

Science before Science Study Group

Week Four

Begin with Prayer

Prayer before Study

Almighty God, Thou who are the creator of all things and our loving Father, send us Thy Holy Spirit to illuminate our minds so that we can understand how Thou hast revealed Thyself to us through the world around us.

Grant to me
keenness of mind
capacity to remember,
skill in learning,
subtlety to interpret,
and eloquence in speech.

May Thou guide the beginning of my work, direct its progress, and bring it to completion.

We ask this through Thy Son, Jesus Christ

Amen

Reminders

- Two books for the course
 - Kid's Introduction to Physics (from IAPWEB.ORG)
 - The Science before Science (from AMAZON)
- Meet for about 45 minutes each week
- Monday at 8:15 Central Time

Review Questions - Memorize

- What is a physical thing?

A physical thing is something and can become something else

- Physical things have two parts – what are they?

Matter and form.

- What is matter?

Matter is what it is potentially

- What is form?

Form is what a thing is actually

- What are the two kinds of changes?

A change of substance and a change of accident (property)

Review Questions - Memorize

- What is a substance?

A substance is something that has its own existence. (e.g. a cat, a man, a tree, etc.)

- What is a property or accident?

A property or accident is something that exists in a substance. (e.g. color, texture, hotness or coldness, shape, impetus)

- What is the mnemonic for remembering the nine properties of physical things ?

The nine properties of physical things can be remembered using the mnemonic
QQ RARe POET

- What are the nine properties?

The nine properties are quantity, quality, relation, action, reception, place, orientation, environment, time

Review Questions - Memorize

- What is the principle of non-contradiction?

The principle of non-contradiction is:

Something cannot BE and NOT BE at the same time and in the same way

- What is change?

Change is the process of what can be becoming what is

- What is the principle of causality?

The principle of causality is:

Nothing can change itself

- What is impetus?

Impetus is the power or quality of something to move itself.

- What is force?

Force is the quality or power of something to change the impetus of another thing.

Review Questions

- What does plana mean in Latin?

Plana is the Latin word for field.

- Is plana a property or substance?

Plana is a substance.

- Can you identify a property of the plana?

Light is a property of the plana.

Another property of the plana is the gravitational field.

- What are the two parts of the scientific method?

The two parts are (1) it looks at the world through the property of quantity and (2) it make use of symbols and rules to make laws that can make predictions.

- Why is quantity the first property of physical things?

Quantity is the first property because we can think of quantity without all the other properties.

Quiz

- What is the property P and the substance S in the following:
 - Brown cat
 - P – brown S - cat
 - Slimy fish
 - P – slimy S - fish
 - Carnivorous animal
 - P – carnivorous S - animal
 - A falling dog
 - S – dog P – is falling (has downward impetus)
- What about these?
 - Ugly duckling
 - Ugly is the absence of something and not a property
 - Dumb rock
 - Dumb is the absence of intelligence and not a property
 - Red circle
 - Both red and circle are properties

Recommendations

- That you read the Kid's book aloud (even if you have no children – but if you do read it to them)
- That you read the Chapter assigned before the class and then after the class.
- Review the slides that I use in the class before the next class
- Keep the class presentations as a way to review what we have covered

This Class

- Introduce a simple formula as an example of the scientific method
- We will define 'empiriometric' as something that encapsulates this method
- We will talk about measurements 🍷
- Explain what the simple formula is about
 - Relationship between different things
 - Need to talk about speed
 - Need to talk about resistance or inversely the receptivity of a thing to the impetus
 - Need to have measurement for each of the things in the equation

Scientific Method – Special Name - Empiriometric

- Empiriometric – is another name for the scientific method
- Empirio
 - Physical world that he see and touch
- Metric
 - Means ‘measured’ (can remember this because of the ‘metric’ system)

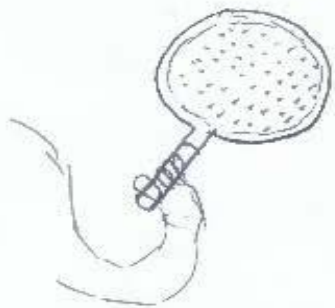
Motion is Very Important

- Why is motion very important?
 - One moves across a distance – so things can act on things
 - Distance gets us to quantity – extension of things
 - Quantity – parts outside of themselves – essential to a physical thing
 - All physical things have extension
- Consider motion in two-dimensions – hockey puck on ice
 - Baseball is more complicated – two dimensions
 - Up/down impetus and gravity
 - Hockey puck – we can ignore gravity
 - Hockey puck – has friction of ice – takes away impetus of puck as it moves – is small – ignore
 - Friction is a force. Why?
 - Drag or friction of the air – also small – so we will ignore
- Our formula
 - To say it in words.
 - First, we have to know what the formula is about
 - This formula will describe the relationship between three things
 - (1) The strength of the impetus
 - (2) the quickness or speed of the body
 - (3) the resistance of the thing to the impetus

The Third Thing in the Formula

- Properties - Action and Reception
 - Something that acts must be received by something
- Resistance - imagine two bodies or things
 - Have the same amount of impetus
 - If one body resists the action of the impetus more than the other it will move slower

Apply Impetus
with Paddle



Before



PING PONG
BALL



GOLF
BALL

After



greater speed



lesser speed

The golf ball has greater resistance to the impetus of the paddle striking it than the ping pong ball.

Resistance to Impetus

- Resistance to receiving impetus
 - We call the quality of resistance to the impetus the 'mass'.
 - Now we have the third thing we need.
- But we still cannot write our formula yet !
 - We need numbers!

Getting a Number for Speed (Velocity)

- Use a rod as a standard – meter or foot – property of relation
 - Compare distance to this standard – property of relation used to get a number
- Need also a measure of time
 - Time is not a quantity – it is a property
 - Use the second hand on the clock – to compare two elapses of time
 - Now we have a quantity – but quantity is not the thing – time
 - It is a measure of time duration
- Something moves a distance in a certain time
 - $\text{Distance/time} = \text{speed}$

Mass or Resistance to Impetus

- Standard is the kilogram
 - A bar that is kept in France
 - Use to get a number for mass
- Standard for the impetus
 - Take kilogram mass and give it speed of 1 m/sec
 - Use as the standard measure of impetus
 - Called the Buridan after the scientist who came up with the first explanation of impetus

Finally ready to say what equation will be about

The measure of the speed of a thing is equal to the measure of the impetus of the thing divided by the measure of its mass!

- Scientists use a short-hand way of saying this.
 - Speed – for the measure of the speed
 - Mass – for the measure of the mass
 - Momentum – for the measure of the impetus
- So they say
 - “Speed is the momentum divided by the mass”
 - This shorthand saves times BUT it hides the fact that is a difference between a number (measurement) and a quality (mass, impetus)
 - People forget that impetus is a power or quality and not a quantity (number)!

Second Part of the Scientific Method

- Use symbols and rules to make predictions
 - Let the speed be symbolized by v
 - The momentum by p
 - The mass by m

$$v = p/m$$

- Can manipulate the symbols to get

$$p = mv$$

Can use to make all kinds of predictions

- Remember
 - We defined our number so that
 - Momentum of 1 kg at 1 m/sec was a 1 kg mass going at a speed of 1 m/sec
 - So now we can use the formula to answer the question
 - How fast will a $\frac{1}{2}$ kg goes if it has the same impetus?
 - $V = (1 \text{ kg m/sec}) / (1/2 \text{ kg}) = 2 \text{ m/sec}$
 - Or answer the question if a thing has a momentum of 1 Buridan and a speed of 10 m/sec, what is its mass?
 - $p = 1 \text{ buridan}$ and $v = 10 \text{ m/sec}$ what is m ?
 - $m = p/v = 1 \text{ buridan} / 10 \text{ m/sec} = 1/10 \text{ kilogram} = 0.1 \text{ kilogram}$
 - Or how much momentum does the earth have in its orbit around the sun?
 - $p = mv$ speed of the Earth = 29,770 m/sec and its mass is 5,983,000,000,000,000,000,000 kg;
 - $p = 178,113,910,000,000,000,000,000,000$ Buridans

Congratulations!

- If you understand
 - Know more physics than most people in the world !
- Few understand
 - The basic physics in the big senseAnd
 - The physics that comes out of modern understanding
 - And we have covered both!
- Glimpse of the wonderful world God has created and you will want to learn more!

Recap: What is the scientific method?

1. Look at the world in terms of quantity
2. Uses symbols and rules to relate measurements
3. Makes predictions about the world

Prior to this formulation, we must be able to state what the symbols and rules mean

Next week

- Re-read Chapter 9
- Read Chapter 10 and 11
- Next week's session will be about God – the unchangeable changer