## RMSE

- Standard deviations from a arithmetic mean or RMS deviations reflects uncertainties in experiments.
- always positive (due to the square).
- Smaller RMSEs mean smaller uncertainties.



## Significant Figures

- A distance of 18 cm measured with a ruler is subject to an error of approximately ± 1 mm. Hence we quote three significant figures: d = 18.0 cm.
- The number of significant figures reflects uncertainties.
- Scientific notations:

d = (1.25 ± 0.01) x 10<sup>-6</sup> m or (1.25 ± 0.01)  $\mu$ m.

• If you combine quantities, the largest uncertainty determines how many significant figures you quote.

## Dimensional analysis Ex: Formula for wavelength of light

- A scientist working in the field of applied optics obtained the following formula for the wavelength of light measured by an instrument:
- $\lambda = (a^2 + b^2/c)/d$
- where a, b, c and d are the dimensions (in meters) of the different parts of the instrument.

Is this formula correct?

- 1. Yes
- 2. No
- 3. Not enough information to decide

#### Phys100: Energy and Energy Conservation

1) Kinetic energy, potential energy and mechanical energy;

2) Conservation of mechanical energy (Demo. here);

3) Other forms of energy include: chemical energy, nuclear energy, thermal energy, solar energy, radiation energy...

4) Energy transfer and energy conservation (Demo. here)

# What is energy "E"?

Google Results 1 - 10 of about 73,200,000 for energy definition. (0.15 seconds)

the capacity of a physical system to do work; the units of energy are joules or ergs; "energy can take a wide variety of forms" • Energy From Wikipedia, the free encyclopedia

In <u>physics</u> and other <u>sciences</u>, energy (from the <u>Greek</u>  $\varepsilon v \varepsilon \rho \gamma \delta \varsigma$ , *energos*, "active, working")[1] is a <u>scalar physical</u> <u>quantity</u>, often represented by the symbol *E*,[2] that is used to describe a conserved property of objects and systems of objects.

It comes in many different forms, such as kinetic, potential, thermal, electrical, chemical, nuclear, and mass energy.

## Energy conservation

Important aspects:

- i) transformation or conversion of energy from one form to other
- (Ex: Kinetic energy K <----> potential energy U );
- ii) energy transfer from one system a to another b

iii) Total energy of different forms (for i)or total energy of sub systems (for ii) are conserved.(Ex: E=K+U or E=Ea+Eb is a constant.)

### Basic forms of mechanical energy

Kinetic energy: associated with motions (m: mass; v: the velocity)

$$K = \frac{1}{2}mv^2$$

Potential energy: associated with the height of an object (g: gravitational acceleration; y: the height )

$$U = mgy$$

Units: 1 Joule =  $1J = 1 \text{ kg m}^2/\text{s}^2$ 

#### Quantitative analysis of a falling pebble I



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#### Quantitative analysis of a falling pebble II: Energy diagram



# Q1

Two marbles, one twice as heavy as the other, are dropped from the ground from

- the roof of a building. When hitting the ground, the heavier marble has
- 1) as much kinetic energy as the light one;
- 2) Twice as much as the light one;
- 3) half as much as the light one;
- 4) Impossible to determined.



#### A pebble tossed into the air



The particle is projected upward. Energy is entirely kinetic. The particle has gained potential energy, lost kinetic energy.

The energy is entirely potential at the turning point.

The particle gains kinetic energy and loses potential energy as it falls.

# Q2

A stone is rolling downhill along two different paths, one is twice as long as the other.

- At the bottom, the velocity of the stone rolling along the longer path is
- twice as much as that along the shorter path;
- 2) one half;
- 3) the same;
- 4) None of the above.

