Midterm 1, Chapters 1-10

Take a deep breath, read carefully and answer the questions by filling the correct answers 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

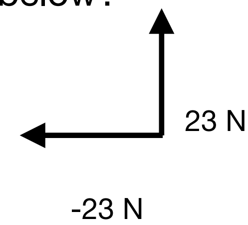
5. Which ones are examples of vector quantities
   A) 10 grams, 3 cm
   B) 1 Newton upwards
   C) 40 km/s South
   D) B and C

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

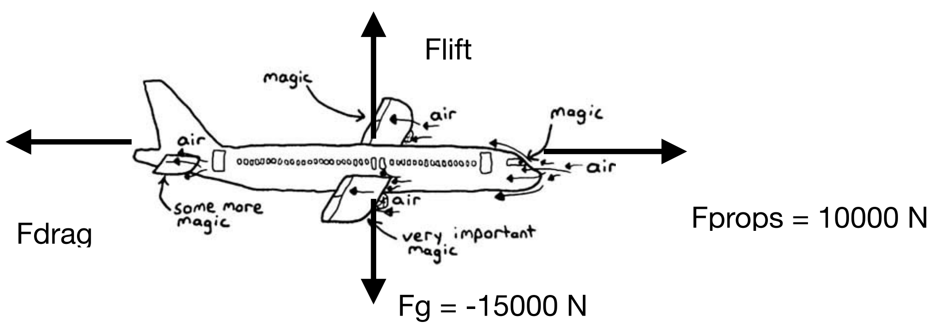
9. What is the resultant magnitude when adding the vectors below?
   A) $\sqrt{46}$
   B) $\sqrt{23}$
   C) $23\sqrt{2}$
   D) $\sqrt{2}$



10. A system is in equilibrium if the
    A) Net force = 0
    B) Net force ≠ 0

11. If a system is in equilibrium
    A) It is not moving nor accelerating
    B) It can be moving but not accelerating
    C) It is accelerating

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



    A) Flift = 10000 N and Fdrag= -15000 N
    B) Flift = 12500 N and Fdrag = -12500 N
    C) Flift = 15000 N and Fdrag = -10000 N
    D) Flift = 0 and Fdrag = -15000 N

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

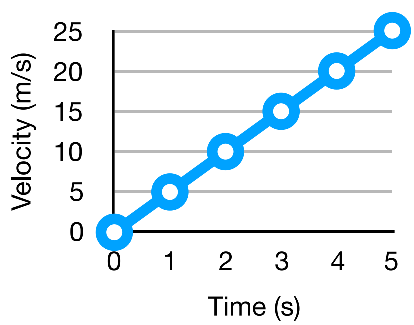
14. A car breaks from 90 km/h to a full stop in 10 s, what is its acceleration? HINT: Watch for the sign, is the car accelerating or decelerating?
    A) 9 km/(h s)
    B) -9 km/(h s)
    C) 9 m/s^2
    D) 90 km/(h s)

15. A rocket accelerates 36 km/h every second, or 36 km/(h s). If 1 h = 3600 s and 1 km = 1000 m what is its acceleration in m/s^2?
    A) 10 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 (i.e constant 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 100x
    B) time to stop by 10x
    C) mass to stop by 100x
    D) acceleration by 1000x

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 hover-board (self-levitating board) with a force of 10 N along a distance of 10 m, by how much would your friend's Kinetic Energy increase (assume there is no friction)? HINT: Use the work-energy theorem
    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. An ice skater starts to spin with an angular velocity of 2 rotations per second, when she moves her arms close together her angular inertia goes down by a factor of 5, how fast would she rotate then?
    A) 2/5 rotations per second
    B) 10 rotations per second
    C) 5/2 rotations per second
    D) 5 rotations per second

31. What is the tangential velocity of a ladybug that is 20 cm from the center of a turntable rotating at 5 radians per second?
    A) 100 m/s
    B) 4 m/s
    C) 0.04 m/s
    D) 1 m/s

32. What is the magnitude of the centripetal force keeping the ladybug of the above problem in circular motion? Use $2x10^{-5}$ kg for her mass.
    A) $1x10^{-5}$ N
    B) $1x10^{-4}$ N
    C) $1x10^{-7}$ N
    D) $2x10^{-3}$ N

33. If the distance between the Earth and the Moon suddenly doubled, how would the force of gravity between them change?
    A) It would double
    B) It would decrease by 1/2
    C) It would increase by 4x
    D) I would decrease by 1/4

Equations Sheet

Units:

$$1\ N = 1kg\frac{m}{s^2}$$

$$1\ Joule = 1kg\frac{m^2}{s^2}$$

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:

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

$\text{Work} = \Delta \text{E}$ (work-energy theorem)

Energy:

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

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

Rotational Motion:

$$\text{Angular Velocity} = \omega = \frac{\text{radians}}{t}$$

$$\text{Tangential Velocity} = v_t = \omega \times r$$

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

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

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

Rotational Equilibrium:

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

Centripetal Force

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

Gravitational Force:

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

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