks from 90 km/h to a full stop in 10 s, what is its acceleration?
    A) 9 km/hs
    B) -9 km/hs
    C) 9 m/s^2
    D) 90 km/hs

15. If a car accelerates by 3.6 km/h, and 1 h = 3600 s what is its acceleration in m/s^2?
    A) 1 m/s^2
    B) 3.6 m/s^2
    C) 36 m/s^2
    D) 1000 m/s^2

16. A stone is dropped from the edge of a cliff and hits the ground below in 3 s. The hight of the cliff is approximately
    A) 90 m
    B) 45 m
    C) 30 m
    D) 10 m

17. Ignoring air resistance, if a 10 kg ball and a 100 kg crate were both dropped from the top of a building, the acceleration of the crate would be _______ the acceleration of the ball.
    A) 100 times
    B) 10 times
    C) the same as
    D) 1/10

18. Given the velocity vs. time plot below, what is the acceleration?



    A) 5 m/s^2
    B) 10 m/s^2
    C) 1 m/s^2
    D) 2 m/s^2

19. Ignoring friction, If an equal force is applied to a 1 kg box and a 10 kg box, the acceleration of the of the 10 kg box is _______ the acceleration of the 1 kg box.
    A) 10 times
    B) 100 times
    C) same as
    D) 1/10

20. A skydiver reaches a terminal velocity of 200 km/h after a few seconds from jumping off the plane, what is its acceleration after reaching terminal velocity and before opening the parachute?
    A) 10 m/s^2
    B) 200 m/s^2
    C) 0 m/s^2
    D) 20 m/s^2

21. If a semi truck collides with a vw bug that is 100 times less massive, what is the acceleration of the vw bug compared to that of the semi truck during the collision?
    A) 100 times more
    B) 100 time less
    C) 10 times more
    D) 10 times less

22. What is the impulse required to fully stop a 100 gram egg flying at 1 m/s?
    A) 0.1 kg m/s
    B) 1 kg m/s
    C) 10 kg m/s
    D) 100 kg m/s

23. If you don't want the egg in the above problem to break, you can apply the same impulse with 10 times less force by extending the ______
    A) time to stop by 100
    B) time to stop by 10
    C) mass to stop by 100
    D) acceleration by 1000

24. Two ice pucks of the same mass collide and stick together after the collision, if one was at rest and the other one had an initial velocity Vi = 2 m/s, what is their velocity after the collision?
    A) 2 m/s
    B) 1m/s
    C) 4 m/s
    D) 0.1 m/s

25. Is the Kinetic Energy conserved in the above collision?
    A) Yes, it is an elastic collision
    B) No, it is an inelastic collision

26. If you push your friend on a skateboard with a force of 10 N along a distance of 10 m, by how much would her Kinetic Energy increase?
    A) 100 Joules
    B) 10 Joules
    C) 100 N
    D) 10 N

27. If you changed the Kinetic Energy of your friend by 1000 Joules in 10 s, what was the power of your push?
    A) 1000 watts
    B) 100 watts
    C) 10 watts
    D) 100 horse power

28. A 1 kg skate rat drops from the top of a 3 m high half-pipe ramp, what is its Kinetic Energy at the lowest point of the ramp?
    A) 300 Joules
    B) 100 Joules
    C) 30 Joules
    D) 3 Joules

29. If we solve for the velocity in the Kinetic Energy equitation, we get $v = \sqrt{\frac{2KE}{m}}$. What is the velocity of the skate rat above at the Lowest point of the ramp?
    A) $\sqrt{60}$ m/s
    B) $\sqrt{30}$ m/s
    C) $\sqrt{3}$ m/s
    D) $\sqrt{600}$ m/s

30. If the moon distance from the earth suddenly doubled, its rotational inertia would double, then it's angular velocity instead of 1 revolution per 28 days would be
    A) 2 revolutions per 28 days
    B) 1 revolution per 14 days
    C) 2 revolution per 14 days
    D) 1 revolution per 56 days

31. By how much would the tangential velocity Vt of the moon change in the above problem (i.e. if the distance suddenly doubled)?
    A) Vt would increase by 2
    B) Vt would stay the same
    C) Vt would decrease by 2
    D) Vt would decrease by 4

32. If the distance to the moon suddenly doubled, the centripetal force Fc would have to _______ in order to keep the moon in a circular orbit around the earth?
    A) increase by 2
    B) stay the same
    C) decrease by 2
    D) Decrease by 4

33. Would the moon be able to stay in a circular orbit if its distance from earth suddenly doubled? Would the change in the force of gravity Fg match the required change in centripetal force?
    A) Yes, Fg would change just as needed.
    B) No, Fg would be to weak. The moon would fly off to space.

Equations Sheet

Pythagorean Theorem:

$$R = \sqrt{X^2 + Y^2}$$

Equilibrium Rule:

$$\sum F = 0$$

Linear Motion:

$$\text{Velocity} = \frac{\text{distance}}{\text{time}},$$

$$\text{Acceleration} = \frac{\Delta\ v}{\Delta\ t}$$

Free Fall Motion:

$$a = g = 9.8\ \frac{m}{s^2} \simeq 10\ \frac{m}{s^2}\ ,$$

$$v = at,\ \ d = \frac{a}{2}\ t^2$$

Newtons Second Law:

$$a = \frac{F}{m}$$

Momentum and Impulse:

$$p = mv \quad Ft = \Delta(mv)$$

Work and Power:

$$W = Fd\ ,\ \text{Power} = \frac{W}{t}$$

$$\text{Work} = \Delta\text{E}$$

Energy:

$$\text{PE} = mgh\ ,\ \ \text{KE} = \frac{1}{2}mv^2,$$

$$E = \text{KE} + \text{PE} = \text{C}$$

Rotational Motion:

$$\omega = \frac{\text{radians}}{t}\ , \quad v_t = \omega \times r\ ,$$

$$\text{Torque} = F \times r$$

$$\text{Angular Acceleration} = \frac{F \times r}{I}$$

$$\text{Angular Momentum} = I\omega$$

Rotational Equilibrium:

$$(F \times r)_{\text{clockwise}} - (F \times r)_{\text{counter clockwise}} = 0$$

Centripetal Force

$$F_c = \frac{mv^2}{r}$$

Gravitational Force:

$$\text{F}_\text{G} = G\frac{m_1 m_2}{d^2}\ ,$$

$$G = 6.67 \times 10^{-11}\frac{\text{N m}^2}{\text{kg}^2}$$

Orbits and Satellites:

$$v_{\text{circ}} = 8\ \frac{km}{s} \quad v_{\text{escape}} = 11.2\ \frac{km}{s}$$