MIDTERM STUDY GUIDE

Topic	Subtopics	
Science Basics	❖ Scientific Method ❖ Metric Units and Conversions ❖ Measurement ❖ Graphs ❖ Scientific Notation ❖ Significant Figures ❖ Precision, Accuracy and Error Analysis	2% alone and Within questions
Motion & Graphical Analysis	❖ Reference Frames ❖ Constant Motion ❖ Motion Diagrams ❖ Vectors and Scalars ❖ Accelerated Motion	30% (18q)
Horizontal and Vertical Motion	❖ Motion Equations	15% (9q)
2D Motion	❖ Circular Motion ❖ Projectile Motion	10% (6q)
Forces and Newton's Laws	❖ Newton's 1st Law ❖ Newton's 2nd Law ❖ Newton's 3rd Law ❖ Freebody (Force) Diagrams	13% (8q)
Universal Law of Gravitation	❖ Gravitational Forces ❖ Weight and Mass ❖ Inverse Square Law ❖ Planetary Motion	5% (3q)
Momentum	❖ Momentum ❖ Impulse ❖ Conservation of Momentum	7% (4q)
Work, Power, Energy	❖ Energy ❖ Work ❖ Conservation of Work and Energy ❖ Power	18% (11q)
	Total	100%

How to Study for a Midterm:

- ❖ Chapter Reviews can be very helpful since test questions are usually similar in form and wording.

- Read through your journal entries as a refresher of what you learned and when. It should be almost like re-living that particular week of classes.
- Notebooks are a great source for notes! (Hopefully you have been keeping good, legible ones)
- Retake/redo past quizzes to practice skills you have learned and reinforce knowledge.
- Look over labs to see how scientific method was used, what concepts were necessary to know and understand the lab, and the outcome/analysis.
- Use past reviews and test for extra practice and to focus on your trouble areas.
- Make index cards for hard to remember vocabulary (or concepts). Put question or word on one side and the answer or definition on the back.
- Study with a friend. Teaching something only helps you learn it more and perhaps a friend can help with something you have trouble with.
- Get rid of any distractions.
- Take a break every 30 minutes. Don't over load your brain.
- Don't wait until the last minute to study; chances are you'll only retain the last thing you looked at instead of the majority of your notes.
- Don't study hungry. Keep a healthy snack nearby.
- Take your exams seriously, but don't stress out so much that it hinders your ability to take tests.
- Be prepared by bringing a couple No. 2 pencils and a good eraser to your exams.

Knowledge & Skills:

- Use metric system (kg-m-s), recognize metric prefix meanings and convert to base units.
- Locate, develop, summarize, organize, synthesize and evaluate information.
- Understand the importance of vectors and scalars in determining an object's motion.
- Differentiate between and solve for resultant and vector components.
- Recognize and define physics terms.
- Draw and interpret motion diagrams that represent a given scenario.
- Interpret displacement, velocity, and acceleration vs. time graphs.
- Apply the mathematical and graphical relationships between position, time, velocity and acceleration.
- Recognize that a change in an objects velocity (direction or speed) is caused by something external→ external net force.
- Understand the mathematical relationship between the mass of an object, the forces exerted on it and the acceleration of the object.
- Determine net force on an object in motion and at rest and predict the magnitude and direction of acceleration.
- Draw and interpret Freebody (force) diagrams that represent a given scenario.
- Identify force pairs and understand that these pairs are two separate objects acting upon one another with potentially different net force magnitude and direction.
- Differentiate between mass and weight and understand that mass does not depend upon location but weight does.
- Understand that projectile motion includes acceleration in the vertical direction and constant velocity in the horizontal.
- Recognize the relationship between launch angle and the displacement (vertical and horizontal) of an object.
- Use vocabulary specifically designated for projectile motion
- Understand circular motion and draw and label diagrams to explain it.
- Relate gravity (gravitational force) to Newton's 3rd Law.
- Calculate gravitational force using the Universal Law of Gravitation (ULOG).
- Recognize that the gravitational force is proportional to the inverse square of its distance.
- Define what momentum is and be able to calculate it for various situations.
- Compare and contrast and object's momentum and inertia
- Recognize that momentum is conserved in a closed system- the total momentum before event is equal to the total momentum after event
- Demonstrate knowledge of the law of conservation in multiple representations including but not limited to mathematical, pictorial and graphical.
- Apply the law of conservation of energy to describe changing systems
- Demonstrate knowledge of the relationship between kinetic and potential energy using mathematical, pictorial and graphical representations
- Calculate work and to distinguish when it is being done on a system as opposed to when it is being done by a system.
- Calculate power recognize that it is a change in energy or work within a given time frame.

Example Questions: This is not a complete list of questions, but gives a sampling of the type and level of difficulty that is expected. There are straight forward motion equation problems that are not necessarily represented here, but proficiency is expected

1. You are inside the cargo compartment of a truck that is traveling at constant velocity. A rock is dropped from the midpoint of the ceiling and hits the floor below. The rock hits the floor:

a. exactly below the midpoint of the ceiling
b. ahead of the midpoint of the ceiling
c. behind the midpoint of the ceiling
d. more information is needed

Two cars start at the same time at the dot on the left and move to the right. The dots in the figure below show the locations for each of the cars every second.

Figure 1.

(t=0s) (t=1s) (t=2s) (t=3s) (t=4s) (t=5s) (t=6s) (t=7s) (t=8s) (t=9s) (t=10s) for car 1.
. . . . car 1

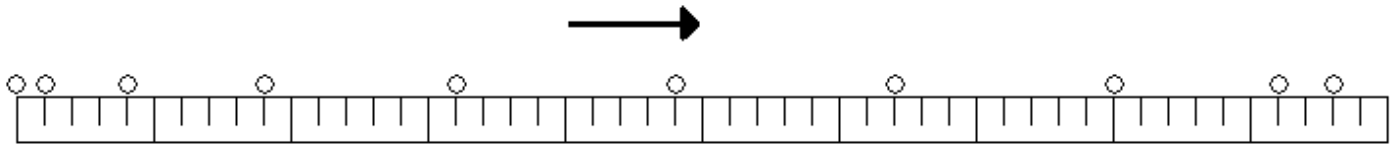
(t=0s) (t=1s) (t=2s) (t=3s) (t=4s) (t=5s) for car 2.
. . . . . . car 2

2. For **Figure 1**, were the cars ever next to each other? If so, at what time

3. For **Figure 1**, For Which are was traveling faster?

4. A soccer ball is kicked horizontally. What is its average speed if its displacement is 21.0 m after 4.00 s?

Refer to the diagram below when answering the next two questions. This diagram represents a time elapse photograph of an object moving along a horizontal surface. The positions as indicated in the diagram are separated by equal time intervals. The first moment occurred just as the object started to move and the last just as it came to rest.



Start End

5. Draw a graph that represents the object's position as a function of time.

6. Draw a graph that represents the object's velocity as a function of time.

7. Draw a graph that represents the object's acceleration as a function of time.

8. A 10 Newton force pushes a body northward while a 15 Newton force acting at the same point of the body pushes it southward. The resultant of these two forces is:

9. What is the term for a physical quantity that has a magnitude and direction?

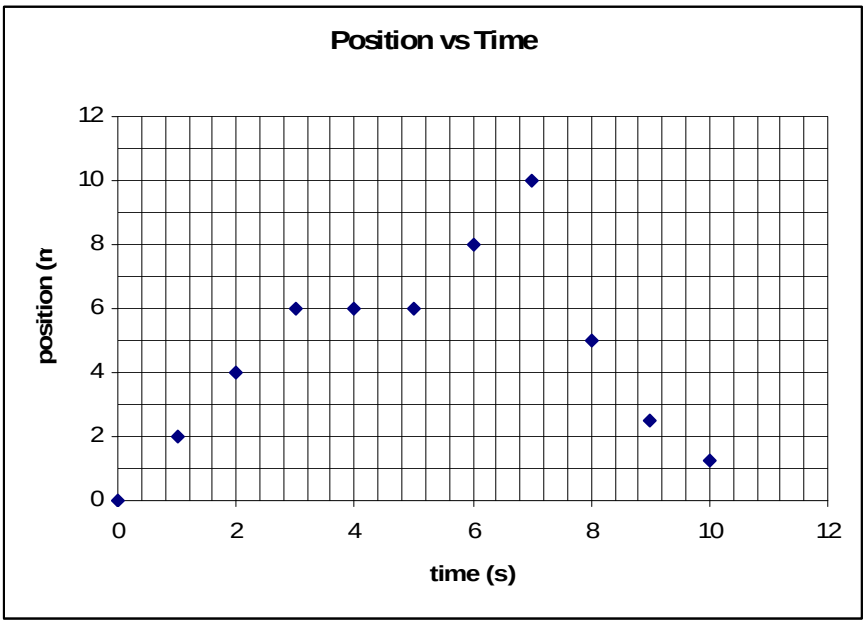
10. What are some examples of a scalar quantity? A vector quantity?
11. Which statement about the acceleration of an object is correct?
a. The acceleration of an object is directly proportional to the net external force acting on the object and inversely proportional to the mass of the object
b. The acceleration of an object is directly proportional to the net external force acting on the object and directly proportional to the mass of the object.
c. The acceleration of an object is inversely proportional to the net external force acting on the object and inversely proportional to the mass of the object.
d. The acceleration of an object is inversely proportional to the net external force acting on the object and directly proportional to the mass of the object.

Answer the following three questions about the graph.

12. During what time(s) or time interval(s), if any, was the object traveling at constant velocity?

13. During what time(s) or time interval(s), if any, was the object traveling backwards?

14. During what time(s) or time interval(s), if any, was the object accelerating?



15. Which would hit the ground first if dropped from the same height in a vacuum, a feather or a metal bolt? Explain your answer.

16. Objects that are falling toward Earth move
a. Faster and faster
b. Slower and slower
c. at a constant velocity
d. slower then faster

17. A projectile is fired horizontally with a velocity of 750 m/s, how far does the projectile travel vertically in 0.75 s?

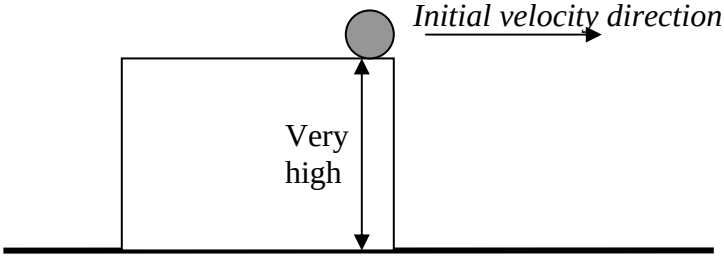
18. A projectile is fired with a velocity, **v,** at an angle, **θ,** above the horizontal.
a. The vertical velocity of the projectile will remain constant while the horizontal velocity will slowly decrease
b. The horizontal velocity of the projectile will slowly increase while the vertical component will remain constant
c. Both components of the projectile's velocity will undergo a constant non-zero acceleration

d. The horizontal velocity of the projectile will remain constant while the vertical component of the velocity will undergo a constant acceleration
e. Both components of the projectile's velocity will remain constant.

A ball is rolled off a very high table, the direction of the initial velocity is parallel to the horizon. Examine the diagram and the graphs and answer the two questions that follow.

20. Draw a velocity vs. time graph for the horizontal component of the ball.

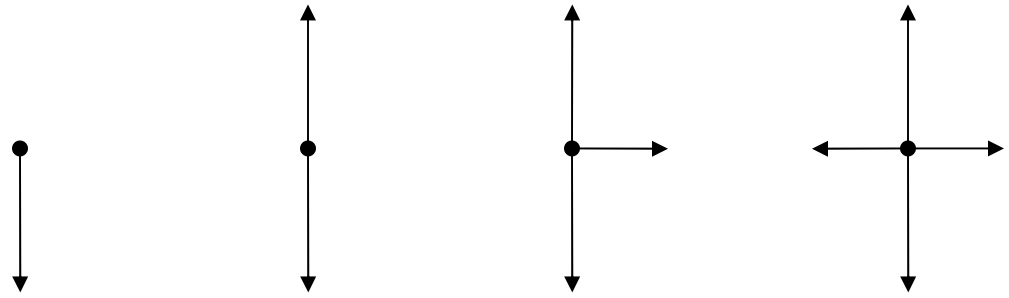
21. Draw a velocity vs. time graph for the vertical component of the ball.



Use the Freebody (force) diagrams to answer the next two questions.

19. Which of the following force diagrams below represent an object in equilibrium?
You may choose more than one.

20. Which of the following force diagrams below represents an object accelerating?
You may choose more than one.



a. b c. d.

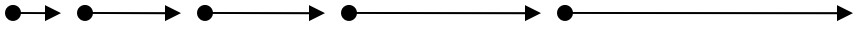
21. If a nonzero net force is acting on an object, then the object is definitely
a. at rest.
b. moving with a constant velocity.
c. being accelerated.
d. losing mass.

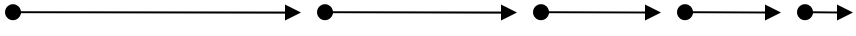
22. A thrown stone hits a window, but doesn't break it. Instead, it reverses direction and ends up on the ground below the window. Which statement is true?
a. The force of the stone on the glass > the force of the glass on the stone.
b. The force of the stone on the glass = the force of the glass on the stone.
c. The force of the stone on the glass < the force of the glass on the stone.
d. The stone didn't slow down as it broke the glass.

Refer to this scenario and the picture to the right for the next 5 questions. A rope pulls a sled exerting a force of 60N to the right. The snow exerts a friction force of 20 N on the sled to the right. The mass of the sled with the passenger is 50 kg.

23. What would the motion diagram look like for the sled?

a.

b. 

c. 

d. 

24. What integer statement represents the sum of the forces in the horizontal direction?
<u>You may choose more than one answer.</u>

a. +20 N + (-60 N)
b. -20 N + (+60 N)
c. -20 N + (-60 N)
d. +20 N + (+60 N)

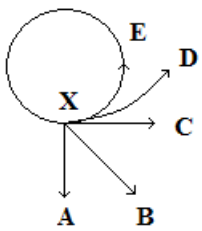
25. What integer represents the forces in the vertical direction?

a. +50 N + (-50 N)
b. + 500 N + (-500 N)
c. + 500 N + (+500 N)
d. - 500 N + (-500 N)

26. What is the acceleration of the sled

27. What will happen to the acceleration of the sled if a new passenger magically appears on the sled increasing the mass from 50 kg to 100 kg?

28. A ball is traveling counter-clockwise in a circular path around a ring. If a piece of the ring is removed atpoint X as the ball approaches, which path will the ball take?



29. The planet Mercury orbits the Sun at some distance. If this distance was doubled what would happen to the gravitational force between Mercury and the Sun?

a. The force would also double
b. The force would be half the original force
c. The force would be ¼th the original force
d. The force would remain the same

30. A 300 g ball moves with a constant velocity of 5.0 m/s. It collides with a stationary second ball that has a mass of 0.50 kg. If the first ball comes to rest after the collision, what is the new velocity of the second ball?

a. 3000 m/s b. 7.5 m/s c. 3.0 m/s d. 0.33 m/s

31. A 300 g ball moves with a constant velocity of 5.0 m/s. It collides with a stationary second ball that has a mass of 0.50 kg. If the first ball comes to rest after the collision, what is the new velocity of the second ball?

32. A soccer ball collides with another soccer ball at rest. The total momentum of the balls
    a. is zero b. increases c. remains constant d. decreases
33. If both the mass and the velocity of a ball are tripled, the kinetic energy of the ball is increased by a factor of _____.

34. Suppose you are jumping on a trampoline. At the top of your jump, your

a. mechanical energy is zero.
b. potential energy is at a maximum.
c. kinetic and potential energy are equal.
d. potential energy is zero.

30. You are examining the external forces exerted on a system of objects. In order to increase the potential of a system to do something, the external force exerted on the system must be _____ to the displacement of the system while the external force was exerted on it.

35. A 3.00 kg toy falls from a height of 10.0 m. Just before hitting the ground, what will its kinetic energy be? (Disregard air resistance; $g = 9.81$ m/s2.)

31. A light bulb emits 3.6×10^4 Joules of energy in 1 minute. What is the power output of the light bulb?

32. Several students are helping their teacher carry textbooks from one classroom to another. Each textbook has a mass of 1.0 kg and the distance between classrooms is 10.0 meters.

    Student I delivers 4 textbooks in 20 seconds
    Student II delivers 10 textbooks in 30 seconds
    Student III delivers 6 textbooks in 30 seconds
    Student IV delivers 6 textbooks in 50 seconds

Rank the students from least power to greatest power.