Name: Key Per.:_____ Date:_____

9th Integrated Physics: Design Final Exam Review

Chapter 1

1. Define accuracy, precision, and resolution. Give an example of each to contrast them.

Accuracy: how close to accepted value

Precision: how repeatable

Resolution: how many sig figs you can get from a measurement tool

2. What are significant figures/digits, and why are they important in science? Give two examples of numbers that have 3 sig figs in them.

measured digits - real measurements have uncertainty

22.2 kg 0.222 m

3. Convert 1,200 meters to millimeters. Show your work.

$$\frac{1{,}200\,m}{1} \cdot \frac{1{,}000\,mm}{1\,m} = 1{,}200{,}000\,mm = 1.2 \times 10^{6}\,mm$$

4. Which is the independent variable, and which the dependent variable, on a graph? How do you know? Why is the distinction important?

convention — x — y — explains results of experiment better

Chapter 2

1. In scientific terms, what is the difference between a theory and a hypothesis?

more evidence, thoroughly tested & understood — educated guess (emphasis on educated)

2. Compare and contrast experimental variables and control variables. Give an example from an experiment we have performed in this class to support your answer.

being varied — can vary, but being made not to

When varying drop height of car, we kept weight constant

3. How are science and technology related? How are they different?

how things work — problem solving

Science figures out how things work, technology uses this information to solve problems.

Chapter 4

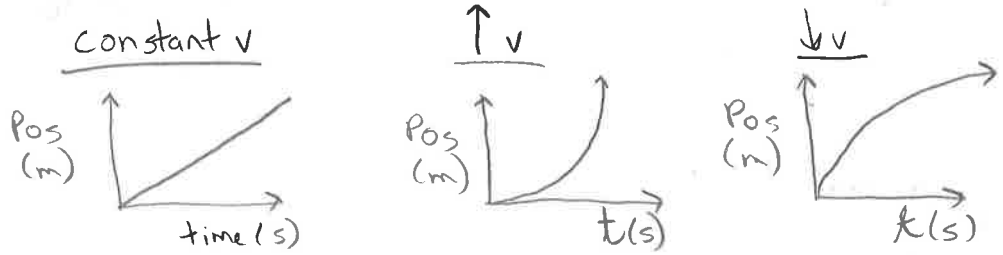
1. Compare and contrast speed and velocity. Which one is a scalar quantity, and which a vector?

scalar vector

Speed: How fast

Velocity: How fast + in what direction.

2. What is the shape of a position vs. time graph for an object traveling at constant velocity? Increasing velocity? Decreasing velocity? Draw a sketch for each.



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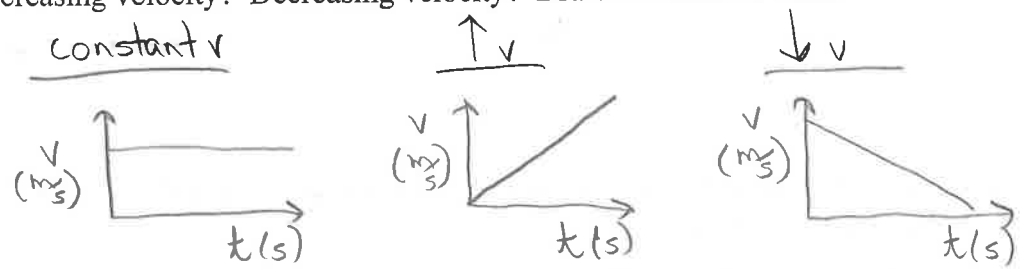


4. Define acceleration. What are the three ways for an object to experience acceleration?

Acceleration - any change in motion

1. speed up
2. slow down
3. change direction

5. If a train is traveling 300. km/hr, how many hours would it take to travel 1,500 km? Show your work (include the formula).

$d = v \cdot t$ $\quad t = \frac{d}{v} = \frac{1{,}500\,km}{300\,km/hr} = 5\,hr.$

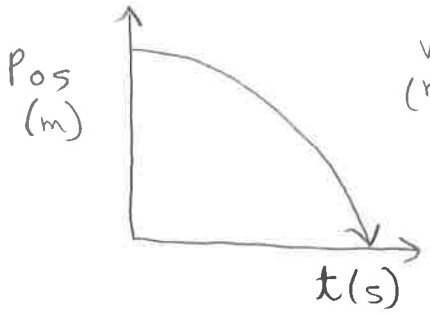
6. If you take a one hour drive at an average speed of 65 mph, and another car is traveling an average speed of 55 mph, would it be possible for that car to pass you at some point? Explain in terms of the distinction between average velocity and instantaneous velocity.

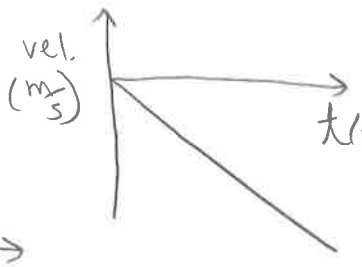
car #1 car #2

yes

Car #2 could be going faster briefly, pass car #1, but be traveling slower on average.

7. A steel ball is dropped off the side of a cliff, and accelerates at 9.80 m/s^2. Assume air friction is negligible. Draw a position vs. time graph for this situation. Draw a velocity vs. time graph for this situation. How fast will the ball be traveling after it has been falling for three seconds?





$V_f = V_i + a\Delta t$

$= 0 + (-9.80\frac{m}{s^2})(3s)$

$= -29.4\frac{m}{s}$

Chapter 5

1. Does force cause acceleration, or motion? Explain.

F=ma Force causes acceleration

2. Compare and contrast contact forces and field forces. Give at least one example of each.

contact forces	field forces
only exist if 2 objects are in contact (eg: Normal force)	can exist over a distance (eg: gravity)

3. What is the relationship between mass and weight (as a force, in newtons)?

$W = m \cdot g = m(9.80\frac{m}{s^2})$ ← acceleration due to gravity

4. What is friction?

A force that opposes motion.

5. If net force on an object is zero, can it be moving? If it is moving, how is it moving? Why?

yes Straight line, constant speed

Zero net force means zero acceleration, not zero motion

6. What is the weight in newtons of a 15 kg book shelf (on Earth)?

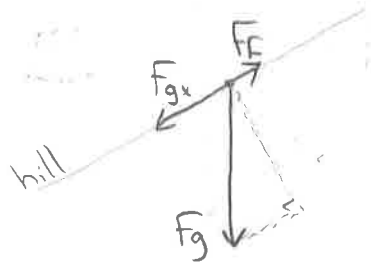
$W = m \cdot g = (15kg)(9.80\frac{m}{s^2})$

$= 147N$

$= 150N$

7. Chatan is riding his bike down a hill. He experiences a downhill force of 25 N in the direction he is riding, and an uphill frictional force of 10. N, opposing his motion. Draw a free body diagram for this situation. What are the magnitude and direction of the net force on him?

$F_{net} = 25N - 10N =$ 15N, down the hill



Chapter 6

1. If an object has zero net force on it, can it be accelerating? Explain your answer.

No: F_{net} = zero means zero acceleration
$= m \cdot a$ (mass won't equal zero, a must)

2. What do unbalanced forces have to do with acceleration?

cause →

3. Define momentum. Include a formula, and define the units for each variable in it.

Momentum = mass • velocity

$P = mv$ $\qquad \frac{kg \cdot m}{s} =$ units

4. Define inertia. What property of an object relates most directly to its inertia?

↓ mass

An objects resistance to changes in its motion

A
5. On object moving at 20 m/s has a force of 5N pushing on it to the left. At the same time, it has a force of 5N pushing on it to the right. What is the net force on the object? What is its acceleration? How fast will the object be moving after 10 seconds under these conditions?

$F_{net} = 5N - 5N =$ 0N

$a = 0 \frac{m}{s^2}$

10 sec later: $V_f = 20 \frac{m}{s}$

6. If the brakes of a truck apply a force of 10,000 N to it, and it has a mass of 2,000 kg, what is its acceleration?

$F = ma$

$a = \frac{F}{m} = \frac{10{,}000\,N}{2{,}000\,kg} = 5\,\frac{m}{s^2}$

7. Hoai-Thu pushes on a boulder with a force of 100 N. What force does the boulder exert on Hoai-Thu? Explain your answer in terms of action-reaction pairs.

100N: equal magnitude, opposite direction

8. A car speeds up from 5 m/s to 29 m/s over 4 seconds. What is the car's acceleration?

$a = \frac{\Delta v}{\Delta t} = \frac{29\,\frac{m}{s} - 5\,\frac{m}{s}}{4\,s} = \frac{24\,\frac{m}{s}}{4\,s} = 6\,\frac{m}{s^2}$

If it had started at 29 m/s and ended at 5 m/s after 4 seconds, what would its acceleration have been? How is this answer different from the previous one?

$-6\,\frac{m}{s}$ same magnitude, opposite sign

Chapter 7

1. Describe the energy transformation as a roller coaster rolls down a hill. Where is the car moving fastest, at the top of the hill or the bottom? Why?

Gravitational potential → kinetic energy
Fastest bottom of hill, because of the higher

2. A car jack exerts a force of 5,000 N to lift a car 0.25 meters. How much work does the jack do on the car?

$W = F \cdot d = (5{,}000\,N)(0.25\,m) = 1250\,J$

3. A 2.00 kg rock is 20.0 meters above the surface of a lake. How much gravitational potential energy does it have?

$PE = mgh = (2.00\,kg)(9.80\,\frac{m}{s^2})(20.0\,m)$
$= 392\,J$

If it falls, how much kinetic energy will it have right before it hits the lake? (Assume no air friction)

392 J (PE → KE)

How fast will it be traveling right before it hits the lake?

$KE = \frac{1}{2}mv^2$ $v = \sqrt{\frac{2KE}{m}} = \sqrt{\frac{2(392\text{J})}{2.00\text{kg}}} = 19.798$

$v = 19.8 \frac{m}{s}$

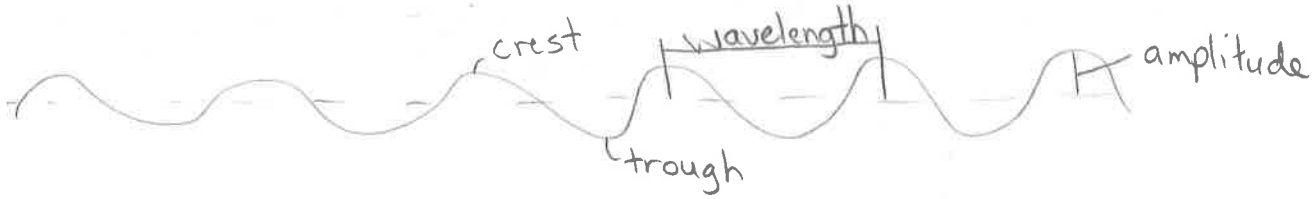
Chapter 24

1. Define harmonic motion. Give at least 2 examples.

Periodic, repetitive

1. waves
2. pendulum

2. Draw a sketch of a transverse wave. Label wavelength, amplitude, crest, and trough.



3. A series of waves is traveling at 5.0 m/s through the ocean. It is 2.5 meters from the crest of one wave to the crest of the next wave. What is the period of these waves?

$\frac{2\text{ waves}}{\text{sec}}$ $T = 0.5s$

$v = 5.0 \frac{m}{s}$

What is the frequency of these waves?

$f = 2\text{Hz}$

Are these transverse or longitudinal waves? How do you know?

They have crests & troughs

Particles moving ⊥ to wave.