



Syllabus

Overview

The StemCo syllabus is inspired by the Singapore education curriculum. Singapore is known for its excellence in PISA tests for both Sciences and Mathematics for the last few years. Results from PISA indicate the quality and equity of learning outcomes attained around the world. By adopting the Singapore education curriculum as a reference, StemCo provides an opportunity for students globally to learn from one of the best practices of education in the world.

Our approach prioritizes understanding, application, and analysis of scientific and mathematical concepts over rote memorization of factual material. This shift in focus is intentional, recognizing the need for students to develop skills with long-term value in an increasingly technological world. Rather than concentrating on large volumes of factual information with limited short-term relevance, StemCo emphasizes critical thinking and practical application of learned concepts.

Categories

Category	International Grade Level	Singapore Grade Level Equivalent	Number of Questions (MCQ)	Exam Duration (Minutes)
Singa 1	1	Primary 1	20	60
Singa 2	2	Primary 2	20	60
Singa 3	3	Primary 3	20	60
Singa 4	4	Primary 4	20	60
Singa 5	5	Primary 5	30	90
Singa 6	6	Primary 6	30	90
Singa 7	7	Secondary 1	30	90
Singa 8	8	Secondary 2	30	90

Syllabus

The StemCo syllabus is designed to cover essential areas and concepts crucial for a holistic understanding of subjects. While it provides a general framework for the topics featured in StemCo competitions, it is not intended to be exhaustive or overly detailed. Our goal is to provide an opportunity for students that encourages deep comprehension and real-world problem-solving, preparing them for future success in dynamic and unpredictable environments.

The syllabus includes a category called "Others" for concepts that don't fit into the main topics. This section may include questions about recent advancements, trends, and discoveries related to the subject area, designed to be inspiring. Questions in this category can also be more advanced.



Singa 1

Areas	Concepts
Pets	Cats, Dogs, Hamsters, Fish, Birds
Colours	Red, Orange, Yellow, Green, Blue, Indigo, Violet
Weather	Sun, Clouds, Rain, Thunder, Lightning, Seasons
Snacks & Tidbits	Chocolate, Potato Chips, Ice Pops, Lollipops, Ice Cream, Candies & Sweets, Biscuits
Toys	Balloons, Plush Toys, Figurines, Building & Construction Sets, Vehicles, Lego
Others	...

Sample Questions:

1. Seasons

The days are short. The weather is cold. The leaves of the trees are yellow and orange.

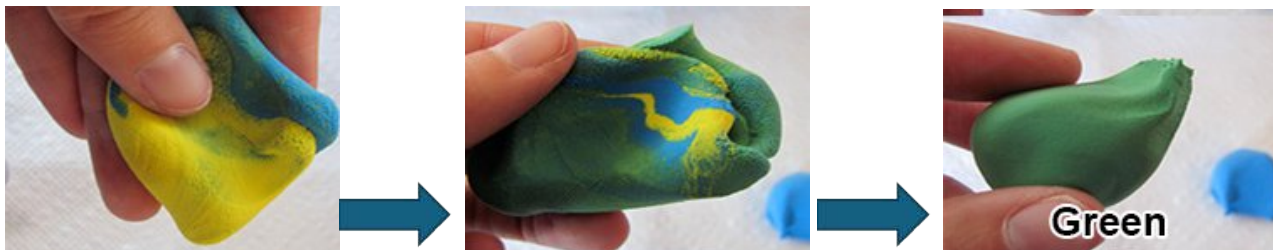
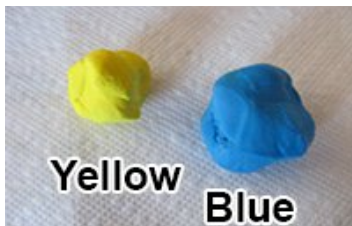


Which season of the year is it?

- (a) Spring
- (b) Summer
- (c) Autumn
- (d) Winter

2. Colours & Clay

Different colours can be produced by mixing clay of two different colours:



Bob was playing with three colours of coloured clay. In the end, Bob has two lumps of clay, one that is purple and one that is dark green. If:

- Yellow + Blue = Green
- Yellow + Red = Orange
- Blue + Red = Purple
- Orange + Green = Brown
- Yellow + Green = Light Green
- Green + Blue = Dark Green

Which three colours did Bob start with?

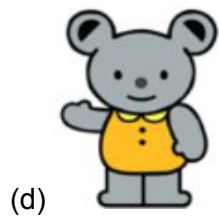
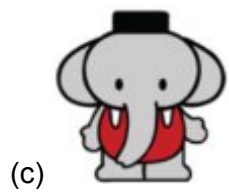
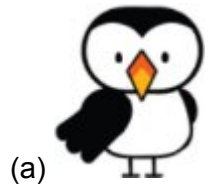
- (a) Blue, Red and Yellow
- (b) Yellow, Red and Green
- (c) Blue, Orange and Red
- (d) Orange, Green and Brown

3. Where is the Bird?

Birds are animals with beaks and wings.



Which animal in the above picture is the bird?



4. Bob's Toy Car

Bob has a remote-controlled toy car which can move on its own.



Bob removed the batteries in the car. What will happen to the car?

- (a) The car cannot move on its own anymore
- (b) The car still can move on its own, at a slower speed
- (c) The car still can move on its own, at a slower speed
- (d) The car still can move on its own, at the same speed



Singa 2

Areas	Concepts
Insects	Flies, Mosquitoes, Beetles, Butterflies, Cockroaches, Ants
Sports	Basketball, Volleyball, Badminton, Table Tennis, Squash, Tennis, Swimming, Track & Field
Park	Trees, Plants, Bushes, Flowers, BBQ Pits, Benches, Exercise Corners, Running & Cycling Tracks
Classroom	Pen, Pencil, Eraser, Ruler, Marker, Whiteboard, Duster, Books, Laser Projector, Computer, Desks & Chairs
Food & Dining	Food Pyramid, Grains, Vegetables, Fruits, Milk & Cheese, Meat, Cutlery (Spoon, Fork & Knife), Plates, Bowls, Cups
Others	...

Sample Questions

1. Juicy Fruit

Some food contains a lot of Juice in them, for example, Oranges:



Which other option shows a juicy fruit?



(a)



(b)



(c)



(d)

2. Camping Trip

Lionel is going for a camping trip with his school. He purchased a product as shown below:



What insect will that patch protect Lionel from?



(a)



(b)



(c)



(d)

3. Pencil Case

Jeremy has a pencil case:



What is the stationery circled in green?

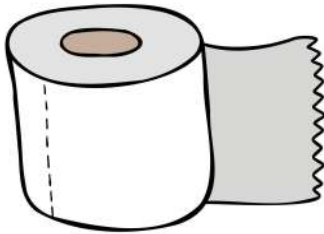
- (a) Scissors
- (b) Sharpener
- (c) Pencil
- (d) Ruler

4. Pooping in Toilet

Daniel has just finished pooping:



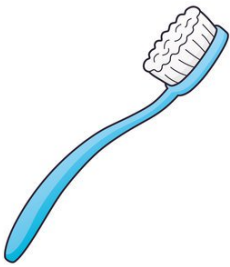
What should he use to clean his buttock after pooping?



(a)



(b)



(c)



(d)



Singa 3

Areas

Concepts

Living Things

Characteristics (Survival, Growth, Reproduction & Response to Environment) Animals (Amphibians, Birds, Fish, Insects, Mammals, Reptiles), Plants (Flowering & Non-Flowering), Fungi (Yeast, Mould, Mushroom), Bacteria

Materials

Wood, Metals, Ceramic, Rubber, Glass, Plastics, Fabrics (& Properties - Strength, Waterproof, Transparency, Ability to Sink/Float on Water, Flexibility)

Life Cycles

Stages in Animals (Chicken, Cockroach, Frog, Grasshopper, Beetle, Butterfly & Mosquito) & Plants (e.g., Seedling, Larvae, Pupae etc.)

Magnets

Poles, Attraction, Repulsion, Magnetic & Non-Magnetic Materials, Stroke & Electrical Method, Daily Applications

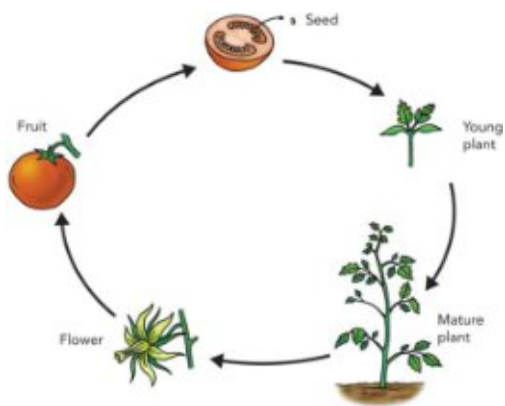
Others

...

Sample Questions

1. Plant Life-Cycle

The life cycle of plants has various stages.



The life cycle starts from a seed. After plants grow from a seed, they eventually bear flowers and fruits.

Which of these stages is the earliest stage in a plant's life cycle?



2. Ariel's Magnet

Ariel the little mermaid found a magnet in a treasure chest while swimming under the sea.



She noticed that the magnet can attract some metal objects, and would like to keep it to show her friends. However, she is also scared that the magnet will lose its strength before she can do so. Which of the following will **not** reduce the magnetism of her magnet?

- (a) Asking flounder (the yellow-blue fish in the picture) to carry it
- (b) Heating the magnet using an undersea fire
- (c) Hitting the magnet with an oyster shell under the sea
- (d) Throwing the magnet onto the seafloor repeatedly

3. Wooden Plate

For thousands of years, people have used wood to build houses, make furniture, tools, or even produce fuel.



Mark decided to make a wooden plate for the kitchen. His dad told him to cover the wood with wax before using it.



Why is it important to cover the wood with wax?

- (a) Wood absorbs water
- (b) Wood is flammable
- (c) Wood does not conduct electricity
- (d) Wood is fragile

4. Captain Jack Sparrow

Pirate Captain Jack Sparrow is currently stranded on an island due to a shipwreck.



What is something that Captain Jack Sparrow does not urgently need, in order to survive?

- (a) Food
- (b) Water
- (c) Air
- (d) Rum (a type of alcohol)



Singa 4

Areas

Concepts

Matter

Definition, 3 States (Solid, Liquid & Gas), Simple Apparatus for Measuring Mass & Volume

Human Systems

Identification & Stating the Functions of Circulatory, Respiratory, Skeletal & Muscular Systems

Digestive System

Identification & Simple Description of Functions (Mouth, Gullet, Stomach, Small Intestine & Large Intestine)

Plants

Identification & Simple Description of Functions of Leaf, Stem & Roots

Heat & Light

Factors affecting Shadows (Size, Shape & Position of Object; Distance from Light Source); Temperature, Heat Transfer, Heat Conductors & Insulators, Expansion, Contraction & Change in States of Matter

Others

...

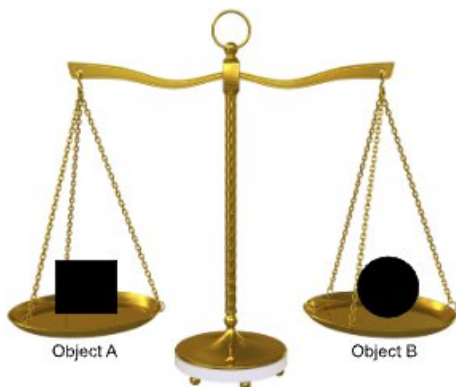
Sample Questions

1. Chinese Traditional Medicine

Mandy and her family were buying some herbs from the Eu Yan Sang Traditional Chinese Medicine Clinic in Singapore.



She noticed that the clinic assistant used an interesting measuring tool while preparing the herbs as shown:



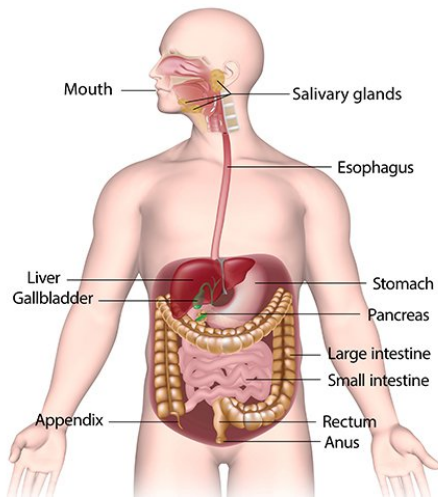
Which of the following statements can be inferred about the objects A and B that the clinic assistant is measuring, solely based on the above diagram?

- (a) They have equal masses
- (b) They will sink in water
- (c) They have the same shape
- (d) They are made of the same material

2. The Digestive System

Kate saw the following diagram about the digestive system, while walking past a tuition center:

The Digestive System



Which part of the digestive system in the above diagram mainly absorbs nutrients from digested food?

- (a) Small Intestine
- (b) Mouth
- (c) Large Intestine
- (d) Stomach

3. Shirts

The weather in Singapore is extremely hot and humid all year round. Ian is preparing to head out to meet his friends for lunch. He opens his wardrobe:



Ian hopes to wear a shirt that will make him feel least warm in Singapore. Which colored shirt should he choose?

- (a) White
- (b) Black
- (c) Purple
- (d) Brown

4. There are 2 main types of industries:

(i) Heavy industry:

- Produces heavy durable goods for other industries or governments, rather than people.
- Requires heavy machinery and powerful equipment



(ii) Light industry

- Produces smaller things for people's everyday use
- Smaller scale and require less energy input



In which option are all 3 factories examples of light industries?

- (a) Steel factory, Furniture factory, Shoe factory
- (b) Furniture factory, Chocolate factory, Toilet Paper factory
- (c) Oil refinery, Sugar factory, Clothing factory
- (d) Milk factory, Cement factory, Car factory



Singa 5

Areas	Concepts
Fertilisation	Plants (Self & Cross-Pollination, Germination, Seed Production & Dispersal - Wind/Insects etc.), Fungi (Spores), Humans (Ovaries - Eggs, Testes - Sperm & Passing on of Characteristics from Parents to Offspring)
Water	Freezing, Boiling, Melting, Evaporation (& Factors Affecting its Rate: Wind, Surface Area, Temperature), Condensation; Water Cycle, Importance for Life's Processes, Impacts of Pollution on Earth's Water Resources
Respiratory Systems	Basic Composition of Air (O_2 , CO_2 , N_2 , H_2O), Respiration in Plants (Leaf Stomata), Humans (Lungs - exclude Alveoli & Bronchioles; Nose & Windpipe) & Fish (Gills)
Circulatory Systems	Plants (Xylem, Phloem & Roots), Humans (Heart, Blood & Blood vessels in Transport of Nutrients, O_2 & CO_2 ,)
Electricity	Simple Electrical Circuits (Battery, Wires, Bulb, Switch), Current Flow, Electrical Conductors & Insulators
Others	...

Sample Questions

1. Mushrooms

Mushrooms are living things belonging to the family of fungi. They come in various shapes, sizes, and colors.

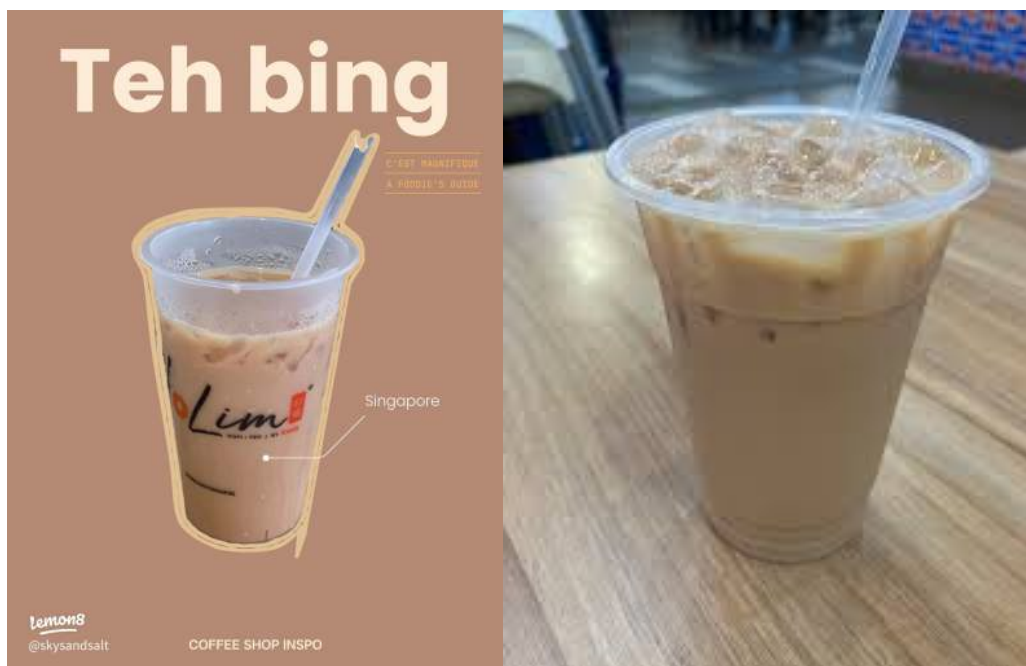


The family of fungi reproduce via a method known as spore dispersal. Which of the following methods is unlikely a medium, of which spores can be transported?

- (a) Wind
- (b) Insects and/or animals
- (c) Water
- (d) Sunlight

2. Teh Bing

Teh Bing (iced milk tea) is a popular drink commonly enjoyed by Singaporeans to cool off from the hot and humid weather in this island nation.



James had ordered a Teh Bing for his breakfast, but unfortunately forgot to drink it and rushed off to work in a haste. His brother, Jeff, wanted to play a prank on him, by trying to get as much Teh Bing evaporated off as possible while on the way to pass James the drink.

Which of the following does not help Jeff in increasing the evaporation rate of the Teh Bing?

- (a) Pour the Teh Bing into a cup with a wider mouth
- (b) Placing a fan (and allowing it to blow wind) onto the Teh Bing
- (c) Placing some dehumidifiers beside the Teh Bing
- (d) Adding more ice cubes into the Teh Bing

3. Singapore's Yellow Boxes

In Singapore, smoking is frowned upon due to its many negative effects on the person, as well as the community. As such, when you walk around Singapore's Central Business District (CBD), you will often find small yellow boxes lying around - these are the designated areas which are legal for people to smoke:



Smoking outside of those areas is banned and if caught, will incur a hefty fine from the police. The bottom shows a picture of a healthy (left) vs a smoker's lung (right), which is significantly darker/black:

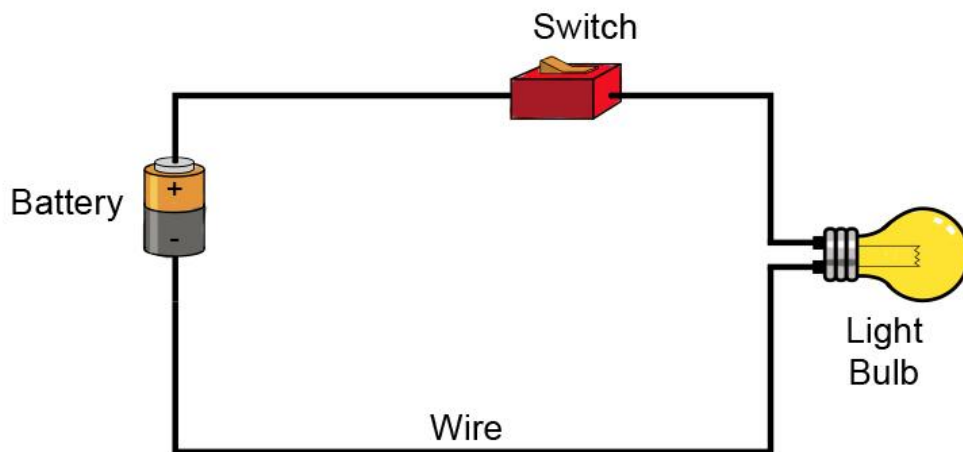


What substance in the cigarette is responsible for the "blackening" of the smoker's lungs?

- (a) Carbon monoxide
- (b) Tar
- (c) Nicotine
- (d) Formaldehyde

4. Simple Electrical Circuit

Below shows a simple electrical circuit:



Desmond, a 5th-grade science student decided that the light bulb is too dim, and would like to attempt ways to make it shine brighter.

Which of the following actions will allow Desmond to succeed in making the light bulb shine brighter?

- (a) Adding a 2nd identical light bulb to the circuit.
- (b) Toggling the switch from ON to OFF in the circuit.
- (c) Installing a 2nd battery to the setup.
- (d) Wrapping a piece of wool to the light bulb.



Singa 6

Areas	Concepts
Forces	Pushes, Pulls, Effects on Stationary & Moving Objects, Magnetic, Gravitational, Frictional (Rolling Objects Included) & Elastic Spring Forces
Energy	Kinetic, Potential, Light, Electrical, Sound, Heat (including Conversions between different Forms)
Survival	Characteristics (Temperature, Food, Water, Light etc.); Producers, Consumers, Decomposers; Adaptation Strategies in Plants & Animals (e.g., Camouflage, Move, Coping, Seed Dispersal etc.)
Environment	Organism (Producers, Consumers, Predators & Prey), Population, Community (Garden, Field, Pond, Seashore, Tree, Mangrove Swamp), Habitats; Food Chains & Web, Man's Impacts on the Environment
Energy	Kinetic, Potential, Light, Electrical, Sound, Heat (including Conversions between different Forms); Respiration & Photosynthesis (Requirements & Products)
Others	...

1. Tobias' Lesson

Tobias has learnt about “Energy” in his latest Science lesson. He drew a few diagrams to share the concept about energy conversion to his brother.



After putting in batteries, the torch lit up.



After eating breakfast, Tom ran to school.



After refuelling, Jane drove to work.



After replacing batteries, Alice's fan started spinning.

Which scenario does not show the conversion of chemical potential energy to kinetic energy?



(a)



(b)



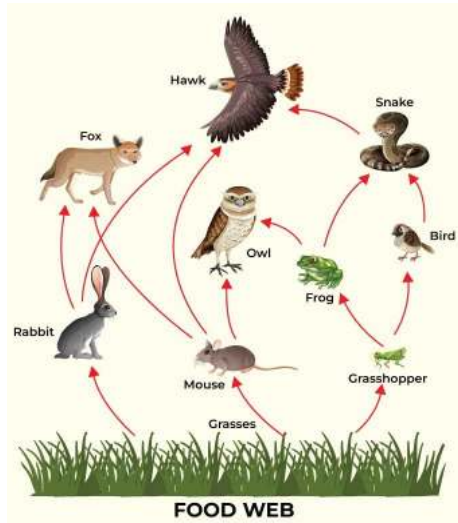
(c)



(d)

2. Survival Techniques

In a food web, energy and nutrients are transferred through an ecosystem when predators feed on prey.



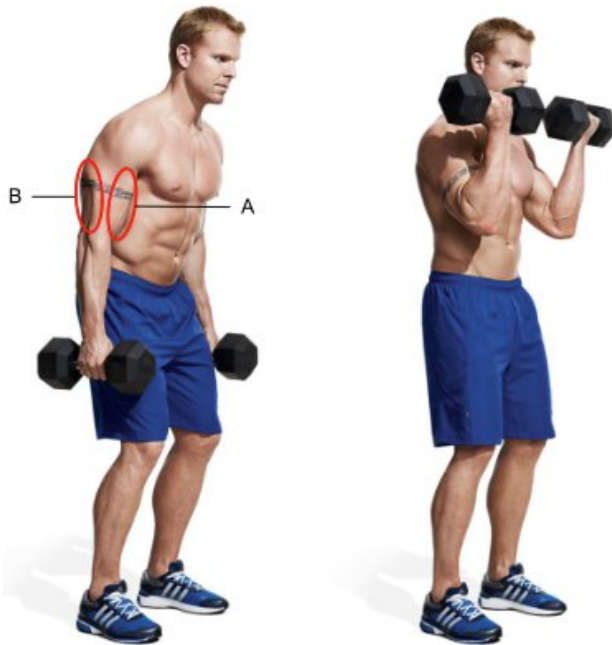
To prevent themselves from being eaten, 1 particular survival mechanism of certain prey is carrying toxins. These prey are often very colourful, which serves as a warning sign to ward off predators.

Which prey uses the above technique for survival?



3. Bicep Curls

Bobby is currently working out in the gym, doing bicep curls. This is an exercise where he pulls a pair of dumbbells, from the thigh to the shoulder position, as shown:



How are muscles A and B working together to help him transit from the left to the right position?

- (a) Muscle A contracts while Muscle B relaxes
- (b) Muscles A and B both contract
- (c) Muscle A relaxes while Muscle B contracts
- (d) Muscles A and B both relax

4. Bean Plants

Samuel placed 4 identical bean plants (which, you can assume all contain the same amount of Chlorophyll) in 4 different small greenhouses for 10 days.



Bean Plant	Light	Water	Carbon dioxide	Result after 10 days
1	Sunlight	Abundant	Abundant	Grew tall and produced new leaves
2	Darkness	Abundant	Abundant	?
3	Sunlight	Abundant	Scarce	?
4	Sunlight	Scarce	Abundant	?

Which of the following orders correctly reflects the health state of bean plants 2-4, from the least to most healthy?

- (a) $2 < 3 < 4$
- (b) $3 < 2 < 4$
- (c) $4 < 3 < 2$
- (d) $2 < 4 < 3$



Singa 7

Areas	Concepts
Experiment	S.I. Units, Accuracy & Precision, Index Notation; Zero, Parallax, Human & Measurement Errors, Estimation; Vernier Calipers & Micrometer Screw Gauge, Approximation
Materials	Electrical & Thermal Conductivity, Strength, Hardness, Flexibility & Density (including Calculations), Volume Displacement for Irregular Objects
Dynamics	Forces, Pressure (Solids & Liquids), Moment of a Force/Torque, Power, Work Done, Energy (& its Conservation), Heat (Conduction, Convection & Radiation; Effects on Density from Expansion & Contraction)
Cells	Functions & Identification via Microscope: Cell Wall, Cell Membrane, Cytoplasm, Vacuole, Nucleus, Chloroplast; Cell Division, Plant & Animal Cell Differences
Living Systems	Human Circulatory, Digestive & Sexual Reproductive Systems, Food & Water Transport Systems in Plants, Diffusion & Osmosis, Interactions in Ecosystems
Others	...

Sample Questions

1. Gravity

In 1687, Newton published his groundbreaking work "*Philosophiae Naturalis Principia Mathematica*," where he described the Principles of Gravity.



Gravity is a force that attracts objects with mass towards Earth:



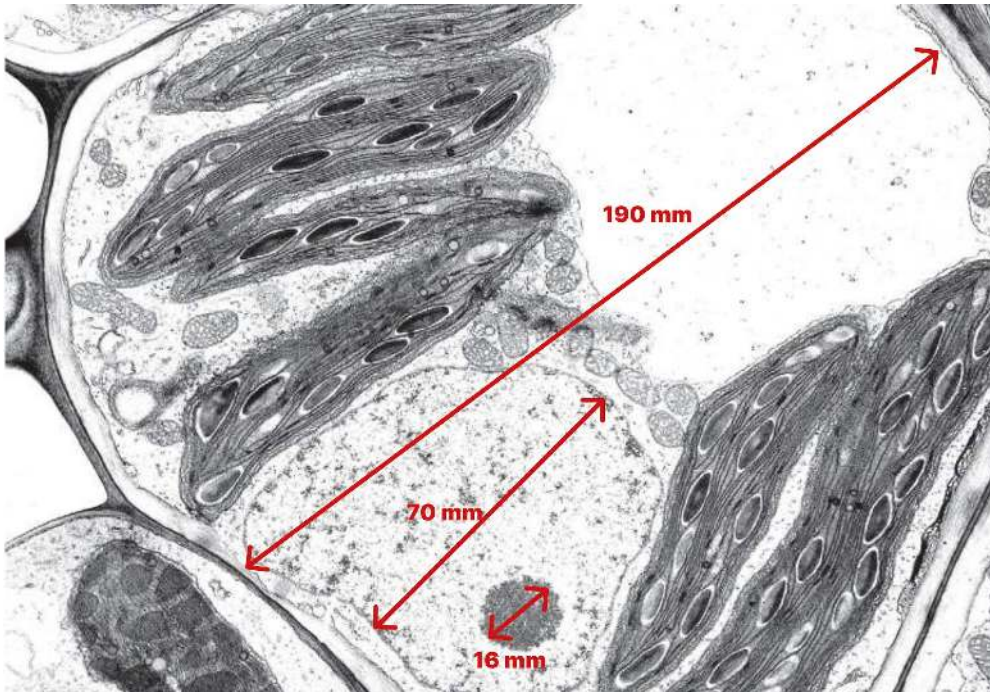
Which of the following is not an example of Gravity in action?

- (a) Magnet attracting iron nails
- (b) Pouring out a cup of coffee
- (c) Moon revolving around Earth
- (d) Dropping a pen onto the floor

2. Electron Microscope

A student was given an image of a cell taken using an electron microscope at a magnification of 5×10^3 . The student measured three different diameters marked on the image using a ruler.

The measured diameters of the three circular structures were 190 mm, 70 mm, and 16 mm.



What is the actual diameter of the nucleus?

- (a) $14\mu\text{m}$
- (b) $35\mu\text{m}$
- (c) $3\mu\text{m}$
- (d) $29\mu\text{m}$

3. Ketogenic Diet

The popular “Ketogenic Diet” claims to help with weight loss. However, many doctors advise caution due to the potential side effects and no concrete clinical evidence regarding the adherence to such a diet.

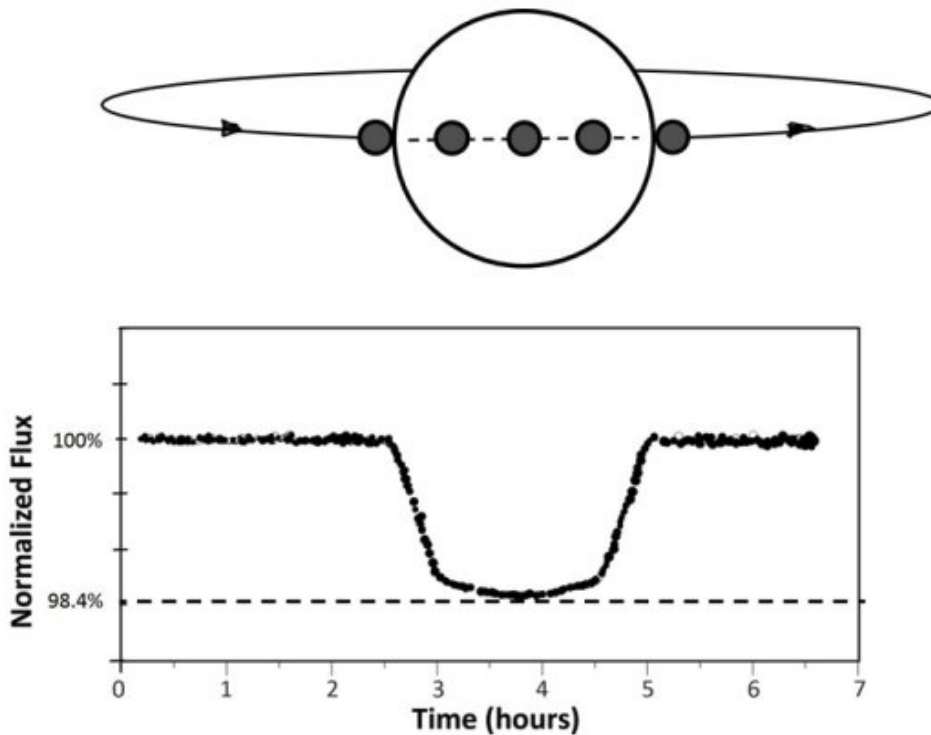


The Ketogenic Diet involves the consumption of food with high protein content and avoidance of carbohydrates. Which enzyme in our digestive system is responsible for breaking down proteins?

- (a) Lipase
- (b) Amylase
- (c) Protease
- (d) Bile

4. WASP-96b

The James Webb Space Telescope observed a clear and unambiguous signature of a planet orbiting a distant star, marking a significant milestone in the ongoing effort to discover and study potentially habitable exoplanets beyond our Solar System. On June 21, 2022, the Near-Infrared Imager and Slitless Spectrograph (NIRISS) recorded light from the planetary system consisting of the star WASP-96 and its companion planet, WASP-96b. As WASP-96b (shown in successive positions as a small gray circle) moved across the face of its host star (depicted as the large white circle), researchers analyzed the resulting data to construct a light curve (see figure below). This curve illustrates the temporary decrease in the star's observed brightness (flux) that occurs while the planet transits in front of it. The sizes of the star and planet in the diagram are not shown to scale.



Astronomers understand that the variation in observed flux during a planetary transit is proportional to the ratio of the planet's cross-sectional area to that of its host star. Using this relationship, what is the radius of planet WASP-96b expressed in units of the Sun's radius, knowing that $R(\text{WASP-96}) = 1.1R(\text{Sun})$?

- (a) $0.14R(\text{Sun})$
- (b) $0.125R(\text{Sun})$
- (c) $0.016R(\text{Sun})$
- (d) $0.018R(\text{Sun})$



Singa 8

Areas	Concepts
Experiment	Decanting, Filtration, Paper Chromatography, Evaporation, Magnetic Attraction, Simple Distillation, pH Probe & Indicator, Data Loggers
Analysis	Elements, Compounds, Mixtures (Solutions, Suspensions, Solutes, Solvents, Saturation), States of Matter (& Interconversion), Conservation of Mass
Matter	Atoms & Ions, Protons, Neutrons & Electrons, Chemical Formulae & Simple Reactions (Neutralisation, Thermal Decomposition, Oxidation & Combustion)
Light	Angle of Incidence, Reflection, Refraction (Snell's Law & Refractive Index: Physics Grades 9-10), Critical Angle & Total Internal Reflection, White Light Dispersion (via Prism)
Electricity	Direct Current, Resistance, Potential Difference, Ammeters, Voltmeters, Series & Parallel Circuits, Circuit Breakers, Household Electrical Costs
Others	...

Sample Questions

1. A Salted Calamansi Drink

A salted calamansi drink is a refreshing and highly popular drink in Singapore to cool off from the hot and humid weather. It consists of sour lime juice (contains citric acid), sugar and a pinch of table salt (NaCl).

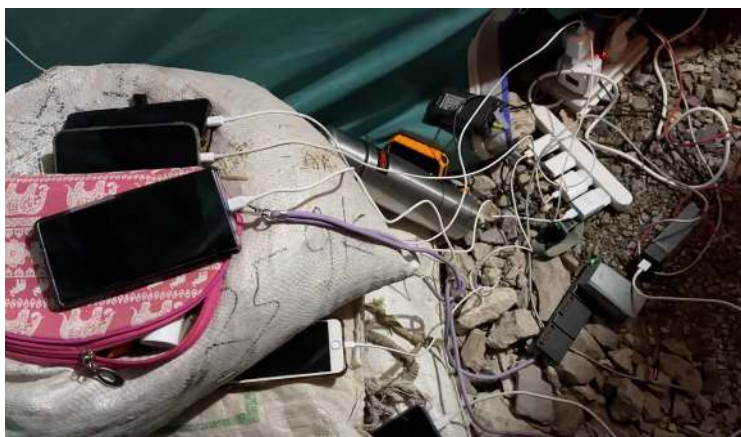


Which of the following cannot be found in a cup of salted calamansi drink?

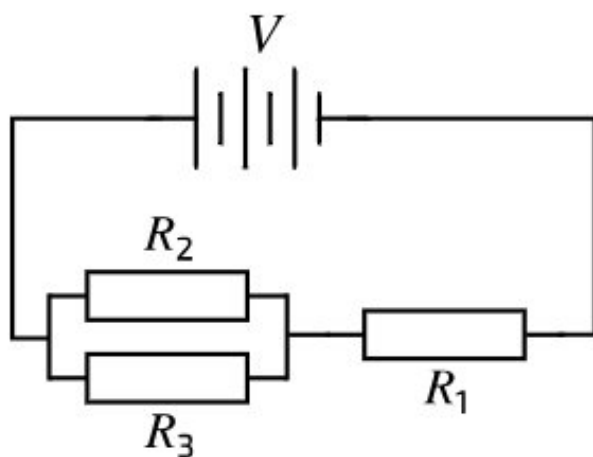
- (a) Sodium (Na) atoms
- (b) Hydrogen (H^+) ions
- (c) Chloride (Cl^-) ions
- (d) Sugar Molecules

2. Portable Power Generator

During long-distance hiking tours, trekking companies will usually bring a portable electrical power generator to allow guests to charge their phones and power banks while resting at night:



This is akin to connecting resistors in series and/or parallel to a power source. For simplicity, let's simplify the above complicated mess to:



Given that:

- The power source, V , has a voltage of 12V
- Phone R_1 has a resistance of 5Ω
- Phone R_2 has a resistance of 8Ω
- Phone R_3 has a resistance of 10Ω

What is the total current in the circuit?

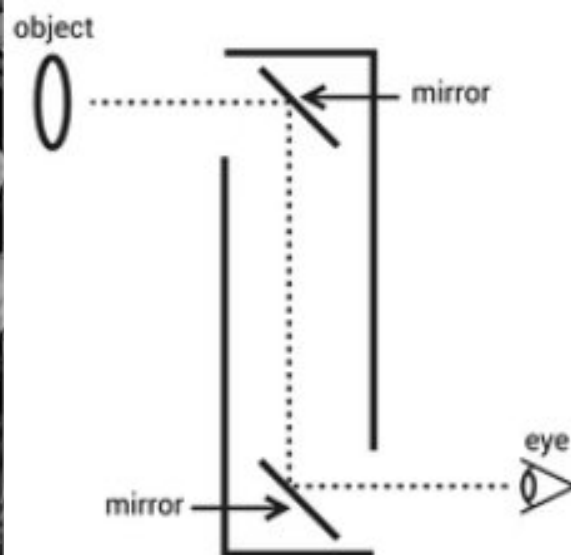
- (a) 0.52A
- (b) 1.44A
- (c) 2.30A
- (d) 1.27A

3. Hunters of the Deep

During World War II, submarines had to stay hidden and avoid detection from enemy destroyers. As a result, they were mostly submerged underwater.



In order to attack the opponents' fleet (via firing of torpedoes), they had to use a periscope to locate and target enemy vessels:



The rightmost diagram shows how light travels in the periscope, in order to allow the submarine crew to spy on vessels on the surface. What phenomenon of light is occurring inside the periscope?

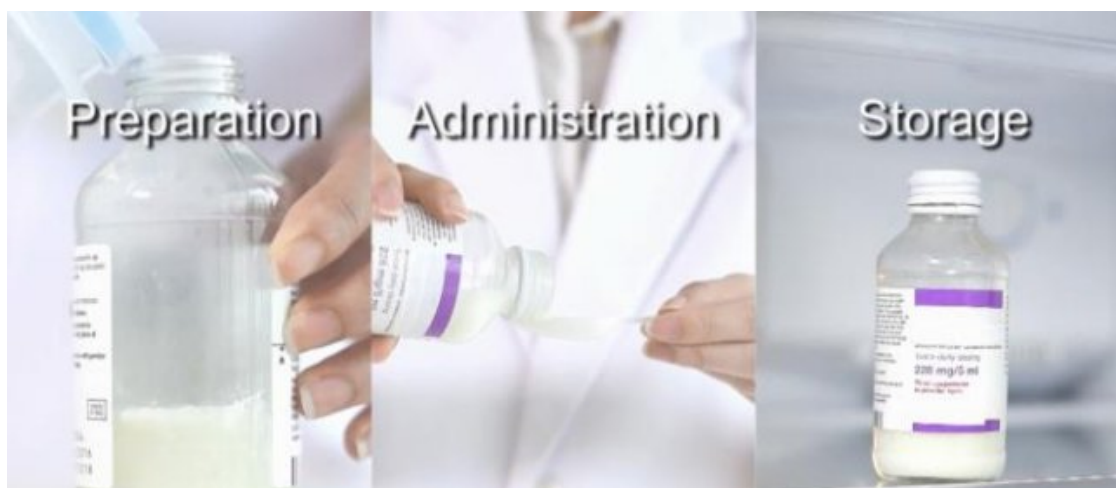
- (a) Reflection
- (b) Refraction
- (c) Diffraction
- (d) Total Internal Reflection

4. Augmentin 228mg/5ml Syrup for Children

Augmentin 228 mg/5ml (70 ml) is a common antibiotic medication consisting of Amoxicillin and Potassium Clavulanate. It can be used to treat common infections in children e.g., otitis media or sinusitis.



To prepare the medication, parents have to add in 70ml of water to the powder provided and leave it in the fridge. When it is time to administer the medication, they will need to first shake the bottle thoroughly until the powder is properly dispersed in the liquid, before feeding their child the medication. This medication can only be stored for 1 week.



An eccentric parent suddenly decided that she did not want to feed her child the antibiotic after she added 70 ml of water to the powder, and would like to return to the Pharmacy for a refund. Which of the following is the most efficient method for her to re-obtain the original Augmentin powder to seek a refund from the Pharmacy?

- (a) Decanting
- (b) Chromatography
- (c) Filtration
- (d) Simple Distillation