God is Truth Teacher's Topic Guide Year 5

Topic: Gravity and Pendulums **Duration: 3 weeks**

Spiritual Awareness: Seek the truth; Discern the truth
In order to understand truth, we need to weigh up and balance the things we hear and see. Through the creation we can see balance at work. This can be used as a symbol for balancing spiritual truth.

To be able to weigh up and measure truth correctly is an essential gift that God makes available to all Christians. This is the gift of discernment.

Throughout history there have been Christian scientists who relied on God for wisdom, and in doing so discovered scientific truth. This newly discovered truth was often unaccepted, and many scientists were persecuted for their beliefs. One such scientist was Galileo, who discovered the telescope and the laws relating to gravity and pendulums.

Our response to 'God is Truth'
- Speak the truth
- Be honest
- Never cheat or steal
- Never lie or exaggerate
- Be trustworthy
- Be true to my word and keep promises.
- Be myself and not try to be someone I am not.
- Search for the truth
- Ask God to show me the truth.
- Ask the Holy Spirit to lead and guide me into all truth.
- Believe that God's word is the truth.
- Believe that Jesus is the Way, the Truth and the Life.

Bible stories and passages
Matthew 16:13-20 Peter declared that Jesus was the Son of God, a truth given directly by the Father.
Acts 7:51-60 Stephen gives his life for believing the truth.
Luke 11:9-13 He that seeks finds.
Daniel ch 13 Shadrach, Meshach and Abednego stood up for the true God.
Daniel ch 6 Daniel also stood up for the true God.
Romans 1:20-25 The truth about God is evident in the Creation, but instead they worship idols. Verse 25 says, "They exchange the truth about God for a lie." (GNB)
Matthew 7:15-21 Wolves in sheep's clothing.
John 18:38 Everyone that is of the truth hears my voice.
John 10:1-8 The Good Shepherd. The sheep hear His voice.
Matthew 7:13-14 The broad and narrow way.
Exodus 20:3-4; Isaiah 42 verses 8 & 17 No other gods.
2 Peter ch 2 False teachers.

2 Corinthians 11:13-14 False apostles, and Satan as an angel of light.
1 Peter 5:8 Satan is a roaring lion.
Luke ch 4 Jesus knew how to deal with Satan

Bible verses

Proverbs 3:5 Trust in the Lord with all your heart. Never rely on what you think you know. (GNB)
John 16:13 When the Spirit of truth comes, He will guide you into all truth.
Acts 14:7 God has always given evidence of His existence by the things He does. (GNB)
John 8:32 You shall know the truth and the truth shall set you free.
Proverbs 11:1 The Lord hates dishonest scales, but He is pleased with correct weights.
John 14:6-7 I am the way, the truth and the life.

Key Questions

about truth

Who do we believe?
How do we know what is true?
How do we weigh and measure solid objects?
How do we weigh and measure the things we see and hear?
How does Satan try to make us turn away from God?
What did Jesus do when He was tempted by Satan?

about science

How do scientists find truth?
How can we use the Bible as a guide to truth about the universe?
What were some of the discoveries made by Galileo about the universe?
What is gravity?
What did he discover about gravity?
How does the earth's gravity differ to that of the moon and other planets?
Why did many people disbelieve the new discoveries of Christian scientists such as Galileo?
Why do we need truth and accuracy in science and not just guess work?

Outcomes

Knowledge

- Study in detail the work of Galileo, and in particular, his discoveries concerning gravity and pendulums.
- Understand that gravity id a force that causes objects to fall
- Understand that air works against gravity to slow down the acceleration of a falling object.
- Understand that without air, all objects would fall with the same acceleration, regardless of mass.

Skills

- Experiment with pendulums and gravity
- Explain gravitational forces
- Use different kinds of scales for weighing objects
- Use drawings to record experiments and graph results
- Predict
- Manipulate, measure and assemble pendulums

Values

- seek truth
- show curiosity to explore the physics of gravity and pendulums
- show patience in experimenting
- show keenness for accuracy in results
- be willing to co-operate with others

Activities

a) Gravity

- Predict the ways in which the following things fall: a ball, a heavy weight, a light weight, rain.
- Study the work of Galileo Galilei (1564-1642) who performed a famous experiment, dropping two objects from the Tower of Pisa.
- Replicate his experiment. First predict whether a heavier or larger object, if dropped from a height, will fall to Earth faster than a lighter or smaller object. Use balls of different sizes, books, paper, cardboard etc. Do objects of different sizes and weights fall at the same rate of speed?
- Try comparing a sheet of paper with a ball of paper. Ask students to suggest why the sheet falls more slowly, (air resistance)
- Write a report explaining the results of the experiments and drawing conclusions regarding the effects of both gravity and air resistance on the speed of falling objects.
- Compare the difference in going uphill / upstairs with downhill / downstairs.
- Make your own weighing device from rubber bands. Measure weight by noting the extension of the bands supporting the object that is being pulled down by gravity.

Activities for 'centre of gravity'

- Discover centre of gravity by experimenting with:
  - mobiles
  - tower constructions
  - making model a see-saw
  - using a beam balance
- Use kitchen scales, bathroom scales and a beam balance.
- Set up see-saws, balancing objects on both ends.
- Move the fulcrum from the see-saw center to investigate how this influences results of above experiment.
- Experiment with cantilevers.
- Make miniature brick arches. Observe the function of the keystone in maintaining balance of forces.
- Examine photographs of ruins that show arches that have survived the centuries.
- Experiment with 'tug-of-war' games to examine balance of forces.
- Experiment with spinning tops.
- Play games with spinning tops. Try to knock opponent out of the circle.
- Play a balancing game, trying to balance on different body parts as directed, e.g. on one hand and one foot; on back or front with arms and legs off the ground.
- Balance bodies when blindfolded. Note effects of spinning, (dizziness).
- Walk while balancing a book on the head.

- Walk along a narrow beam.
- Relate the experience of walking along a narrow beam to the Biblical reference to the broad and narrow way.

b) Pendulums

One of Galileo's key experiments involved observing pendulums. Using a variety of different lengths and weights, he carefully noted each pendulum's period (the amount of time it takes for a pendulum to make one complete swing). Galileo's observations allowed him to determine that the period of a pendulum's swing is affected by its length but not its weight—an observation that may run counter to what students expect.

To begin the following activities, lead a class discussion about the fact that scientists cannot rely on intuition alone, but must perform experiments to test their hypotheses. Ask your students to replicate Galileo's pendulum experiments using varying lengths of string with different numbers of washers attached to the ends. Students should measure each pendulum's length, weight, and period, making sure that they keep the amplitude, or angle to which the pendulum is raised, consistent. When their observations are complete ask them to record their data in a chart.

Activities

- Free play with pendulums.
- Define a pendulum.
- Experiment using pendulums with the same mass bob but different lengths. Use the steps of the Scientific Method.
- Discuss applications of pendulums, e.g. clocks, demolition.
- Construct a giant pendulum several metres long. Students make predictions which can then be checked.
- Use pendulums of the same length, but attach a variety of different mass bobs. Use the same mass bob and the same length line, but vary angles of release. Does this affect the number of periods per unit time?
- Release pendulums from different heights and time the number of periods over 3 minutes. Does release height influence the number of periods?
- Release pendulum so that it follows different paths. Include a circular path. Does the path the bob follows influence the number of periods the pendulum swings through in 2 minutes?
- Graph results, infer from the graphs, test inferences.
- Set up a set of skittles and use the pendulum bob as the 'bowling ball'.
- Link pendulums together and explore the effect of releasing one pendulum on its partner.
- Discuss whether the evidence of design in the forces that control pendulums suggests the product of random forces, or God the designer.

Assessment: Students are to write a report on their experiments:

1. Describe what they did.
2. Record the results.
3. Illustrate and label diagrams.

Values education Year 5
God is Truth
Honesty

Honesty is…

- speaking the truth
- not cheating
- not stealing
- not exaggerating
- being trustworthy
- being yourself and not trying to be someone you are not.

Activities

1. Sometimes people think they are telling the truth by saying the right words, but the meaning of their words is not completely truthful. This is called a white lie. Here is an example:
   John is asked to clean his room. He goes to his room and pushes all the things on the floor under the bed. The room looks neat and tidy but really it isn't.
   Mum calls, "John, have you cleaned your room?"
   John answers, "Yes."
   Why would you say this is not telling the truth?

2. Why would you like your best friends to be honest?
3. Which of these are caused by dishonesty:
   a) shop-lifting (stealing)
   b) fighting
   c) swearing
   d) cheating in a test
   e) riding on a bus without a ticket

What does the Bible say about honesty?

Acts 5 Ananias and Sapphira
James 1:22 Be doers of the word and not hearers only.
Proverbs 8:7 My mouth shall speak truth.
Proverbs 12:17 When you tell the truth, justice is done.

Thinking Skills

Year 5 Truth

Gravity and pendulums 1 Invent a game that uses a beam balance. 	**Gravity and pendulums 2** To prove the theory of gravity, Galileo dropped a feather and a rock from the top of the tower of Pisa. What else could he have dropped to prove the theory?
Gravity and pendulums 3 Make an improvement to a playground swing so that it is not so dangerous. 	**Gravity and pendulums 4** Design a children's playground that is made up of equipment that relies on gravity.
Gravity and pendulums 5 Work out a sequence of 5 balancing exercises that do not use equipment. List the activities, e.g. balance on the left foot. 	**Gravity and pendulums 6** Invent a game that uses a pendulum to hit a target.

Practical Science 1: Gravity and Pendulums

Balancing Act (Gravity)

http://www.madaboutscience.com.au/store/index.php?main_page=page&id=20

Balance a can on its bottom rim and amaze your friends. Suitable for kids aged 6+

What you will need:

- 2 empty 375ml cans
- 100mls of water approx

What to do:

1. Pour about 100mls of water secretly into one can.
2. Have someone try to balance the other empty can on its bottom rim. It is impossible.
3. Then amaze them, by easily balancing your 'magic' can on its bottom rim (they don't need to know it has water in it).

How does it work?

It works because the water adds weight to the bottom of the can, changing its centre of gravity and allowing it to balance in impossible ways.

Practical Science 2: Gravity and Pendulums

Raw or Boiled Egg? (Gravity)

http://www.sciencekids.co.nz/experiments/eggboiledraw.html

Two eggs look and feel the same but there is a big difference, one is raw and the other hard boiled, find out which is which with this fun experiment.

What you'll need:
Two eggs, one hard boiled and one raw. Make sure the hard boiled egg has been in the fridge long enough to be the same temperature as the raw egg.

Instructions:

1. Spin the eggs and watch what happens, one egg should spin while the other wobbles.
2. You can also lightly touch each of the eggs while they are spinning, one should stop quickly while the other keeps moving after you have touched it.

What's happening?
The raw egg's centre of gravity changes as the white and yolk move around inside the shell, causing the wobbling motion. Even after you touch the shell it continues moving. This is because of inertia, the same type of force you feel when you change direction or stop suddenly in a car, your body wants to move one way while the car wants to do something different. Inertia causes the raw egg to spin even after you have stopped it, this contrasts with the solid white and yolk of the hardboiled egg, it responds much quicker if you touch it.

Practical Science 3: Gravity and Pendulums

Gravity as a pump – Make a siphon

Did you know that you can use the earth's gravity to help you pump water? This is very helpful if you have a flood!

What you will need:

- Approx 350 cm (10 feet) of transparent flexible tubing (2-4 cm in diameter (half inch)
- Kitchen sink
- Large bucket
- Food colouring
- Ladder or stack of books
- Chair

What to do

1. Coil the flexible tube and put it in your kitchen sink.
2. Put the plug in the sink, then start to fill the sink with water.
3. Put one end of the hose to the tap and the other end in the sink. Run the tap to get all the air out of the hose.
4. Put your thumbs over both ends of the hose, put one end in the sink and bring one end to the bucket on the floor.
5. Take your thumbs off and see what happens.
6. Let the water drain out of the sink completely.
7. Now repeat the experiment, this time draining the water from the bucket back into the sink.
8. Now put the bucket on a chair. Will your pump still work?
9. Now put the bucket even higher. e.g. on a ladder or a stack of books. How high does it have to be before the water will drain back into the sink?

Why does it work?

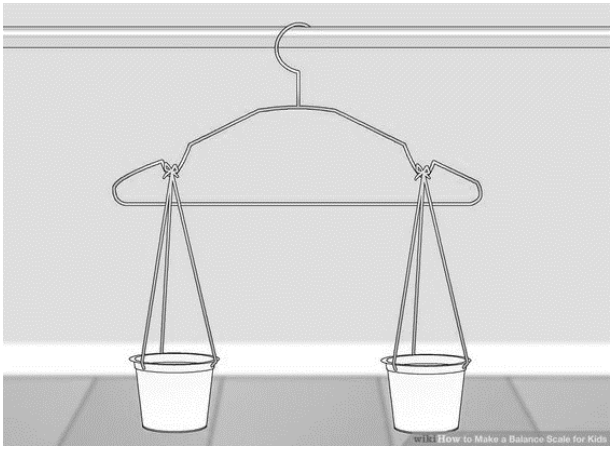
Why does the water drain out of the sink?

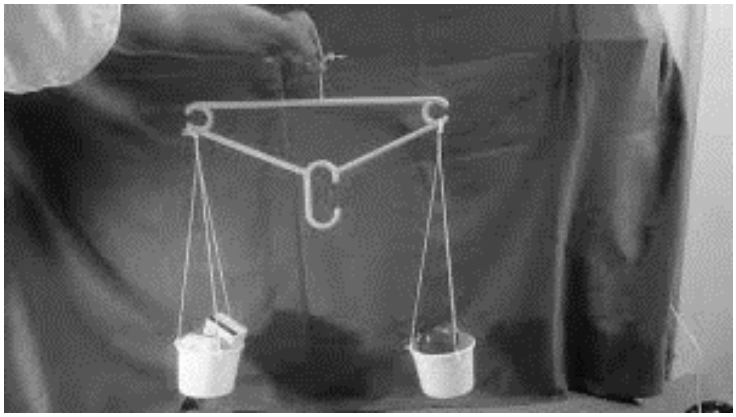
The water in the sink wants to come down seeing it is above ground level. This is due to the force of gravity.

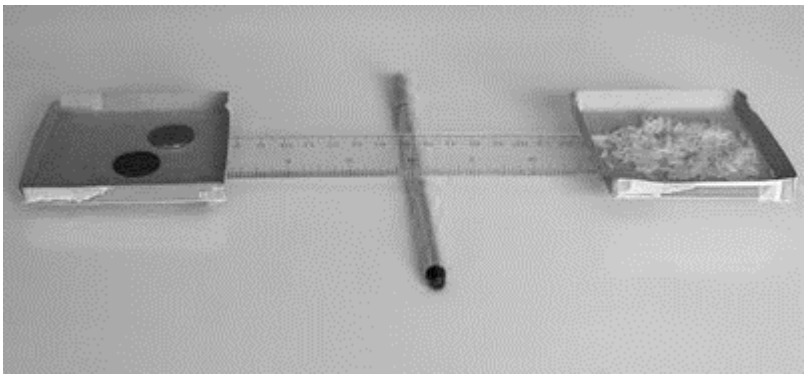
Practical Science 4: Gravity and pendulums

Build your own beam balance (balance scale)

*Live a life that **measures up** to the standard God set when He called you.*
Ephesians 4:1 (GNB) The Bible is our measure that we use to weigh up what we see and hear.







Practical Science 5: Pendulums

Build a pendulum

Follow these steps to build a pendulum:

1. Take a ball (the 'bob'), some string, a ruler, and strong sticky tape.
2. Place the ruler on a desk so that 10 cm (4 inches) of the ruler is on the desk and 20 cm (8 inches) extends over the side. Tape it to the desk.
3. Wrap one end of the string around the ball once. Wrap a piece of tape around the ball, covering the string. Put two pieces of tape where the string hangs off the ball.
4. Tie or tape the other end of the string around the ruler.

Now you are ready to do the experiment.

1. Set the pendulum in motion by pulling it up and letting it go.
2. Predict what will happen.
3. Observe how the pendulum swings back and forth (periods), and time how long it takes to stop. *(Note – one swing back and forth makes one period)*
4. Write your results.
5. Why you think it happened.
6. Now repeat the experiment using different lengths of string.
7. Record any differences in results.

	Prediction	**Results**	**Why do you think this happened?**
Pendulum 1			
Pendulum 2 (longer string)			
Pendulum 3 (shorter string)			

Practical Science 6: Pendulums

Bobs of different mass

1. Make a pendulum using the same length of string as the last one, but a bob of different mass. (The ball was the 'bob' in the first experiment.) e.g. You could use a marble, a bigger ball, a rock, a pebble
2. Predict what might happen.
3. Set the pendulum in motion and count the number of periods it completes until it stops. Write your results and why you think this happened.
4. Repeat the experiment using different bobs of different mass.

Type of bob	**Prediction**	**Results**	**Why do you think this happened?**

Practical Science 7: Pendulums

Pendulums can follow different paths

1. Take a pendulum that you have already made.
2. Release pendulum so that it follows a particular path, e.g. straight line, at a different angle or in a circular/oval path.
3. Count the number of periods the pendulum completes in 2 minutes.
4. Record your results.
5. Now repeat the experiment and set the pendulum swinging to follow a different path.
6. Examine your results to see whether the path followed affected the number of periods pendulum made in 2 minutes.
7. Explain why this happened.

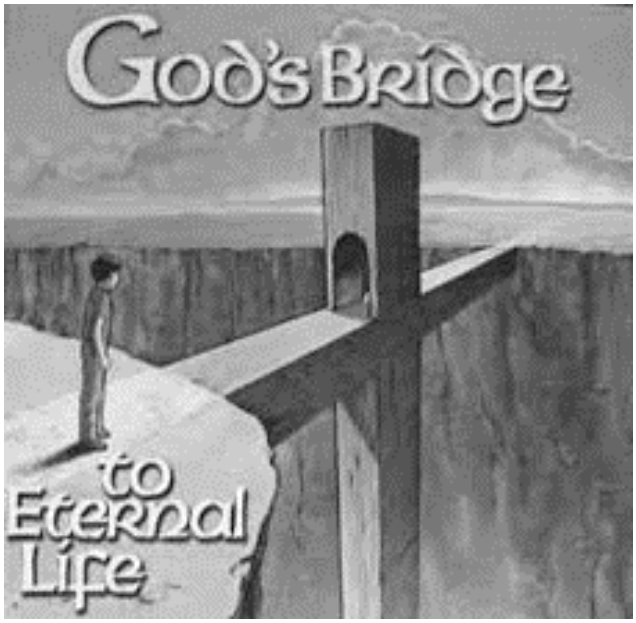
Type of path	**Prediction**	**Results**	**Why do you think this happened?**

Art Year 5

God is Truth

Pendulums and gravity

Biblical wall display: Jesus said, “I am the way, the truth and the life. No one comes to the Father except through me.”



Construction

Students can make 3D mobiles. They can find the centre of gravity of each piece to make the parts balance.