Forces Review: look over all labs and worksheets. Your answers should be in another color pen. This is not all inclusive of items on the test but a very close representation.

1.

The table shows the results of an experiment with a projectile fired from a spring gun. The results could be *most* easily interpreted if the data were

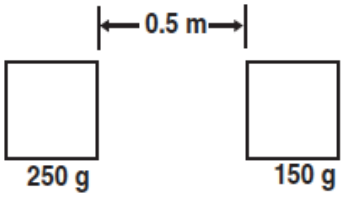
A entered into a spreadsheet.
B put into a database.
C plotted in a histogram.
D plotted as range vs. angle.

Angle between the spring gun and the horizon (degrees)	Range (meters)
20	6.4
30	8.6
40	9.8
50	9.6
60	8.7
70	6.3
80	3.4

2.

SKIP THIS YEAR

What event will produce the *greatest* increase in the gravitational force between the two masses?



A doubling the large mass
B doubling the distance between the masses
C reducing the small mass by half
D reducing the distance between the masses by half

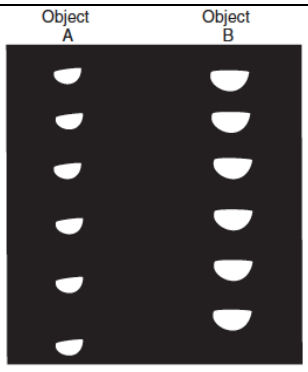
3. SKIP THIS YEAR

A communication satellite is in a circular orbit around Earth. If the speed of the satellite is constant, the force acting on the satellite
A is zero.
B is decreasing.
C points toward the center of Earth at all times.
D points in the direction that the satellite is moving.

4. A small car is being driven in a circular path at constant speed on a horizontal surface. What is the direction of the frictional force that keeps the car from skidding as it travels along this path?
A opposite the direction of the velocity of the car
B in the same direction as the velocity of the car
C toward the center of the circle
D outward from the center of the circle

5. A student does an experiment to measure the acceleration of a falling object, which is 9.8 m /s^2. The student obtains an experimental value of 14.6 m /s^2 . The reason for this variation is *most* likely due to
A human error.
B air resistance.
C local fluctuations in gravity.
D the mass of the object.

6. The picture shows two objects that were dropped and recorded with a stroboscopic camera. The *best* explanation for the results is that object A



A has less air resistance
B was dropped from a greater height
C has a greater mass
D accelerated

Class Questions:

7. 4 washers are stacked one on top of the other so that you form a tower of washers. One washer is aimed at the bottom of the stack of four washers with good hard flick with your finger or hand. One washer is pushed out from the bottom of the stack and the original moving washer stays at the bottom of the still stack. Which principle is illustrated with this example.
   a. momentum
   b. inertia
   c. free fall
   d. impulse

8. _____ is directly related to inertia. The greater the _____ the greater the tendency to change an object's motion.
Which term fills the blank to correctly complete the sentence?
   a. mass
   b. inertia
   c. velocity
   d. impulse

9. An object with a net force of 0 N is :
   a. not moving
   b. moving at a constant speed
   c. both a or b
   d. neither

10. The _____ force is equal in magnitude and opposite in direction from the gravitational force.
   a. Fg
   b. Normal
   c. Applied
   d. Frictional

11. When there is a net force a 5 N on a mass of 10 kg, is the applied force
   a. Increasing
   b. decreasing
   c. constant

12. When there is a net force of 5N on a mass of 10 kg, is the objects velocity
   a. Increasing
   b. Decreasing
   c. Constant

13. Two bricks of unknown materials are on a wall. In order to determine which brick is more massive, you push both off the edge to see which is harder to push. This is an example of
   a. Newton's 1^{st} law
   b. Newton's 2^{nd} law
   c. Newton's 3^{rd} law

14. True or False. Acceleration is only caused when there is a net force.
   a. True
   b. False

15. Inertia is to _____ as Momentum is to _____
Choose from the following to complete the pairs. This requires two different terms.

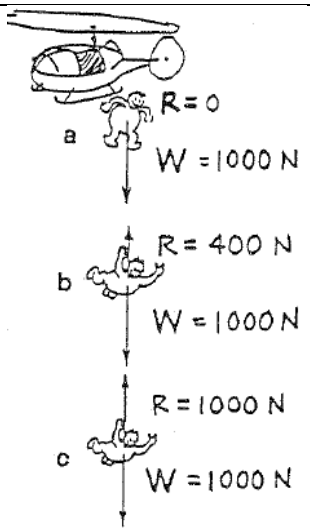
Velocity Mass Force Acceleration

16. When considering the equation F = ma. Which term describes the relationship between m and a?
   a. linear (meaning as one variable increases the other increases as well)
   b. inverse (meaning as one variable increases the other decreases)

17. A 12.0 kg objet is moving across a friction free surface at a constant velocity of 10 m/s. Which one of the following horizontal forces is necessary to maintain this state of motion?
a. 0N b. 12 N c. 120 N d. 1.2 N

18. Imagine a place in the cosmos far from all gravitational and frictional influences. Suppose you visit this place and throw a rock. The rock will:
   a. gradually stop
   b. continue with the same motion and speed

19. Bronco skydives from a stationary helicopter.
Use F = ma or a = Fnet/m
Fnet = W (weight) – R (air resistance)
Find Bronco's acceleration for pictures



A:

B:

C:

20. When Bronco's (above) speed is the least his acceleration is the
   a. least
   b. most

21. When Bronco jumps from the helicopter his velocity is in which direction?
   a. up
   b. down

22. In figure C, Bronco has an acceleration
   a. in the same direction as his velocity
   b. in the opposite direction of his velocity
   c. is equal to 0 m/s/s

23. In which position(s) does Bronco experience a downward acceleration?
a. a b.b c.c d . both a and b

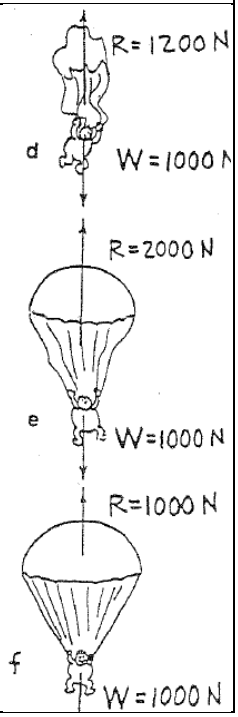
24. In which positions does Bronco experience an upward acceleration?
D E F

25. When Bronco experiences an upward acceleration, his velocity is:
   a. still downward
   b. b. upward also

26. In which position is his velocity constant?
D E F

27. Compare the two figures A – F. In which positions does Bronco experience terminal velocity?
A B C D E F

28. In which position is his terminal velocity the greatest?
A B C D E F



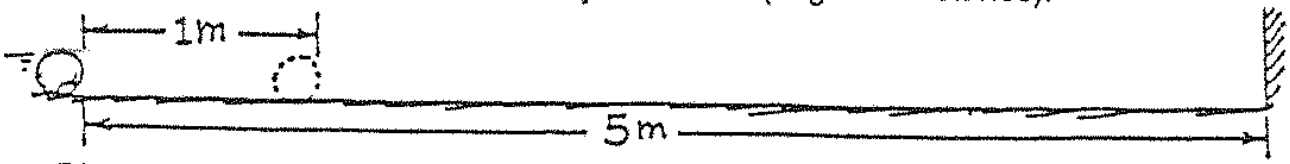
Formulas F = m/a $a = \frac{F}{m}$ $a = \frac{\Delta v}{\Delta t}$ $v = \frac{\Delta d}{\Delta t}$ $p = mv$

29. A 214 kg boat is sinking in the ocean. The force of gravity that draws the boat down is partially offset by the buoyant force of the water, so the net unbalanced force on the boat is 1310 N. What is the acceleration of the boat?

30. The whale shark is the largest of all fish and can have the mass of three adult elephants. Suppose that a crane is lifting a whale shark into a tank for delivery to an aquarium. The crane must exert an unbalanced for of 2500 N to lift the shark from rest. If the shark's acceleration equals 1.25 m/s^2. What is the shark's mass?

31. In drag racing, acceleration is more important than speed, and therefore drag racers are designed to provide high accelerations. Suppose a drag racer has a mass is 1250 kg and accelerates at a constant rate of 16.5 m/s^2. How large in the unbalanced force acting on the racer?

The sketch shows a ball rolling at constant velocity along a level floor. The ball rolls from the first position shown to the second in 1 second. The two positons are 1 meter apart. Sketch the ball at successive 1-second intervals all the way to the wall (neglect resistance).



a. Did you draw successive ball positions evenly spaced, farther apart, or closer together? Why?

_____

b. The ball reaches the wall with a speed of _____ m/s and takes a time of _____ seconds.

32.

Table I shows data of sprinting speeds of some animals. Make whatever computations are necessary to complete the table.

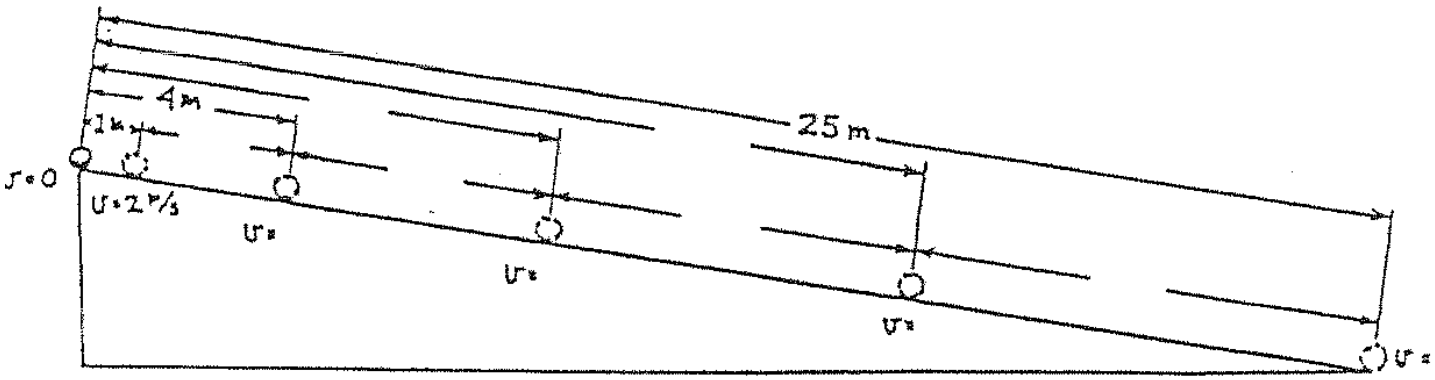
Table I

ANIMAL	DISTANCE	TIME	SPEED
CHEETAH	75 m	3 s	25 m/s
GREYHOUND	160 m	10 s	
GAZELLE	1 km		100 km/h
TURTLE		30 s	1 cm/s

33.

Complete the velocities and distances covered for the following ramp scenario.

3. An object starting from rest gains a speed $v = at$ when it undergoes uniform acceleration. The distance it covers is $d = 1/2\ at^2$. Uniform acceleration occurs for a ball rolling down an inclined plane. The plane below is tilted so a ball picks up a speed of 2 m/s each second; then its acceleration a = 2 m/s^2. The positions of the ball are shown at 1-second intervals. Complete the six blank spaces for distance covered, and the four blank spaces for speeds.



$a = \frac{\Delta v}{\Delta t}$ $d = \frac{1}{2}at^2$

34.

35.

36. From the following equation derive the formulas for solving for g and then for t

$d = \frac{1}{2}\ gt^2$

t = g=

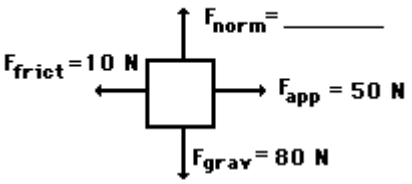
37. If the same bean bag is dropped 5 meters and then thrown horizontally with 10 N of force. Will there be a difference in the times the bag hits the ground between trials?

a. yes
b. no

38. In the above problem, what one factor determines the time it takes to drop this distance?

a. gravity
b. inertia
c. air resistance
d. terminal velocity

39. An applied force of 50 N is used to accelerate an object to the right across a frictional surface. The object encounters 10 N of friction. Use the diagram to determine the normal force, the net force, the mass, and the acceleration of the object. (Neglect air resistance.)



m = _____

a = _____

F_{net} = _____

40. In the hang time lab, students compared their height to their actual jump height (the difference between the height if your hand extended straight overhead and the total height you can hitat a running jump). If a graph was constructed of this data table. Which variable would belong on the y axis?

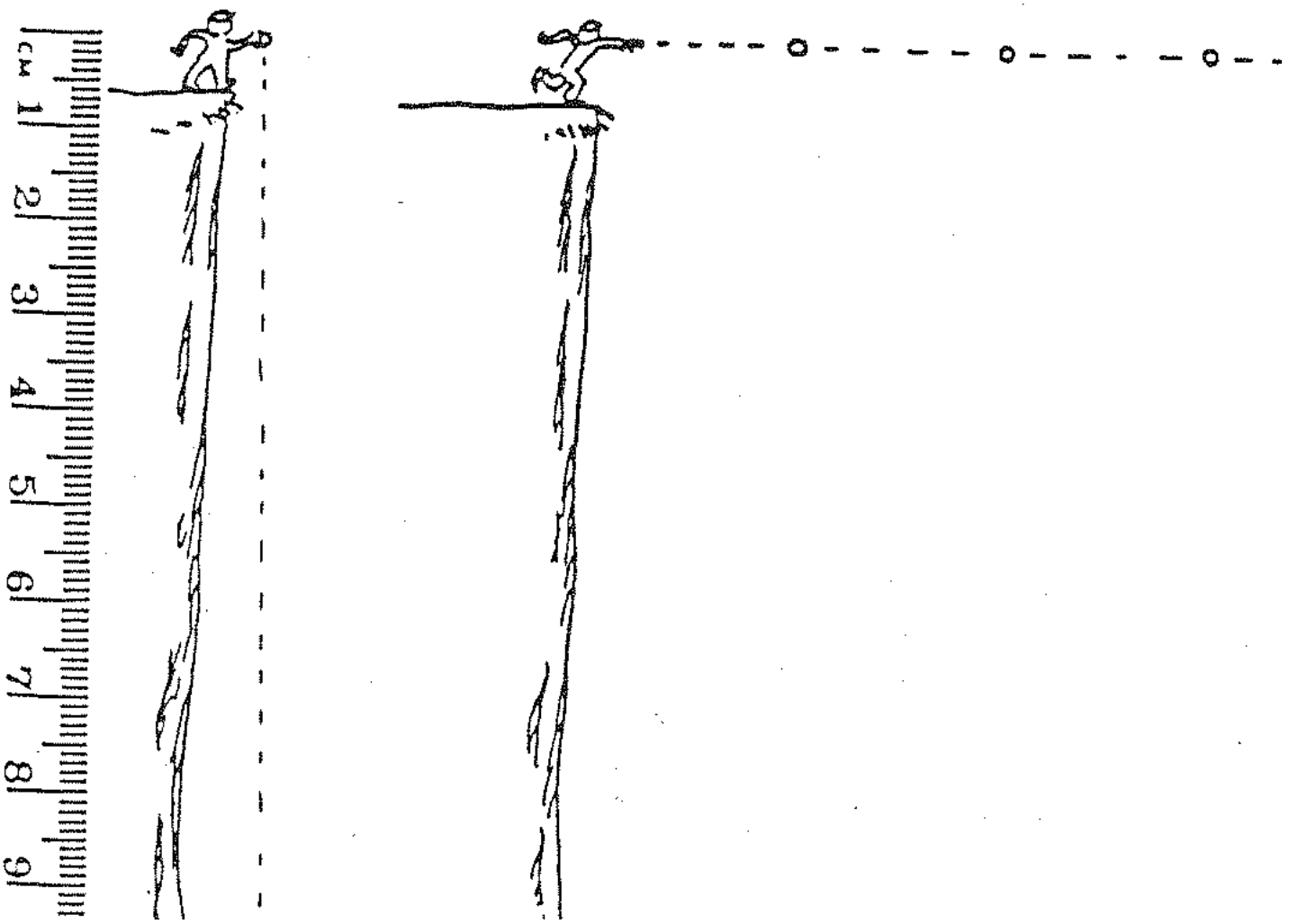
a. height
b. jump distance

41. In the hang time lab, as you jumped up to hit the wall your velocity:

a. increased
b. decreased

42. If you were having a slam dunk contest on another planet, what pieces of information would be the most crucial for you to determine your hang time?

a. your mass
b. gravity on the planet



Above left use the scale of 1 cm = 5 m. draw the positions of the dropped ball at 1 sec intervals. Neglect air drag and assume g = 10m/s2, Estimate the number of seconds the ball is in the air.

43.

Repeat for the right scenario where a ball is thrown horizontally but ignore air resistance.

44. While driving down the road, a firefly strikes the windshield of a bus and makes a quite obvious mess in front of the face of the driver. This is a clear case of Newton's third law of motion. The firefly hit the bus and the bus hits the firefly. Which of the two forces is greater: the force on the firefly or the force on the bus?

45. Momentum can be expressed in 2 formulas P = mv or Ft = mΔv
When referring to the impulse, which part of these equations is being identified?

a. mv
b. Ft

46. Which unergoes the greater acceleration?

a. the bus
b. the bug
c. the same

47. In a car crash, one of the best ways to decrease a chance for injuries would be to
    a. decrease the time of impact
    b. increase the time of impact
    c.

48. In the equation Ft = mΔv , F and t are _____ related.
    a. inversely
    b. linearly

49. True or False, In elastic collisions, objects collide and then separate. There is no sticking of the object.
    a. True
    b. False

50. True or False, In elastic collisions, momentum is conserved if friction is ignored.
    a. True
    b. False

51. True or False, During an inelastic collision, the objects stick together and move as one unit.
    a. True
    b. False

52. Remember how it feels to swing as high as you can on a swing set and the moment your body comes up off of the swing for a split second. At that moment when you hang in space you have:
    a. 100 % KE and 0% PE
    b. 100% PE and 0% KE
    c. 50% PE and 50% KE

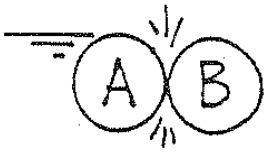
53. When you start to fall back down and swing at the bottom, you have the
    a. greatest velocity
    b. least velocity
    c. constant velocity all the way up and down

54. A moving car has momentum. If it moves twice as fast, its momentum is _____.
    A. the same
    B. twice as much
    C. is half what it was originally.

55. The recoil momentum of a gun that kicks is _____ the momentum of the gases and the bullet it fires.
    a. more than
    b. less than
    c. same as

2. Billiard ball A collides with billiard ball B at rest. Isolate each system with a closed dashed line. Draw only the external force vectors that act on each system.

System A



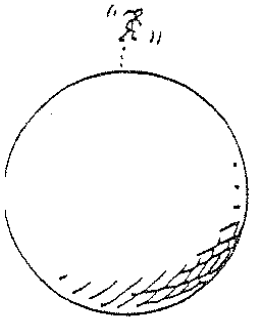
System B

System A+B

a. Upon collision, the momentum of System A (increases) (decreases) (remains unchanged).

b. Upon collision, the momentum of System B (increases) (decreases) (remains unchanged).

c. Upon collision, the momentum of System A+B (increases) (decreases) (remains unchanged).

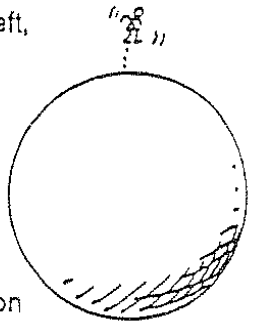


3. A girl jumps upward from the Earth's surface. In the sketch to the left, draw a closed dashed line to indicate the system of the girl.

a. Is there an external force acting on her? (yes) (no)

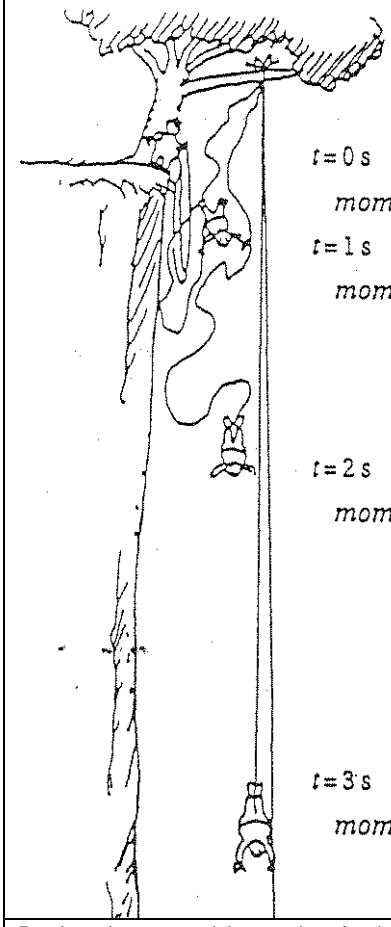
Does her momentum change? (yes) (no)

Is the girl's momentum conserved? (yes) (no)



b. In the sketch to the right, draw a closed dashed line to indicate the system [girl + Earth]. Is there an external force due to the interaction between the girl and the Earth that acts on the system? (yes) (no)

Is the momentum of the system conserved? (yes) (no)



$t = 0$ s $v =$ _____

momentum = _____

$t = 1$ s $v =$ _____

momentum = _____

$t = 2$ s $v =$ _____

momentum = _____

$t = 3$ s $v =$ _____

momentum = _____

Bronco Brown wants to put $Ft = \Delta mv$ to the test and try bungee jumping. Bronco leaps from a high cliff and experiences free fall for 3 seconds. Then the bungee cord begins to stretch, reducing his speed to zero in 2 seconds. Fortunately, the cord stretches to its maximum length just short of the ground below.

Fill in the blanks. Bronco's mass is 100 kg. Acceleration of free fall is 10 m/s².

Express values in SI units (*distance* in m, *velocity* in m/s, *momentum* in kg-m/s, *impulse* in N-s, and *deceleration* in m/s²).

The 3-s free-fall distance of Bronco just before the bungee cord begins to stretch

= _____

Δmv during the 3-s interval of free fall

= _____

Δmv during the 2-s interval of slowing down

= _____ _____

In the above problem what is the average force exerted by the cord during the 2 s interval of slowing down?

What is the impulse during the 2 s interval of slowing down?

How much energy does Bronco have 3 s after his jump?

Draw a graph for the relationship between
F and t in the Ft=mΔv equation