Physics Review #1

1. Explain the difference between

a) distance and displacement

b) velocity and speed

c) instantaneous and average

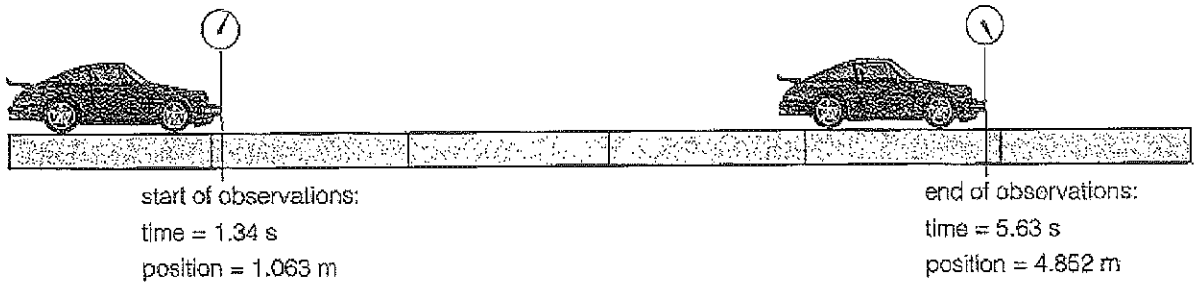
2. Explain the difference between the everyday use of each term below and the way it is used in physics.

a) acceleration

b) initial

c) interval

3. Examine the figure below to find each piece of information listed.



a) $\vec{d}_1$

b) d_2

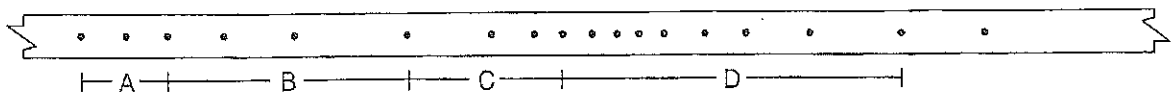
c) $\vec{\Delta d}$

d) $\vec{\Delta t}$

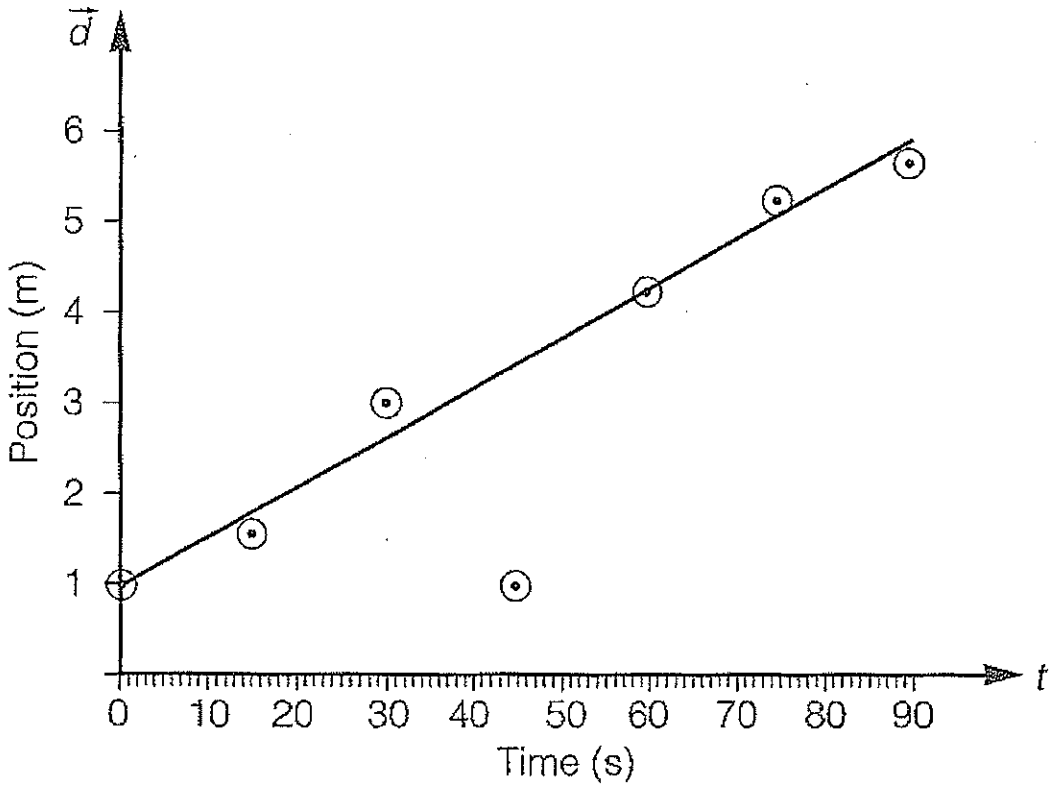
4. Fill in the blank boxes in the table below and circle the appropriate word from each pair in the right-hand column.

t_1 (s)	t_2 (s)	Δt (s)	$\vec{d}_1$ (cm)	$\vec{d}_2$ (cm)	$\vec{\Delta d}$ (cm)	Direction of motion
5.0	6.5		+17.3	+20.0		left/right
	8.3	2.1	+26.9		+5.3	up/down
0		105.4		+26.8	-15.4	left/right

5. The ticker-timer tape below shows the motion of a lab cart that had very sticky wheels, which did not roll evenly. For each section of the tape, describe any changes in the cart's speed that occur.



6. Examine the position-time graph, and identify or calculate each quantity below.



a) a point that probably represents a measurement error
b) direction of motion (+ or -)
c) initial position
d) final position
e) displacement
f) time interval

7. High-speed passenger elevators move at speeds of up to 7.11 m/s. How long would it take to travel up 37.5 m?

8. A balance measurement is correctly reported at 154.36 g. How many significant digits are in this measurement?

9. In your own words, describe what physicists mean by precision and certainty.

10. List the rules for calculating and rounding with significant digits.

Key Terms

Distance	Scalar	Time	Time interval
Position	Vector	Displacement	Velocity
Instantaneous	Speed	Acceleration	Precision
Change of	Position/Time Graph		

11. Choose the term from the list above that best describes each statement below.
    a) Art left his home at 3:42 pm.
    b) A car accelerated from 0 to 40 km/h in 5.4 s.
    c) Travelling at 50 km/h due north, Art soon reached the store.
    d) On his way home, Art followed a winding road that ended only one block from the store.
    e) Art glanced at the speedometer, which at that moment read 47 km/h.
    f) Finally, 44 minutes and 26 seconds after leaving, Art returned home.
    g) The car's odometer showed that he had travelled over 15.4 km to get a loaf of bread.

12. What information do you need to calculate each of these features of an object's motion?
    a) displacement
    b) average velocity
    c) average acceleration
    d) average speed

13. For each measurement below, indicate the number of significant digits.
    a) 4.37 g
    b) 0.00630 m
    c) 4.062×10^5 s

14. Identify which of the following situations are accelerated motion.
    a) a runner poised at the starting line
    b) the runner speeding up just after the starting gun is fired
    c) the runner travelling at a steady speed around a corner
    d) the runner slowing down after passing the finish line

15. Which of the following is a vector quantity?
    a) speed
    b) time
    c) velocity
    d) distance

16. The fastest-flying insect is the Australian dragonfly, it can reach a speed of 58 km/h. If it maintained that speed for 7.8 s, how far would it travel in meters?

17. Some insects can fly 250 m in about 23 s. What is their maximum flying speed?

18. What is uniform motion?

19. Use the speed formula to fill in the blanks on the following table. Write out each calculation in proper form, and round your answer appropriately.

10.5 m	4.3 s	
	8.2 s	25 m/s
164 km		110 km/h

20. Examine the following graph. Identify all the lettered sections that indicate

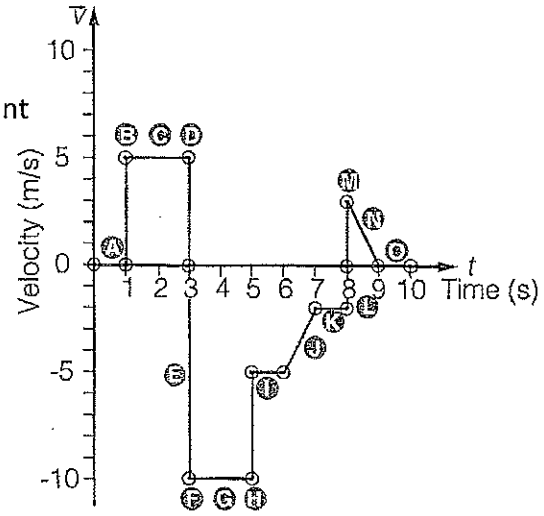
a) uniform motion

b) movement to the left

c) the object slowing down

d) the object +10 m from its starting point

e) motion to the right at 5 m/s



21. Sketch, and describe in words, the appearance of

a) position-time graphs of uniform motion in a negative direction

b) velocity-time graphs of uniform motion

c) velocity-time graphs of accelerated motion

d) position-time graphs of a stopped object

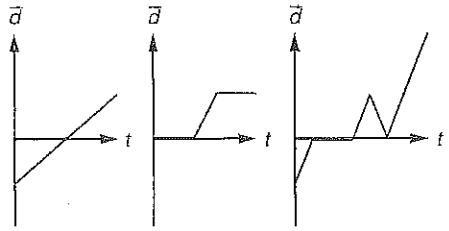
22. Sketch a position-time graph with a positive slope. Mark on it a slope triangle with the following features labeled: $\overrightarrow{\Delta d}$, Δt, rise, run.

23. Describe how you could determine each quantity below from a position-time graph of an object's motion.

a) average velocity

b) instantaneous velocity

24. Suppose that each position-time graph below represents the motion of a train travelling over level ground. The reference point for position is the station from which the train departed. Give an example of a scenario that would produce each graph and a description of the slope of each graph of graph section (increasing, decreasing, constant, positive, negative, zero).



25. A high diver (A) stands motionless at the end of a platform. Suddenly (B) she leaps upward. A second later (C) she seems to be suspended motionless high in the air, and then (D) she falls faster and faster toward the water below. As she slices into the water (E), her speed drops quickly and (F) continues to slow more gradually. Finally (G) she comes to within a few centimeters of the bottom of the pool. Arcing upward (H), she rises steadily to the surface (I) and swims slowly to the side. Sketch a velocity-time graph that shows the motion of the diver. Label points A to I above.

26. What is the speed of sound, given that a clap of thunder is heard by an observer 1.5 km away, 4.6 seconds after the lightning that produced it is seen.

27. What is the distance in kilometers from Earth to the Moon, given that radio waves travelling at 300 000 km/s take 1.28 s to cover this distance?

28. What time that light from the Sun takes to reach Earth if it must travel 150 000 000 km at the speed of light (calculated in #26)?

29. An athlete on an interval training program alternates jogging 100 paces, which takes 41 s, and walking 50 paces, which takes 27 s. Each jogging pace is 0.9 m long, and each walking pace is 0.6 m long.

a) Calculate the jogging velocity, the walking velocity and the average velocity over the entire motion.

b) Sketch a velocity-time graph of the motion

30. The most powerful production car in the world in 1999 (a McLaren F1) could reach a speed of 26.8 m/s in 3.2 s.

a) Find the car's average acceleration

b) If the car could maintain this acceleration, how long would it take to reach a speed of 200 km/h?

31. A new world acceleration record for electrically powered motorcycles was set by a motorcycle that started from rest and took 14.57 s to reach a maximum forward velocity of +18.3 m/s.

a) Find the motorcycle's average acceleration.

b) At its maximum speed, how long would the motorcycle have taken to travel once around a 400 m track?

32. Modern strobe equipment can easily take photographs 0.001 s apart. At this rate, if you were photographing a cheetah (the fastest land mammal) moving at its maximum speed of about 27 m/s, how far would it move between any two flashes of the strobe light?

33. A car leaving a city and travelling north at 15 m/s. As it enters a highway the driver accelerates at 4.0 m/s^2 for 5 s. What is the cars speed after the acceleration?

34. Correct the errors in the following statements.

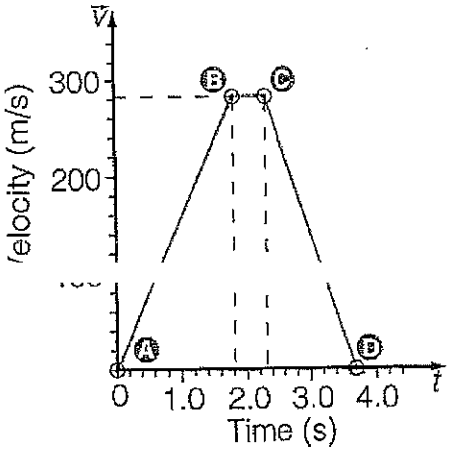
a) $\vec{v} = -10\ m/s^2$

b) $a = \frac{v_1 - v_2}{t}$

c) $a = 3.5\ m^2/s$

d) The direction of velocity is always opposite to the direction of the displacement

35. U.S. Air Force Colonel John Stapp, a medical doctor, took several dozen test rides on a rocket-driven sled in the early 1950s. After reaching a maximum velocity of over 1000 km/h on a 2 km track, the sled hit a long trough of water, which slowed it very rapidly. The graph below shows a typical sled run. Calculate the acceleration of the sled in the intervals between A and B and between B and C.



Physics Review #2

1. Newton's first law can be described with one word: _____

2. Newton's second law can be explained with the following equation: _____

3. What are the units for force?

4. What does Newton's third law state?

5. The force of friction always acts in the _____ direction of motion.

6. According to the conservation of momentum, the total momentum before the collision must be _____ to the total momentum _____ the collision.

7. When two objects bounce off each other like pool balls, what type of collision is it?

8. What net force is present in pushing a 185 kg football player along the ground with an acceleration of 1.0 m/s^2 if the force of friction is 150 N?

9. What is the acceleration of a rock that is dropped off the East Selkirk bridge if it has a mass of 2 kg and hits the water with a force of 20 N?

10. What is the mass of a student sliding down a hill on a toboggan with an acceleration of 20. m/s^2 and force of 150 N just before the bottom of the hill?

11. What is the momentum of an 1800 kg Dodge Dakota travelling with a velocity of 29 m/s [E]?

12. A baseball of mass 0.145 kg has an initial speed of 45 m/s before the batter hits it. After the batter hits the ball, it leaves the bat with a speed of 55 m/s in the opposite direction. If the ball was in contact with the bat for 0.030 seconds, determine the impulsive force on the baseball.

13. If a 1200 kg Echo travelling at 20 m/s collides in an inelastic collision with a Ford F-150 of mass 2400 kg initially at rest, determine the speed of the cars after the collision.

14. Two small heavy objects are dropped at the same time and from the same height. According to Galileo, which object will hit the ground first?

15. What amount of force is required to keep a 5 kg object moving rightward at an acceleration of 2 m/s^2?

16. A 72 kg skydiver is falling from 10,000 feet. At an instant during the fall, the skydiver encounters an air resistance force of 540 N. What is the acceleration of the skydiver at this instant?

17. A 1250 kg small aircraft decelerates along the runway from 36.6 m/s to 6.8 m/s in 5.1 seconds. Determine the force acting upon the plane.

18. A freight train rolls along a track with considerable momentum. If it rolls at the same speed but has twice as much mass, what happens to its momentum?

19. Describe the four types of friction.

20. What is the net force of a 40 kg sled that is sliding down a hill with an acceleration of 5.0 m/s^2 if the force of friction that opposes the sled is 150 N?

21. Two identical freight cars roll toward each other on a track. One rolls at 2 m/s and the other rolls at 1 m/s. What will be the velocity (direction) of the freight cars after the collision if the collision is inelastic?

22. A 4 kg ball has a momentum of 12 kg·m/s. What is the ball's velocity?

23. A 5 N force is applied to a 3 kg object to change its velocity from 3 m/s to 9 m/s. How long is the impulse?

24. A 0.5 kg ball moving at 5 m/s strikes a wall and rebounds in the opposite direction with a speed of 2 m/s. If the impulse occurs for a time of 0.015 s, what is the force action upon the ball?

25. A 16 kg ball is thrown with a speed of 22 m/s to a clown weighing 55 kg who is at rest on ice. The clown catches the ball and glides across the ice. Determine the velocity of the clown and ball following the catch.

26. When two forces are equal and act in opposite directions, they are said to be _____.

27. Forces that occur over very short time intervals are called _____.

28. Describe the typical effects of the following external forces acting on bodies:
    a. Friction between surfaces
    b. Air resistance

29. An unbalanced force of 48N west is applied to a 4 kg cart. Calculate the cart's acceleration.

30. A 2200 kg car, travelling at 25 m/s south, comes to a stop in 10 s. Calculate (a) the car's acceleration and (b) the unbalanced force required to cause that acceleration.

31. Astronauts are placed horizontally in their space capsule during launch. Use Newton's First Law to explain why this is a good idea.

32. The driver's handbook in a particular country states that the minimum safe distance between vehicles on the road is the distance a vehicle can travel in 2 s at constant speed. Assume that a 1200 kg car is travelling south at 72 km/h when the truck ahead crashes into a northbound truck and comes to a sudden stop. If the average braking force exerted by the car is 6400 N north, how long would it take the car to stop?

33. A 2200 kg car, travelling at 25 m/s south, comes to a stop in 10 s. Calculate the momentum of the car.

34. A hammer strikes a nail with a force of 55 N for a period of 0.2 s. Calculate the impulse of the force.

35. For how long must an explosive force of 33,000 N act on a stationary bullet of mass 0.15 kg to give it a velocity of 220 m/s?

36. In experimental tests run by the manufacturer, a car of mass 1500 kg travelling at 20 m/s due east collides with an identical stationary car. Assuming that all of the kinetic energy of the moving car is transferred to the stationary car during the collision, describe the expected results of the collision.

37. Laboratory Trolley Car A has a mass of 0.9 kg and Laboratory Trolley Car B a mass of 0.5 kg. For each of the situations below, describe the expected results of the collision for Car A:

    a. Car A moves east at 0.5 m/s and collides but does not stick with Car B moving west at the same speed. After collision, Car B is moving east with a speed of 0.79 m/s.

    b. Car A moves east at 0.5 m/s and collides but does not stick with Car B moving east at 0.3 m/s. After collision, Car B is moving east with a speed of 0.56 m/s.

c. Car A moves east at 0.4 m/s and collides but does not stick with Car B moving west at 0.3 m/s. After collision, Car B is moving east with a speed of 0.6 m/s.

d. Car A moving at 0.3 m/s east collides and sticks with Car B moving at 0.5 m/s west.

(Hint: Use appropriate signs, +, -, to designate direction.)

38. A car of mass 1300 kg travelling at 25 m/s south, collides with a solid rock cliff face. Use your knowledge of force and momentum to describe a possible result of this collision.

39. A car of mass 1000kg changes its velocity from 20m/s north to 30m/s north in 2 seconds. Calculate the acceleration of the car and the net force applied by the engine to cause this acceleration.

40. Two trucks pull on a large boulder in an effort to shift it out of the way of a new fence line. One truck pulls with a force of 3000 N east and the other truck pulls with a force of 2500 N east. Determine the magnitude of the net force acting on the boulder. If the boulder has a mass of 500 kg calculate the size of the acceleration of the boulder due to this net force.

41. When drawing a vector diagram, a _____ and a _____ must be included.

42. A grade 10 science student who shall remain nameless decided to skip my class one day. On their adventure away from school, the student traveled 400 m [E] and then 850 m [W]. Using a vector diagram, find the students resultant displacement.

43. State the steps you would take to find the resultant displacement in a vector diagram.

44. A student goes out for a walk. The first part of her journey took her 20 m [E], then 35 m [W], then 60 m [E] and finally 15 m [W]. Using the algebraic method, find the students resultant displacement.