Scholar's Name_____

NEWTON'S LAWS

1. What is Newton's first law? (1 point)

2. EXPLAIN an example of Newton's first law. (1 point)

3. What is Newton's second law? (1 point)

4. EXPLAIN an example of Newton's second law. (1 point)

5. What is Newton's third law? (1 point)

6. EXPLAIN an example of Newton's third law. (1 point)

7. As a fish swims in the ocean, he moves his fins backwards and exerts a force on the water. This causes the fish to be propelled forward. This is an example of... (1 point)

   a. Newton's 1st Law
   b. Newton's 2nd Law
   c. Newton's 3rd Law
   d. Newton's 4th Law

8. During a storm, a student sees a rock fall from a cliff and smash into another rock below. Which of the following is an application of Newton's 2nd Law of Motion? (1 point)

   a. The gravitational attraction of Earth initially pulled the rock toward the ground.
   b. The mass of the rock is related to the force with which it hit the ground.
   c. The ground and the rock exerted equal and opposite forces on each other.
   d. The rock's inertia increased during collision.

9. According to Newton's first Law an object in motion... (1 point)
   a. will stop.
   b. will remain in motion.
   c. will speed up then slow down.
   d. will remain at rest.

10. According to Newton's first Law an object that is at rest (1 point)
   a. will stop.
   b. will remain in motion.
   c. will speed up then slow down.
   d. will remain at rest.

11. Newton's first law of motion is commonly referred to as the law of (1 point)
   a. motion.
   b. friction.
   c. acceleration.
   d. inertia.

12. If Bob and Tom are playing tug of war. Bob pulls on the rope with a force of 5 N and Tom pulls on the rope with a force of 6 N. These forces would be considered _____. (1 point)
   a. Balanced
   b. Unbalanced
   c. Even
   d. Equal

13. What is friction? (1 point)
    a. Rough like sand paper.
    b. When two forces are unbalanced.
    c. A force that resists the motion between two surfaces in contact.
    d. A force that resists the motion between two forces not in contact.

14. When you slide across ice, friction is what _____. (1 point)
    a. Allows you to move forward.
    b. Slows you down.
    c. Speeds you up.
    d. Keeps you standing up.

FORCE MASS AND ACCELERATION

15. What is the formula use to find force? (1 point)
    a. F = m/a
    b. M = f/a
    c. A = m/f
    d. F = ma

16. What is the force of a truck if it has a mass of 2000 kg and an acceleration of 10 m/s²? (1 point)
    a. 20 N
    b. 200 N
    c. 2000 N
    d. 20000 N

17. A 50 kg egg is dropped from a height of 10 m and falls for 2.5 seconds. If its acceleration is 9 m/s², what is its force when it hits the ground? (1 point)
    a. 45 N
    b. 450 N
    c. 5.45 N
    d. 25 N

18. Three vehicles are traveling with the same velocity. Which of the following would require the most force to come to a stop? (1 point)
    a. A train
    b. A semi truck
    c. A pick-up truck

19. Which of the following represents the greatest force? (1 point) F = M(kg) × a(m/s²)
    a. m = 15g a = 3 m/s² = 0.045 N
    b. m = 50g a = .5 m/s² = 0.025 N
    c. m = 10g a = 1 m/s² = 0.010 N
    d. m = 12g a = 3 m/s² = 0.036 N
    ↳ Remember to convert to Kg

20. What is the force of a baseball that has a mass of 50 g and is accelerating at 3m/s²? (1 point) ↳ convert to Kg
    a. ~~15 N~~ 0.15 N
    b. 1.6 N
    c. 125 N
    d. 150 N

21. Sid the squirrel is sleepwalking. He walks outside onto the highway, where he wakes up just in time to see a car coming right at him. Sid knows that if the car hits him with a force of 2000 N, then he will die. If the car has a mass of 20 kg and when it hits Sid he accelerates 180 m/s², what will happen to Sid? (1 point)
    a. He will die.
    b. He will survive.
    c. He will not get hit.
    d. He will not survive.

    20Kg × 180m/s²
    ↳ 3600N
    3600N is > than 2000N

22. Which of the following represents the greatest force? (1 point) F = ma
    a. m = 150kg a = .15 m/s² = 22.5 N
    b. m = 5kg a = .5 m/s² = 2.5 N
    c. m = 10kg a = 10 m/s² = 100 N
    d. m = 2kg a = 11 m/s² = 22 N

23. This chart below represents information 3 different carts and the force applied to each cart.

Cart Masses and Forces Applied

Cart	Mass (kg)	Force (N)
W	5	60
X	5	20
Y	5	40

Which cart will have the greatest acceleration? (1 point)

a. Cart W
b. Cart X
c. Cart Y
d. None – all of the accelerations are equal

POTENTIAL AND KINETIC ENERGY

24. Potential energy depends on: (1 point)
    a. Position
    b. Time
    c. Velocity
    d. Mass
    e. A and d

25. Kinetic energy depends on: (1 point)
    a. Position
    b. Time
    c. Velocity

26. What is the potential energy of a rock that weighs 5 kg that is sitting on top of a hill 200 meters high? SHOW ALL WORK (2 points)

$m = 5\,kg$
$h = 200m$
$PE = mgh$
$= (5kg)(9.8\ \frac{m}{s^2})(200m)$
$= 9,800\,J$

27. What is the kinetic energy of a bicycle with a mass of 10 kg travelling at a velocity of 3.21m/s? SHOW ALL WORK (2 points)

$m = 10kg$
$v = 3.21\,m/s$
$KE = \frac{1}{2}\,m\,(v)^2$
$= \frac{1}{2}\,(10kg)(3.21)^2 = 51.52\,J$

28. 3. A flower pot weighing .105kg is sitting on a windowsill 50 meters from the ground. Is the energy of the flower pot potential or kinetic? How many joules is this? SHOW ALL WORK (2 points)

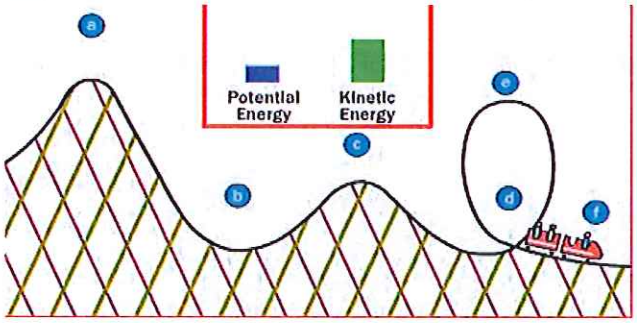
Energy is Potential

$m = .105kg$
$h = 50m$
$PE = mhg$
$= (0.105kg)(50m)(9.80)$
$= 51.45\,J$

29. When the flower pot in problem ~~38~~ is only 3 meters from the ground what is the potential energy? SHOW ALL WORK (2 points)

$m = .105kg$
$h = 3m$
$PE = mhg$
$= (0.105kg)(3m)(9.8m/s^2)$
$= 3.087\,J$

30.



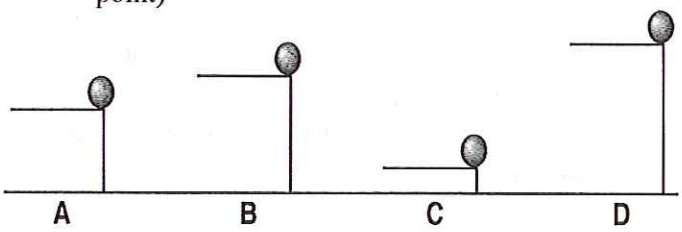
In the above diagram of the roller coaster, where does the coaster have the highest potential energy? (1 point)

a. a
b. b
c. c
d. d
e. e
f. f

31. The above coaster never loses energy. Explain how this works. (HINT: use a LAW we learned in class) (2 points)

Energy is conserved and cannot be destroyed: Law of conservation of energy

32. Which ball in Figure 4 below has the greatest potential energy? Circle your answer below. (1 point)



a. Ball A
b. Ball B
c. Ball C
d. Ball D

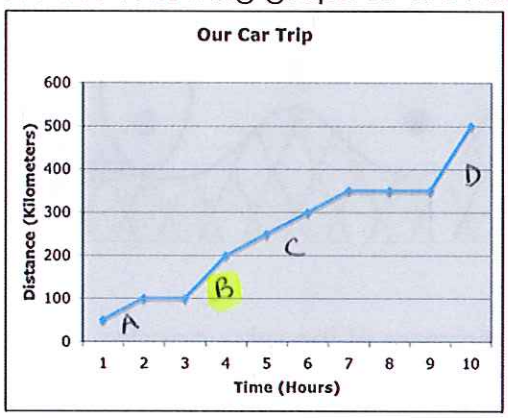
33. A snowboarder with a mass of 120 kilograms jumped off a cliff. After the jump, he was 7 meters off the ground moving forward at 3 meters/second.

How much kinetic energy did the snowboarder have after the jump? (1 point)

a. 2,520 J
b. 8,232 J
c. 3,528 J
d. 540 J

$m = 120kg$
$h = 7m$
$v = 3m/s$
$KE = \frac{1}{2} m (v)^2$
$= \frac{1}{2} (120kg)(3m/s)^2$
$= 540J$

Use the following graph to answer questions 34-36.



34. Between which times, was the car **motionless** (not moving)? (example: between 10 and 12 hours) (1 point)

- Between 2 and 3 hours
- Between 7 and 8.5 hours

35. Between which times was the speed of the car the **fastest? How do you know**? (1 point)

A: (x_1, y_1) $(1, 50)$ (x_2, y_2) $(2, 100)$ $\frac{100-50}{2-1} = \frac{50}{1} = 50 km/h$ = A
B: $(3, 100)$ $(3.5, 200)$ $\frac{200-100}{3.5-3} = \frac{100}{0.5} = 200 km/h$ = B
C: $(3.5, 200)$ $(7, 350)$ $\frac{350-200}{7-3.5} = \frac{150}{3.5} = 42.86 km/h$ = C
D: $(9, 350)$ $(10, 500)$ $\frac{500-350}{10-9} = \frac{150}{1} = 150 km/h$ = D

$slope = \frac{y_2 - y_1}{x_2 - x_1}$

36. What was the **average speed of the car** during the trip? (2 points)

$= 50km/h + 200km/h + 42.86km/h + 150km/h$
$= \frac{442.86 km/h}{4}$
$= 110.72 km/h$
$= 111 km/h$

SPEED, VELOCITY, AND ACCELERATION

Match the units with their corrected variable.

37. H Km — E. velocity
38. J m/s^2 — F. force
39. I second — G. speed
40. E Km/hr North — H. distance
41. G m/s — I. time
42. F N — J. acceleration

43. An object moves at a constant speed of 6 m/s. This means that the object:
    a. Increases its speed by 6 m/s every second
    b. Decreases its speed by 6 m/s every second
    c. Doesn't move
    d. Has a positive acceleration
    e. Moves 6 meters every second

44. A toy car moves 8 m in 4 s at the constant velocity. What is the car's **velocity**?
    A. 1 m/s B. 2 m/s C. 3 m/s D. 4 m/s

45. A train moves at a constant velocity of 50 km/h. **How far** will it move in 0.5 h?
    A. 10 km B. 20 km C. 25 km
    D. 45 km E. 50 km

46. A boat can move at a constant velocity of 8 km/h in still water. **How long** will it take for the boat to move 24 km?
    A. 2 h B. 3 h C. 4 h D. 6 h

47. A bicyclist moves at a constant speed of 4 m/s. **How long** it will take for the bicyclist to move 36 m?
    A. 3 s B. 6 s C. 12 s D. 9 s E. 18 s

48. A truck comes to a stop its speed changes from 50 m/s to 35m/s in 5 secs. What is trucks acceleration?

$a = \frac{\Delta V}{t} = \frac{V_f - V_i}{t} = \frac{35m/s - 50m/s}{5s} = \frac{-15m/s}{5s} =$ The truck slows down to $3 m/s^2$

note: you may also do the acceleration as the car comes to a stop BUT $\frac{0m/s - 35m/s}{?}$ there is no time given so you would end up with something like this

49. A runner covers the last straight stretch of a race in 4 s. During that time, he speeds up from 5 m/s to 9 m/s. What is the runner's acceleration in this part of the race?

$a = \frac{\Delta V}{t} = \frac{V_f - V_i}{t} = \frac{9m/s - 5m/s}{4s} = 1 m/s^2$

50. True/False: Speed is velocity in a given direction.

51. True/False: The speed of a plane can be described as 300 mi/h.

52. True/False: The velocity of a car can be described as 60 km/h to the North.