PHYSICS

CALCULATIONS

Motion Calculations I

- **Velocity … [$v = d/t$]**
- **Acceleration … [$a = \Delta v/t$]**
- **Distance … [$d = \frac{1}{2} a t^2$]**
- **Momentum … [$P = mv$]**

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1. **How fast is a rocket going in mph if it travels at 90 ft in 6 sec?**

2. **What is the acceleration of a thrown baseball while it is in the hand of the pitcher and goes from 0 mph to 90 mph; and he performs his pitch in ½ second?**

3. **How tall (in meters) is a building from which a penny is dropped, if it falls 3 seconds before hitting the ground?**

4. **How far down (in meters) does a penny go in 1 second if dropped from a rocket that is traveling at a horizontal velocity of 3,000 km/hr?**

5. **How fast will a rock be going when it hits the ground if you throw it straight up at 123.26 km/hr?**

6. **What is the momentum of a 1 ton car moving at 100 km/hr? How fast would a 4 ton cement truck have to move to have that same momentum?**

7. **A 5 ton railroad car going at 8 mph links to a stationary 15 ton car. They move slowly down the track after the linkage. How fast are they now going?**

8. **A big fish eats a small fish. The big fish was going 3 m/s. The little fish was still.**
   m_{big} = 5 kg
   m_{little} = 1 kg
   What is the net momentum before and after lunch? And what is the velocity of the big fish with the small fish inside it?

PHYSICS

Motion Calculations II

- **Velocity … [$v = d/t$]**
- **Acceleration … [$a = \Delta v/t$]**
- **Distance … [$d = \frac{1}{2} a t^2$]**
- **Momentum … [$P = mv$]**

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9. What is the speed of light in m/s if it is 186,000 mph?

10. What is the acceleration of an object that has v_i = 36.2 km/s, v_f = 98.7 km/s, and a time of 32.5 s?

11. How far does an object in free fall go in 8.3 s if it starts at rest?

12. A 656 g clay object is going a 75 cm/s. It collides with a second clay object that weighs 426 g and they stick together. How fast are they now going?

PHYSICS

Motion Calculations III

- **Velocity … [$v = d/t$]**
- **Acceleration … [$a = \Delta v/t$]**
- **Distance … [$d = \frac{1}{2} a t^2$]**
- **Momentum … [$P = mv$]**

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13. How fast is an object going in mph if it travels at 131 ft in 5.30 seconds?

velocity in mph = _____

14. What is the acceleration of an object if it goes from 0.0 mph to 80 mph in .30 second?

acceleration =_____

15. How high is a building (in meters) if one drops a nickel and it falls 15.35 seconds before hitting the ground?

distance from earth =_____

16. A rocket is traveling at a horizontal velocity of 3,333.33333333333333 km/hr. How far down (in meters) will an object go if it is dropped from the rocket and it falls 8.30000000000000000 seconds miraculously without air friction?

distance =_____

17. How fast will a pebble be going when it is caught at the exact height from which it was thrown, if a thrower throws it straight up at 77.7777 km/hr?

pebble velocity =_____

18. Crash dummy #1 is driving a 1,500 kg car at 123 km/hr. Crash dummy #2 is driving a 6,800 kg cement truck. How fast will Crash dummy #2's truck have to move to have the same momentum?

Crash dummy #2's truck's velocity =_____

19. A 14 ton railroad car is traveling at 100 mph. It links to a stationary 36 ton car. They move slowly down the track after the linkage. How fast are they now going?

The railroad car plus the linked car's velocity =_____

20. A large fish going 5 m/s eats a small, still fish.
m_{big} = 5 kg
m_{little} = 1 kg
What is the net momentum? And what is the final velocity?

net momentum =_____ final velocity =_____

PHYSICS

Energy Calculations

- **Work … [W = fd]**
- **Power … [Power = W/t]**
- **Potential Energy … [PE = wt h]**
- **Kinetic Energy … [KE = ½ mv$_2$]**
- **Work - Energy Theorem … [W = ΔKE]**

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21. A power lifter lifts a 300 pound barbell 2.3 meters off the ground (1 lb is about 4.45 Newtons). How much *work* did she do in joules (1 j = 1Nm)?

Work = _____ j

22. What is the *power* of a 500 horsepower truck in kiloWatts? Remember that 1horsepower = 750w.

Power = _____ kW

23. How much *potential energy* does a 63.8N rock have if it is on a cliff that is 450.2m above the valley floor? Remember that 1j = 1Nm.

PE = _____ j

24. a) How much *work* is done carrying a 75N bowling ball horizontally across the room for 10m? b) How about lifting it 1.27m?

a) W = _____ j b) W = _____ j

25. a) How much *kinetic energy* in joules does a 1.45kg ball thrown at 35.5m/s? b) How about 0.1kg bullet shot at 894.08 m/s?

a) KE = _____ j b) KE = _____ j

26. a) How much *work* in joules does a 907 kg car exert in slowing down from 25 m/s (which is about 90 km/hr or 60 mph) to 8.3 m/s (which is about 30 km/hr or 20 mph)?
b) Since the formula [KE = ½ mv$_2$] has velocity being squared, how much more stopping distance will the car need at 90 km/hr compared to 30 km/hr?

a) KE = _____ j b) stopping distance of _____ times more

Motion/Energy Calculations

- **Velocity … [$v = d/t$]**
- **Acceleration … [$a = \Delta v/t$]**
- **Distance … [$d = \frac{1}{2} a t^2$]**
- **Momentum … [$P = mv$]**
- **Work … [$W = fd$]**
- **Power … [$Power = W/t$]**
- **Potential Energy … [$PE = wt\ h$]**
- **Kinetic Energy … [$KE = \frac{1}{2} mv^2$]**
- **Work - Energy Theorem … [$W = \Delta KE$]**

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27. How fast is a rocket going in mph if it travels at 120 ft in 6 sec?

___ mph

28. A weight lifter lifts a 400 pound barbell 2.3 meters off the ground (1 lb is about 4.45 Newtons). How much *work* did he do in joules (1 j = 1Nm)?

Work = _____ j

29. What is the acceleration of a thrown baseball while it is in the hand of the pitcher and goes from 0 mph to 95 mph; and he performs his pitch in ½ second?

30. How tall (in meters) is a building from which a penny is dropped, if it falls 4 seconds before hitting the ground?

31. What is the *power* of a 500 horsepower truck in kiloWatts?
Remember that 1horsepower = 750 w.

Power =_____ kW

32. How far down (in meters) does a penny go in 3 seconds if dropped from a rocket that is traveling at a horizontal velocity of 2,238 km/hr?

33. How much *potential energy* does a 53.8N rock have if it is on a cliff that is 550.8m above the valley floor? Remember that 1j = 1Nm.

PE =_____ j

34. How fast will a rock be going when it hits the ground if thrown straight up at

125.36 km/hr?

35. What is the momentum of a 1 ton car moving at 100 km/hr? How fast would a 4 ton cement truck have to move to have that same momentum?

36. a) How much *work* is done carrying a 64N bowling ball horizontally across the room for 10m? b) How about lifting it 1.88m?

a) W =_____ j b) W =_____ j

37. a) How much *kinetic energy* in joules does a 2.45kg ball thrown at 45.5m/s have? b) How about 0.1kg bullet shot at 794.28 m/s?

a) KE =_____ j b) KE =_____ j

38. A big fish eats a small fish. The big fish was going 3 m/s. The little fish was still.
m_{big} = 5 kg
m_{little} = 1 kg
What is the net momentum before and after lunch? And what is the velocity of the big fish with the small fish inside it?

39. What is the speed of light in m/s if it is 186,000 mph?

40. What is the acceleration of an object that has v_i = 36.2 km/s, v_f = 98.7 km/s, and a time of 32.5 s?

41. a) How much *work* in joules does a 800 kg car exert in slowing down from 24.8 m/s to 4.8 m/s?
b) Since the formula [$KE = \frac{1}{2} mv^2$] has velocity being squared, how much more stopping distance will the car need at 80 km/hr compared to 20 km/hr?

a) KE =_____ j b) stopping distance of _____ times more

42. A 656 g clay object is going a 75 cm/s. It collides with a second clay object that weighs 426 g and they stick together. How fast are they now going?

43. A rocket is traveling at a horizontal velocity of 3,333.33333333333333 km/hr. How far down (in meters) will an object go if it is dropped from the rocket and it falls 8.3 seconds miraculously without air friction?

distance =_____

44. How fast will a pebble be going when it is caught at the exact height from which it was thrown, if a thrower throws it straight up at 77.7777 km/hr?

pebble velocity =_____

45. Crash dummy #1 is driving a 1,500 kg car at 123 km/hr. Crash dummy #2 is driving a 6,800 kg cement truck. How fast will Crash dummy #2's truck have to move to have the same momentum?

Crash dummy #2's truck's velocity =_____

46. A 14 ton railroad car is traveling at 100 mph. It links to a stationary 36 ton car. They move slowly down the track after the linkage. How fast are they now going?

The railroad car plus the linked car's velocity =_____