Essential Concepts

FOREWORD

Dear all,

We hope you, your family and friends are keeping safe during these challenging and unprecedented times.

The education world got utterly changed in 2020 and it continues in 2021! Students, parents, teachers and school leaders have all been impacted due to the COVID-19 pandemic and each one has had to adapt themselves to the needs of the changing environment. Whether it be teachers adopting technology in their everyday teaching, or school leaders managing the expectations of parents with students learning from home, we are experiencing unprecedented challenges. For many educators, the disruptions caused by this pandemic have raised some important questions, like – "Are our students learning?", "How well are they learning?, "How best can we help and support our students?", "How can we couple assessments and learning tightly to achieve the desired outcomes?", "How do we best integrate in-person and remote learning?", "Are we completing the syllabus in the time available?", "Are there other efficient ways to ensure we are completing syllabi in a way that the learning loss is minimised?".

These are all valid concerns and we truly empathise with the feelings of teachers, parents, students and school leaders. Our efforts in the past year and even now continue not only to closely support teachers in this transitional phase of shifting from classroom to blended learning, but also to create solutions and resources that can help them bridge learning gaps, thereby ensuring minimum learning loss due to the pandemic.

Teachers have proved to be the real heroes in the current COVID-19 pandemic situation. They have been quick to learn, adapt and use technology to facilitate online learning, while staying true to their focus on student learning. In order to support them in their endeavour, CBSE along with Educational Initiatives (EI) has put together a list of Essential Concepts in English, Mathematics and Science for classes 1 to 10. The objective of these Essential Concepts is to help prioritise key ideas and distil the ones that are most important for a given topic so that teachers' time is focused on ensuring that students don't miss out on these essential concepts. Given the limited time available for teaching, these Essential Concepts are a must and should be emphasised in order to minimise the learning loss.

We hope these *Essential Concepts* will support teachers in focusing on what is non-negotiable, so that the time available to them for teaching is spent effectively towards improving student learning outcomes.

Regards,

Manoj Ahuja, IAS
Chairman, CBSE

ACKNOWLEDGEMENT

Contents

Ensuring Minimal Learning Loss Due to School Shutdowns Using Essential Concepts
Helping minimise learning losses due to reduced teaching time

The COVID-19 pandemic has changed the way teachers teach and students learn. While on the technology front it has left teachers with many different things to learn and adapt to, on the academic side it has left them with less time to complete the curriculum. One of the priorities listed in the National Education Policy, 2020 is '*Reduce curriculum content to enhance essential learning and critical thinking*'. It states that in order to give the desired priority to critical thinking and more holistic learning, the curriculum across subjects will be reduced to cover the 'core essentials'. These mandated essentials will focus on key concepts, ideas, application and problem-solving. This, we believe, is a much needed, bold step towards strengthening our education system.

Given the paradigm shift in the education sector due to the COVID-19 pandemic, and the recent proposals made in the new policy, which may result in reduced syllabus, our teachers will most likely face the challenge of ensuring 'real understanding' of concepts in a reduced time frame. A sharp focus on core learning and enduring understanding has never before been this crucial to ensure effective learning.

EI has always emphasised the need for conceptual clarity and learning with understanding. We use a framework to design our learning and assessment offerings that places emphasis on core learning. While there are always multiple learning goals, every discipline has some big ideas which form the basis for learning other important ideas and skills. These fall under the category of 'core learning' which is the most important part of learning. The other important ideas and skills form what we call 'supporting learning'. And finally, there are facts that are part of a learning unit but may not be very important, which we call 'peripheral learning'. Using this framework, in order to help teachers in prioritisation of key ideas, which becomes even more relevant in the current scenario where the time to teach a concept is limited, we have come up with a list of **Essential Concepts**.

For example, if we take the topic of *Heat*, there may be many different things the curriculum may cover – from the definition of heat to the understanding of what heat is and how it transfers, from units to measure temperature to the different types of thermometers, from the boiling point of water to the temperature of the sun. While the textbook is written to make it comprehensive from a topic coverage perspective, it is left to the teacher to decide upon the core ideas that the students *must* understand, and without which building further understanding may not be possible. These ideas are seldom explicitly stated for the teachers, and so depending on the teacher's experience, expertise, comfort with the topic and proportionate discretion, certain ideas may get selected for teaching. Sometimes, while the key ideas may get selected, they may not get prioritised well and may at times get missed out or be given insufficient time.

It is okay, in times like a pandemic, for students to lose peripheral learning. However, we need to be diligent to ensure that they are not losing out on core learning. We hope that teachers will be able to refer to this list of concepts while making their lesson plans, in order to ensure that these essential concepts are covered and given sufficient time during teaching.

Pranav Kothari,
Chief Executive Officer,
Educational Initiatives

About Essential Concepts

Essential Concepts are the building blocks of learning a given topic. If they are not put in place at the right stage, it may hamper the development of associated and further concepts.

Fundamental
Essential Concepts are concepts that are critical to be learnt and understood, and which support the learning of other concepts.

Effective
Essential Concepts, if understood, can help in facilitating enduring learning which can be useful throughout one's lifetime

Curriculum-aligned
Essential Concepts are identified by studying different curricula, and are aligned to what is expected by different grade levels.

Using the document

Indicates the grade

Indicates the subject

Indicates the topic

Indicates the essential concepts in the topic

Indicates some example of what can be skipped

Indicates an example of a question worth testing

Grade 9

Essential Concepts | Mathematics

Real Numbers
- Identifying if a number is irrational
- Finding irrational numbers between two real numbers
- Representing irrational numbers on a number line
- Estimating or approximating the value of an irrational number
- Rationalising the denominator of an expression containing irrational terms

Algebra
- Identifying the zeroes of a polynomial
- Applying reminder theorem and factor theorem on polynomials
- Applying algebraic identities in factorisation of polynomials
- Identifying if given values are the solutions of linear equation(s) in two variables
- Plotting graphs of linear equation(s) in two variables
- Modelling a mathematical or a real life situation using linear equation(s) in two variables

Geometry
- Plotting and identifying points in the coordinate system
- Applying the properties of angles formed by a transversal along with other mathematical and geometrical concepts
- Applying the properties of sides and angles in a triangle
- Identifying and applying different criteria to test the congruency of triangles
- Knowing and applying the suﬃcient conditions for a parallelogram to be a square, rectangle or a rhombus
- Applying the properties of chords of a circle
- Applying the properties of cyclic quadrilaterals

Mensuration
- Finding the area of triangles when all the side lengths are given (by applying Heron's formula)
- Applying the volume and surface area of a cube, cuboid and cylinder in mathematical and real life situations

Statistics and Probability
- Constructing and interpreting histograms
- Finding probability of a simple event empirically

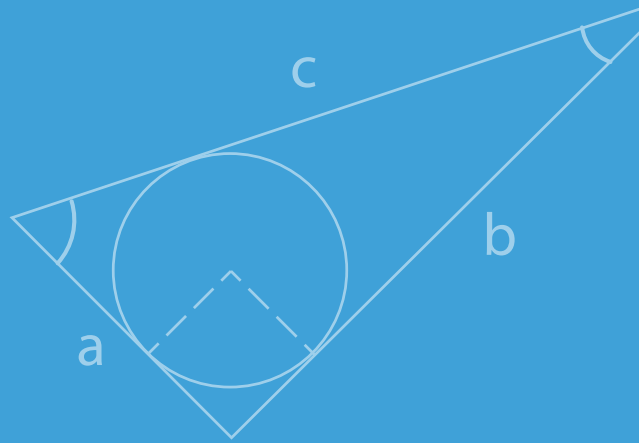**Few examples of what can be skipped in interest of time:**
- Simplifying expressions containing irrational numbers
- Applying properties of quadrilaterals along with other geometrical concepts
- Construction of bisectors and triangles
- Applying the volume and surface area of a sphere and cone in mathematical and real life situations
- Applying the mean, median and mode of ungrouped data

Are students learning with understanding? Try asking them this question.

p is a number such that p × p is less than p. Between which of these pairs of numbers could p lie?
A. -10 and 1
B. -1 and 0
C. 0 and 1
D. (It is not possible that p × p is less than p.)

16415 students attempted this question. Only around 22% students selected the correct answer, option C. 52% students selected option D, indicating that they have a misconception that a number multiplied by itself will always be bigger than p and either don't understand or are ignoring what happens in case of squaring numbers lying between 0 and 1.
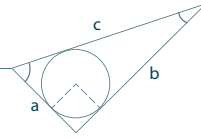
MATHEMATICS

Grade 1

Essential Concepts | Mathematics

Number Concepts

- Count objects up to 20 using 1-1 correspondence between objects and number names.
- Identify or write any number up to 100 as a numeral upon hearing its number name.
- Fluently recognising the number given as numeral (upto 100).
- Write a quantity (number of objects) less than 100 grouped in 10's and 1's as a number.
- Find missing number(s) between given numbers, identify a number after for numbers up to 99.
- Compare and order numbers upto 99.

Whole Number operations

- Add single-digit numbers with sum upto 10.
- Add single-digit numbers with sum upto 18.
- Subtract numbers within 20 accurately.

Basic shapes and Spatial reasoning

- Identify basic shapes (a rectangle, a triangle, a square, and a circle) by their visuals.
- Identify identical shapes (same shape but in different orientations).

Measurement

- Compare lengths of objects/shapes.
- Measure lengths by iterating non-standard length units.
- Compare duration of events.

Few examples of what can be skipped in interest of time:

- Money measurement
- Weight measurement
- Data handling
- Patterns in shapes

Are students learning with understanding? Try asking them this question.

A rabbit jumps on the number blocks as shown below.

What number will come in the place having '?' symbol

A. 4
B. 6
C. 7
D. 8

The question tests if students can identify the pattern and the missing number in it. One of the most common mistakes that we have found in this question is that students are unable to see the pattern and just look at the immediate previous number and answer based on what comes next. So in this case, they would answer 6.

Grade 2
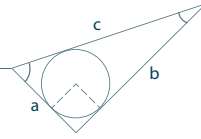
Essential Concepts | Mathematics

Number Concepts
- Recognize a number from the given number words or quantities and vice versa for numbers upto 100.
- Fluently recognising the number given as numeral (upto 100).
- Write a quantity (number of objects) less than 100 grouped in 10's and 1's as a number.
- Find missing number(s) between given numbers, identify a number after for numbers up to 99.
- Compare and order numbers upto 99.
- Form a number less than 100 using given digits as per the given condition (the smallest number, the largest number, etc.).
- Recognize number patterns (simple arithmetic progressions) involving skip counting in 10s,5s and 2s with numbers up to 100.

Whole Number operations
- Add single-digit numbers accurately.
- Add single-digit numbers fluently (accurately with speed).
- Subtract numbers within 20 accurately.
- Subtract numbers within 20 (reverse single-digit addition facts) fluently.
- Adding 0 to a number within 10 and vice versa.
- Addition of 2-digit numbers with sum up to 100 without and with regrouping (vertical and horizontal format).
- Subtracting 0 from a number within 10.
- Subtraction of 2-digit numbers within 100 vertically without and with regrouping.
- Apply addition or subtraction within 100 in result unknown problems.
- Apply addition of single-digit facts or related subtraction facts in change unknown problems.

Basic shapes and Spatial reasoning
- Identify basic shapes (a rectangle, a triangle, a square, and a circle) from a collection.
- Identify congruent shapes (same shape but in different orientations).

Measurement
- Compare lengths of objects/shapes.
- Measure lengths by iterating uniform length units.
- Compare weights.
- Compare capacities of containers or amounts of solid/liquid in containers.
- Compare duration of events.

Few examples of what can be skipped in interest of time:
- Estimate the result of addition and subtraction
- Money measurement
- Data handling
- Patterns in shapes

Are students learning with understanding? Try asking them this question.

Sheela has 3 pencils. She would like to have 7 pencils.

How many more pencils does she have to get?
Answer: _____

The given word problem is of a 'change unknown' type, where students need to identify what when added to a certain number gives the desired result. It is important to give exposure to students to variety of word problems and this is one of the important ones. Many students are found to simply add the two given numbers, without understanding what the question is asking. For eg. they would answer 10 thinking it is 3 + 7 instead of 4 (3+4=7).

Grade 3
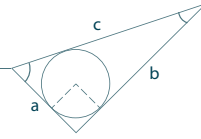
Essential Concepts | Mathematics

Number Concepts
- Recognize a number from the given number words or quantities and vice versa up to 1000.
- Fluently recognising the number given as numeral up to 1000.
- Compare and order numbers upto 999.
- Form a number less than 1000 using given digits as per the given condition (the smallest number, the largest number, etc.).
- Recognize number patterns (simple arithmetic progressions) involving skip counting in 10s,5s, 2s, 3s and 4s with numbers up to 100.

Addition and Subtraction of Whole Numbers
- Add single-digit numbers fluently (accurately with speed).
- Subtract numbers within 20 (reverse single-digit addition facts) fluently.
- Addition of numbers with sum up to 1000 without and with regrouping (vertical and horizontal format).
- Subtraction of numbers within 1000 vertically without and with regrouping.
- Apply addition or subtraction within 100 in result unknown problems.
- Apply addition of single-digit facts or related subtraction facts in change unknown problems.
- Apply addition of single-digit facts or related subtraction facts in start unknown problems.

Multiplication and Division of Whole Numbers
- Recalling multiplication facts (Multiplication tables up to 10) fluently.
- Multiplication of 2-digit and 1-digit numbers using a standard algorithm.
- Divide within 100 by applying division facts or related multiplication facts.
- Apply multiplication facts or related division facts in problems involving equal groups.

Basic shapes and Spatial reasoning
- Identify basic shapes (rectangle, triangle, square and circle) based on their properties including shapes in unfamiliar orientations.
- Identify congruent shapes (same shape but in different orientations).
- Identify a composite shape formed using given tiles and vice versa.
- Recognize a repeating pattern in shapes, objects or letters and complete it.

Measurement
- Knowing (sense of) how much length is 1 centimeter, 1 metre and 1 kilometre.
- Measure lengths in standard units.
- Read time from an analog clock and a digital clock.
- Measure weight using simple balance in standard and non-standard units.
- Using money in day to-day transactions.

Few examples of what can be skipped in interest of time:
- Intuitive understanding of maps, 3D solids, tiling and patterns etc.
- Measurement of capacity
- Data handling

Are students learning with understanding? Try asking them this question.

$$\begin{array}{r} \square \\ -52 \\ \hline 45 \end{array}$$

What number should be put in the empty box to get the subtraction correct?
A. 7
B. 13
C. 93
D. 97

11136 students attempted this question. Only 50% students selected the correct answer, option D. Around 32% students selected option A, most probably by subtracting 45 from 52 instead of understanding that 45 is the result of subtracting 52 from the missing number.

Grade 4
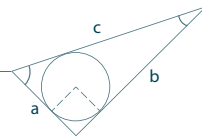
Essential Concepts | Mathematics

Number Concepts
- Form a number less than 1000 using given digits as per the given condition (the smallest number, the largest number, etc.).
- Recognize number patterns (simple arithmetic progressions) involving skip counting in 10s,5s, 2s, 3s and 4s with numbers up to 100.

Addition and Subtraction of Whole Numbers
- Addition of numbers with sum up to 1000 without and with regrouping (vertical and horizontal format).
- Subtraction of numbers within 1000 vertically without and with regrouping.
- Apply addition or subtraction within 1000 in result unknown problems.
- Apply addition or subtraction within 100 in change unknown problems and start unknown problems.

Multiplication and Division of Whole Numbers
- Multiplication of two 2-digit numbers using a standard algorithm.
- Divide a 2-digit number by a single-digit using long division or such algorithms.
- Divide a 3-digit number by a single-digit using long division or such algorithms.
- Apply multiplication facts or related division facts in problems involving equal groups.

Basic shapes and Spatial reasoning
- Identify basic shapes (rectangle, triangle, square and circle) based on their properties including non-stereotypes.
- Identify congruent shapes (same shape but in different orientations).
- Identify a composite shape formed using given tiles and vice versa.
- Recognize a repeating pattern in shapes, objects or letters and complete it.

Fractions
- Recognize and represent halves and quarters of a shape or an object.
- Recognize and represent halves and quarters in a collection.

Measurement
- Applications of length, weight and capacity in real life.
- Using money in day to-day transactions.
- Find time elapses of an event(s) in real life situations.

Few examples of what can be skipped in interest of time:
- Intuitive understanding of area/views of 3D solids/symmetry and reflection
- Estimation of the result of operations
- Computing number of days between days
- Estimating length, weight and capacity
- Interpreting bar graphs

Are students learning with understanding? Try asking them this question.
What fraction of the apples is green?
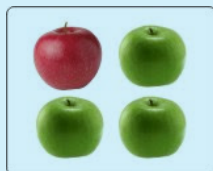
A. 1/4
B. 1/3
C. 3/4
D. 3

27612 students attempted this question. 40% students selected the correct answer, option C. 29% students selected option B; they don't seem to understand what fraction represents and think that since there is 1 red and 3 green apples, the fraction is 1/3. Around 21% students selected option A; they seem to have missed that the question is talking about the fraction of green apples and not red apples.

Grade 5
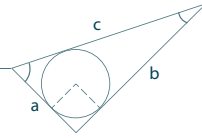
Essential Concepts | Mathematics

Whole Number Concepts
- Recognising and comparing large numbers (upto 4-digits) using place value concepts.
- Estimating position of a number up to 1000 on a number line with just endpoints and key benchmarks given.
- Recognising patterns in numbers.

Whole Number Operations
- Applying place value understanding in addition, subtraction and multiplication algorithms.
- Divide a 3-digit number by a 2-digit using long division or such algorithms.
- Applying operations on whole numbers in real-life situations.

Factors and Multiples
- Finding factors and multiples (using basic multiplication and division facts).

Fractions and Decimal fractions
- Recognising and representing unit fractions and proper fractions in shapes, objects, collection and shares.
- Identifying and applying relationship between half, quarter, 3-quarters and whole unit 1.
- Comparing fractions with same numerator or denominator by reasoning about their sizes.
- Recognising and generating equivalent fractions for simple fractions – ¼, ½ and ¾.
- Using decimal fractions in measurement (length, weight and money).

Geometry
- Recognising angles as a measure of turn and comparing angles visually.
- Classifying angles as right angle, less than or greater than right angle.
- Visual Estimation of Angles.

Mensuration
- Applying the concept of area as the amount of space covered (using square grid, tiling etc.).
- Applications of money, length, weight and capacity in real life.
- Finding the length of boundary (perimeter) of polygons using the side lengths.

Few examples of what can be skipped in interest of time:
- Intuitive understanding of reflection and rotation in 2D shapes
- Symmetry in 3D shapes and nets of 3D shapes
- Estimate the degree of closeness of fractions to known fractions like ½ and ¼
- Express a given fraction into decimal Intuitive understanding of volume

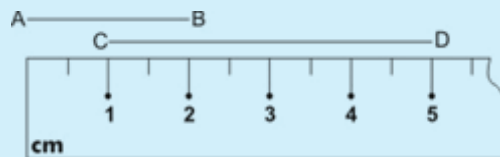### Are students learning with understanding? Try asking them this question.

By how much is line CD longer than line AB?

A. 2 cm
B. 3 cm
C. 4 cm
D. 5 cm

8342 students attempted this questions. Around 26% students selected the correct answer, option A. Almost 32% students selected option B, indicating the common error that when measuring length, count the individual points instead of distance between two points (in this case, they think length of line AB is 2 cm as there are two points, point 1 and point 2; and length of line CD is 4 cm as there are four points, point 1, point 2, point 3 and point 4.).

Grade 6
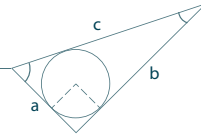
Essential Concepts | Mathematics

Whole Number Concepts
- Recognising and comparing large numbers (5-digits and above) using place value concepts.
- Representing whole numbers on a number line.
- Recognising patterns in numbers.

Whole Number Operations
- Estimation of operations (Four arithmetic operations) using large numbers.
- Applying operations on large numbers in real life situations.
- Applying properties of operations in simplifying calculations.

Factors and Multiples
- Applying divisibility rules.
- Finding common factors and common multiples.
- Identifying if a given number is prime or composite.
- Expressing a number as a product of its prime factors.
- Finding the HCF and LCM and applying it in real life situations.

Integers
- Representing quantities in real life situations using both positive and negative integers.
- Representing integers on a number line.
- Comparing and ordering integers.
- Adding and subtracting integers (using manipulatives and solving abstract problems).

Fractions
- Recognising and representing unit fractions and proper fractions in shapes, objects, collection and shares.
- Recognising and representing fractions greater than 1.
- Representing fractions on a number line
- Recognising and generating equivalent fractions of a fraction.
- Adding and subtracting proper fractions.

Decimal Fractions
- Express a decimal fraction in the numeral form in its equivalent expanded form based on place value of digits and vice versa.
- Representing a number in the fraction form as a decimal fraction and vice-versa.
- Representing a decimal fraction on a number line.
- Comparing and ordering decimal fractions.
- Adding and subtracting decimal fractions and applying both operations in real life.

Ratio and Proportion
- Expressing and interpreting the ratio relationship between quantities in different forms.
- Identifying if the quantities (or numbers) are in the same ratio and/or generating equivalent ratios.
- Applying proportional reasoning (ratio reasoning) to find unknown quantities in ratio relationships.

Geometry
- Recognising angles as a measure of turn and comparing angles visually.
- Measuring angles using a protractor and estimating angles.
- Classifying angles.
- Classifying triangles based on sides and angles.

Algebra
- Generalising simple shape and number. patterns and expressing a general term of the pattern using a variable.
- Framing and evaluating linear algebraic expressions in one variable.

Mensuration
- Applying the concept of area as the amount of space covered (using square grid, tiling etc.).
- Applying the area of squares and rectangles in mathematical and real-life situations.
- Applying the perimeter of square and rectangle in mathematical and real life situations.

Few examples of what can be skipped in interest of time:
- Reading and constructing pictographs and bar graphs.
- Recognising line of symmetry.
- Construction of lines and angles.

Are students learning with understanding? Try asking them this question.
Shown here are 3 shapes.

Shape 1   Shape 2   Shape 3
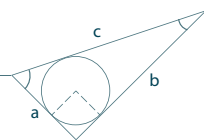
Which of them has a perimeter?
A. shape 1 only
B. shape 2 only
C. shapes 1 and 2 only
D. All of them have a perimeter.

23823 students attempted this question. Only 19% students got this question correct (option D). Around 51% students selected option C, indicating that they have a misconception that only shapes with straight sides have perimeter.

Grade 7

Essential Concepts | Mathematics

Integers
- Multiplying and dividing integers.
- Applying properties of operations on integers.
- Applying operations on integers in real life situations.

Fractions, Decimals and Rational numbers
- Multiplying and dividing fractions.
- Representing rational numbers on a number line.
- Operations on rational numbers.
- Representing rational number as a decimal.
- Multiplying and dividing decimal fractions.
- Applying operations on rational numbers (both in fraction and decimal form) in real life situations.

Exponents
- Applying the laws of exponents to simplify. numerical and algebraic expressions that have positive integral exponents.

Ratio, Proportion and Percentages
- Expressing a number or quantity in the fraction, decimal fraction or ratio form in the equivalent percentage form and vice-versa.
- Finding percentages of a number/quantity.
- Applying percentages in real life situations involving profit, loss and simple interest.

Lines and Angles
- Applying the properties of related angles (pairs of angles).
- Applying the properties of angles formed by a transversal cutting parallel lines.

Symmetry
- Recognising 2D shapes having line symmetry and rotational symmetry.
- Finding the order of rotation and angle of rotation in 2D shapes.

Triangles
- Applying the angle sum property for the interior angles in triangles.
- Applying the property that any exterior angle of a triangle is equal to the sum of the interior opposite angles.
- Applying Pythagoras' theorem to find the unknown sides.
- Identifying if two or more shapes are congruent to one another.
- Identifying and applying different criteria to test the congruency of triangles.

Linear equations in one variable and Algebraic Expressions
- Modelling a mathematical or a real-life situation using linear equations in one variable.
- Solving a linear equation having terms with variables on one side of the equality (integral coefficients).
- Solving a linear equation having terms with variables on both sides of the equality (integral coefficients).
- Adding and subtracting algebraic expressions.

Mensuration
- Finding the area of a circle, given the radius or the diameter.
- Applying area of a circle in real-life applications.
- Applying the area of squares and rectangles in finding the area of composite shapes.

Data Handling
- Finding and applying the mean of ungrouped data.

### Few examples of what can be skipped in interest of time:
- Construction of lines and angles
- Nets and views of 2D solids
- Rotational and reflection symmetry
- Intuitive understanding of probability

Are students learning with understanding? Try asking them this question.

Which of the following expressions represents subtracting -30 from -20?
A. -20 + 30
B. -20 – 30
C. -30 + 20
D. 30 + 20

19167 students attempted this question. Around 27% students selected the correct answer, option A. Around 36% students selected option B, indicating that they are ignoring the negative sign of -30 and are subtracting 30 instead of -30 from -20. Another 23% students selected option C, indicating that these students may not understand what is being subtracted from what and are simply taking the numbers in the order in which they are given, -30 – (-20) = -30 +20.

Grade 8
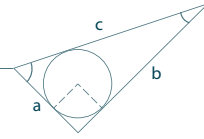
Essential Concepts | Mathematics

Rational numbers
- Applying the properties of rational numbers.
- Finding rational numbers between two numbers.

Square roots and Cube roots
- Finding and estimating the square of a number.
- Finding and estimating the square root of whole numbers.
- Finding and estimating the cubes of given numbers.
- Estimating the cube roots of numbers.

Exponents
- Applying the laws of exponents to simplify numerical and algebraic expressions that have negative integral exponents.

Ratio, Proportion and Percentages
- Representing changes in quantities (increase or decrease) as percentages and vice versa.
- Finding the cost price (or selling price) when profit (loss) percentage is known.
- Finding the percentage discount, cost price or selling price when any two of the same are known.
- Applying inverse variation to solve problems in real life situations.

Quadrilaterals
- Applying the angle sum property for the interior angles of a quadrilateral.
- Identifying a shape as parallelogram, trapezium or kite based on properties.
- Applying properties of sides, angles or diagonals of a parallelogram to find unknown sides, angles etc.
- Identifying if a parallelogram is a rectangle, square or rhombus based on their properties.

Linear equations in one variable and Algebraic Expressions
- Applying linear equations in one variable to real life situations.
- Multiplying a polynomial with a monomial.
- Multiplying a polynomial with another polynomial.
- Dividing a polynomial by a monomial.
- Expanding algebraic expressions using the identities for $(a+b)^2$ and $a^2 - b^2$.
- Factorising by regrouping and bringing out common factors.
- Factorising trinomials of the form $ax^2 + bx + c$.

Mensuration
- Finding the area of quadrilaterals by decomposing them into rectangles and triangles.
- Finding the area of parallelogram, rhombus and trapezium).
- Finding the surface area of a solid applying the concept of surface area as area of surface exposed (e.g. using nets, unit cubes).
- Applying the surface area of a cube and cuboid in real life situations.
- Finding the volume of a solid formed by the unit cubes.
- Applying the volume of a cube and cuboid to solve real life situations.

Data Handling
- Interpreting circle graphs/pie charts by applying percentage concepts.
- Interpreting pie charts represented using sector angles.
- Approximating the probability of a chance event by repeating the random experiment several times.
- Representing and interpreting grouped data.

Few examples of what can be skipped in interest of time:
- Operations on rational numbers, word problems
- Applying percentages in calculating compound interest
- Representing 3D in 2D
- Construction of quadrilaterals
- Volume and surface area of a cylinder

### Are students learning with understanding? Try asking them this question.

$2^{2011} +$ _____ $= 2^{2012}$

What should come in the blank to make the above number sentence true?

A. 1
B. 2^1
C. 2011
D. 2^{2011}

13803 students attempted this question. Only 14% students selected the correct answer, option D. Around 66% students selected option B, indicating that they do not understand laws of exponents and think that just because 2011 + 1 = 2012, in the given case of exponents as well, the same will work.

Grade 9
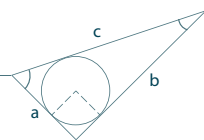
Essential Concepts | Mathematics

Real Numbers
- Identifying if a number is irrational.
- Finding irrational numbers between two real numbers.
- Representing irrational numbers on a number line.
- Estimating or approximating the value of an irrational number.
- Rationalising the denominator of an expression containing irrational terms.

Algebra
- Identifying the zeroes of a polynomial.
- Applying remainder theorem and factor theorem on polynomials.
- Applying algebraic identities in factorisation of quadratic and cubic polynomials.
- Identifying if given values are the solutions of linear equation(s) in two variables.
- Plotting graphs of linear equation(s) in two variables.
- Modelling a mathematical or a real life situation using linear equation(s) in two variables.

Geometry
- Coordinate Geometry - Plotting and identifying points in the coordinate system.
- Applying the properties of angles formed by a transversal along with other mathematical and geometrical concepts.
- Applying the properties of sides and angles in a triangle.
- Identifying and applying different criteria to test the congruency of triangles.
- Knowing and applying the sufficient conditions for a parallelogram to be a square, rectangle or a rhombus.
- Knowing and applying midpoint theorem.
- Applying the properties of chords of a circle.
- Applying the properties of cyclic quadrilaterals.

Mensuration
- Finding the area of triangles when all the side lengths are given (by applying Heron's formula).
- Applying the property - parallelograms and triangles on the same base and between the same parallels have equal area.
- Applying the volume and surface area of a cube, cuboid and cylinder in mathematical and real life situations.

Statistics and Probability

- Constructing and interpreting histograms.
- Finding probability of a simple event empirically.

Few examples of what can be skipped in interest of time:
- Simplifying expressions containing irrational numbers
- Applying properties of quadrilaterals along with other geometrical concepts
- Construction of bisectors and triangles
- Applying the volume and surface area of a sphere and cone in mathematical and real life situations
- Applying the mean, median and mode of ungrouped data

Are students learning with understanding? Try asking them this question.

p is a number such that p × p is less than p. Between which of these pairs of numbers could p lie?
A. -10 and 1
B. -1 and 0
C. 0 and 1
D. (It is not possible that p × p is less than p.)

16415 students attempted this question. Only around 22% students selected the correct answer, option C. 52% students selected option D, indicating that they have a misconception that a number multiplied by itself will always be bigger than p and either don't understand or are ignoring what happens in case of squaring numbers lying between 0 and 1.

Grade 10
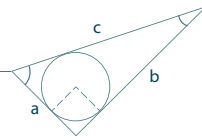
Essential Concepts | Mathematics

Real Numbers
- Representing a whole number as a unique product of prime numbers.
- Applying the Fundamental Theorem of Arithmetic.
- Proof of irrationality of $\sqrt{2}$ and $\sqrt{3}$.
- Converting a non-terminating but repeating (recurring) decimal to its equivalent rational form (p/q form).

Algebra
- Applying the relationship between the zeroes and coefficients of a Quadratic polynomial.
- Finding the number of solution(s) of a pair of linear equations in two variables.
- Solving a pair of linear equations in two variables (elimination, substitution, cross multiplication and graphical method).
- Applying linear equation(s) in two variables to real life situations.
- Framing a mathematical or a real-life situation using quadratic equations.
- Solving a quadratic equation.
- Identifying the nature of the roots in a quadratic equation.
- Applying the formula for nth term of an arithmetic progression.
- Applying the formula for the sum of n terms of an arithmetic progression.
- Applying arithmetic progressions to real life situations.

Coordinate Geometry
- Finding and applying the distance between two points.
- Finding and applying ratios in which a point divides a line segment (section formula).

Geometry
- Applying the properties of proportional sides and equal corresponding angles to test similarity of shapes.
- Applying the properties of similar shapes to determine unknown sides and angles.
- Applying the basic proportionality theorem and its converse.
- Applying Pythagoras' theorem and its converse to solve real life problems.
- Applying the property that the tangent to a circle is perpendicular to the radius at the point of contact.
- Applying the property that tangents drawn from the same external point to a circle are equal.

Trigonometry
- Identifying trigonometric ratios and evaluating trigonometric expressions.
- Evaluating or simplifying expressions and determining angles using trigonometric ratios for standard angles.
- Applying trigonometric identities to simplify and prove relationships between trigonometric ratios.
- Applying trigonometry to real life situations (with angle of elevation 30, 45 and 60 degrees).

Mensuration
- Applying the area of sectors and segments in mathematical and real-life situations.
- Finding surface areas and volumes of combinations of any two of the following: cubes, cuboids, spheres, hemispheres and right circular cylinders/cones.

Statistics and Probability
- Finding and applying the mean, median and mode of a grouped data.
- Finding the probability of a simple event using the classical definition of probability.

Grade 10
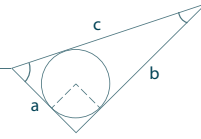
Few examples of what can be skipped in interest of time:

- Solving pair of linear equations reducible to linear equations
- Applying the formula for the area of a triangle when given the coordinates of vertices
- Constructing tangents to a circle

Are students learning with understanding? Try asking them this question.

Which of the following is/are IRRATIONAL numbers?
i) 22/7
ii) 3π
iii) 3.142857

A. only (ii)
B. only (i) and (ii)
C. only (ii) and (iii)
D. all – (i), (ii) and (iii)

7603 students attempted this question. Around 23% students selected the correct answer, option A. Around 37% students selected option D, indicating that they don't understand what rational numbers are and are ignoring the fact that in case of both i) and iii), the number is expressed in the form of p/q and a non-recurring decimal and hence are rational numbers. Around 27% students selected option B, indicating that they know that iii) is a rational number but may have seen or read that 22/7 is equal to π and so think that it is irrational.
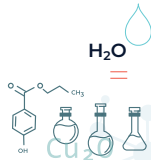
CBSE | Essential Concepts

ENVIRONMENTAL STUDIES / SCIENCE
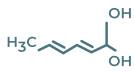
Grade 3

Essential Concepts | *Environmental Studies*

Animals and Human Body
- Different animals have different body shapes and structures, move in different ways and live in different habitats.
- Different birds have different types of beaks depending on the type of food they eat.
- Different animals eat different kinds of food.
- Different animals give us things that are useful to us and so they are kept and looked after.

Plants
- Leaves of different plants have different shapes, colours and patterns.

Matter
- Different amounts of water are needed for different activities.
- Two vessels with the same amount of water may have different water levels.

Food and Nutrition
- Many of the foods we eat are different parts of plants.
- Some foods are eaten raw, some are cooked and some either way.
- Some of the main methods of cooking are roasting, boiling, frying and baking.

Motion and Time
- Find time by looking at the two hands of a clock.
- Correlating directions with representation of places on simple maps.

Natural Resources
- Water is scarce and its wastage needs to be avoided.
- Water should be reused wherever possible.
- Water for use is obtained from different sources such as rivers, ponds, wells, lakes.
- Different fuels or sources of heat energy can be used for cooking.

Ecology
- Living things depend on other living things as well as non-living things in the surroundings.

Few examples of what can be skipped in interest of time:
- Relation between type of food and age
- A variety of different things are eaten as food.
- Different types of vehicles based on the number of wheels and source of energy
- Different stages involved in pottery

Are students learning with understanding? Try asking them this question.
Water is poured from a glass into an empty bottle.

The only thing that changes, is the _____
A. taste
B. colour
C. shape
D. amount of water

7923 students attempted this question. Only 40% students selected the correct answer, option C. Around 43% students selected option D, indicating that they do not understand the concept of conservation of volume and think that the amount changes just by transferring to another container.
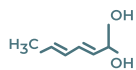
Grade 4
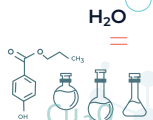
Essential Concepts | *Environmental Studies*

Force and Motion
- A pulley makes it easier to lift a weight.

Animals and Human Body
- Some animals have ears that can be seen, some animals have ears that cannot be seen.
- Different groups of animals have different types of body coverings.
- Some animals lay eggs while some others give birth to live young ones.
- Correlation between the different characteristics of a group of animals.
- Different birds make different kinds of nests.
- Different birds have different kinds of feet depending on where they live.
- Different birds have different kinds of beaks depending on the food they eat.
- Animals have different types of teeth based on the type of food they eat.

Natural Resources
- Forests provide many useful materials for wildlife and for people. They need to be conserved.
- Human activities make water sources polluted.
- Even after cleaning, water can contain germs which cause diseases.
- Boiling kills most of the germs and makes water safe for drinking.

Matter
- Some things dissolve in water while other things do not.

Food and Nutrition
- Some vegetables and fruits spoil quickly while others stay for longer.

Plants
- Roots absorb water from the soil.
- Roots provide support to plants.
- Roots of some plants are modified to store food, and can be eaten by us.

Few examples of what can be skipped in interest of time:
- Thread is made into cloth through weaving.
- Names of common water-borne diseases
- Building materials in use have changed over time.
- Insects like ants and honey bees have a very complex social order, with different individuals carrying out different tasks.

Are students learning with understanding? Try asking them this question.
Shown here is a balloon.
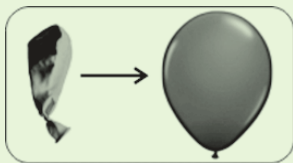
What will happen to its weight if it is blown?
A. It will increase because air has weight.
B. It will remain unchanged as air has no weight.
C. It will decrease because air makes things lighter.
D. Cannot say without knowing the balloon's weight before blowing.

24224 students attempted this question. Around 39% students selected the correct answer, option A. Around 23% students selected option C, indicating that they have a wrong notion that air makes things lighter. Around 20% students selected option B and seem to have a wrong notion that air has no weight.
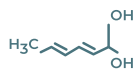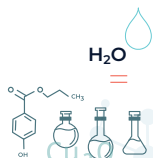
Animals and Human Body
- Most animals have some sense organs.
- Hearing, smell and sight in animals are similar in some ways and different in other ways to those in humans.
- Different animals sleep for different durations in a day.
- The tongue helps in recognising different tastes.
- Glucose can be directly used by the body to produce energy, so it can be given directly to the blood.
- The stomach breaks food into smaller pieces and digests it with the help of digestive juices.
- Malaria is a disease caused by certain mosquitoes carrying the germs.
- Anaemia is a condition caused by low amount of iron in the diet and leads to tiredness.
- Mosquitoes can be controlled by preventing their breeding in stagnant water.
- Some characteristics are passed on from parents to children.

Food and Nutrition
- Most food items get spoilt if left alone. Many of them can be preserved by drying, or adding salt or sugar.

Plants
- Seeds sprout given the right conditions to form new plants.
- Seeds get spread far from their parent plant by animals, wind, water, etc.
- Many common fruits and vegetables that we use originated in other parts of the world.

Matter
- Some objects float in water while others sink.
- Two different objects made of the same material may float or sink depending on their shape.
- Dissolving salt in water can affect whether an object floats or sinks.
- Some liquids flow more easily than others.

Force and Motion
- Everything that is thrown up falls back to the Earth because of gravity.
- In a spaceship far away from the Earth, the force due to gravity is very weak and things can float around.

Natural Resources
- Petrol and diesel are fuels dug up from under the ground, and will get over in the future.

Heat and Energy
- How things can be made warm or made to cool down.
- Air has moisture which forms a mist on cold surfaces.

Cosmic Science
- The shape of the Moon and its rising and setting times change in a repeating cycle.

Few examples of what can be skipped in interest of time:

- Snake venom is used to make anti-venom and certain medicines.
- Earthquakes and their consequences
- Water supply systems and rainwater harvesting

Are students learning with understanding? Try asking them this question.

Mansi looked at the Moon on a clear, cloudless night.
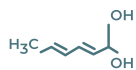Shown below is what she observed.
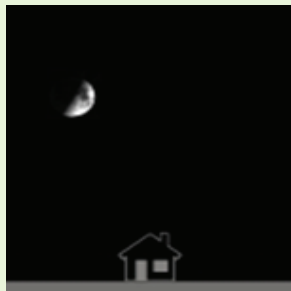
She looked at the Moon again after 2 days.
What could the Moon have looked like?

A.   B.   C.   D.
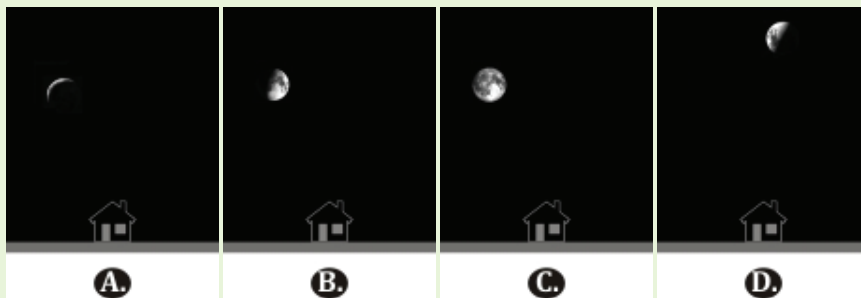
24622 students attempted this questions. 35.5% students selected the correct answer, option B. Around 35% students selected option C, indicating that they may not have observed the moon changing shape and how many days it takes to go from half moon to full moon (around 7 days). While C was the most common wrong answer, almost 28% students selected A and D, indicating a similar lack of observation skills.
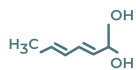
Food, its sources and components
- All food that is available comes from either plant or animal sources.
- Sun is the ultimate source of energy.
- A minimum amount of each of the nutrients, carbohydrates, proteins, fats, vitamins, minerals and water are needed by the body daily.
- Different food items contain different amounts of nutrients and so the diet needs to comprise of food items in a way that we get the minimum amount of nutrients needed daily. This kind of diet is called a balanced diet.
- The kind of balanced diet may differ from one individual to another depending on the age, gender, occupation and other factors.

Separation of substances
- Depending on the properties of the particles in the mixture like size, weight, solubility in liquids etc., dif f erent methods can be used to separate the substances in a mixture.
- Water changes into vapour on heating. Vapour condenses to water on cooling.
- Evaporation and condensation are processes that continuously take place.
- At a given temperature, only a certain amount of a substance can be dissolved in a given liquid.

Changes around us
- It is easy to get back substances lost in some changes/processes. Such changes are reversible changes.
- Heating generally leads to expansion of material whereas cooling leads to contraction.

Plants
- Plants take in water and minerals from the soil through their roots and transport them to different parts of the plant through specific vessels in the stem.
- Leaves help in exchange of gases and in preparing food for the plant.
- Using the water taken in by the roots and carbon dioxide from the air, plants prepare food in the presence of sunlight and a green pigment (chlorophyll).
- Excess food produced by the plants is transported from the leaves to the different parts of the plants through specific vessels in the stem and stored in the form of starch.
- Water in the form of water vapour escapes plants through leaves by a process called transpiration.

Movement in humans
- Bones and cartilages form the skeletal system which provides a structure to the body, helps in movement and protects certain body parts.
- Joints are places in our body where two bones connect. They help in moving and bending different body parts.
- Depending on the type of joint present, different body parts move and bend in different ways.
- Bones are connected to muscles and alternate contraction and relaxation of two muscles connected to a bone help in moving it.

Living organisms and their surroundings
- A living organism needs food and water, respires and excretes, reproduces, grows, can move and can respond to stimuli.
- An object needs to satisfy a set of requirements, and not just one or two characteristics, to be called living.
- The factors required for life vary across habitats and across seasons within a habitat.
- Over a certain period of time as the factors in the environment change, specific features/characteristics that some organisms may possess enable better survival of those organisms. These features get preferred over other in that given set of environment. This process of adjustment that the organisms go through is called adaptation.
- Depending on the habitat, certain features/characteristics may be observed in the living organisms.
- Adaptations help living organisms survive better in a given habitat.

Motion and measurement of distance
- To locate an object or place, the distance and direction needs to be given in reference to a specific point.
- Length can be measured and expressed using any other object; however, to ensure standardisation and be able to compare lengths easily, formal units (like cm, m etc.) are used to measure and express length.
- Displacement is the change in position of an object whereas distance indicates the total path length covered from a given point.
- An object is said to be in motion when its position changes with time.
- Motion can be classified into different types based on certain properties.
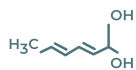
Grade 6

Essential Concepts | Science

Electricity
- An electric cell is a source of electricity.
- Some materials (conductors of electricity) let electricity to pass through whereas some materials (insulators) don't.
- Electricity flows from one terminal of the electric cell, through the conductor, to the other terminal of the electric cell. Without such a closed circuit, electricity cannot flow.

Magnets
- Magnets can exert force on other magnets and certain objects.
- A magnet has two poles – north and south; like poles of magnets repel each other whereas unlike poles attract.

Water
- Water evaporates all the time and not only when water is boiled.
- Evaporation of water results in pure water vapour, without any dissolved substances in it.
- The water vapour in the atmosphere comes from living beings, from evaporation from the surface of water bodies and groundwater.
- Only water vapour condenses to give liquid water.
- Condensed water droplets are present in the air surrounding us as well as in clouds.
- Water on the earth continuously cycles through its di–erent states; the water cycle does not have a beginning or an end and it is not lost during the water cycle.
- There is limited amount of usable water and so it is important to conserve water.

Air
- Air is found everywhere and it occupies space.
- Air is composed of different gases; majority of air is nitrogen and oxygen whereas carbon dioxide, water vapour and other gases are present to a small extent.
- Oxygen and carbon dioxide cycle continuously through the living organisms and the atmosphere.

Classification of object
- Depending on what the purpose of classification is, things having similar characteristics can be put into one group and separated from the others which don't possess that characteristics.
- The same set of objects can be regrouped into di–erent groups depending on the purpose of classification.
- To make the study of living organisms more systematic, a universally accepted scheme of classification is in place which classifies living things based on certain rules. Classification of living things is hierarchical - a given group may be a part of a larger group which may be a part of another larger group.

Light
- A light source and an object are required for a shadow to form.
- A shadow is formed when light from a source is blocked by an object.
- Each light source directed at an object will create a shadow.
- Shadow falls in the direction opposite to that of the light source.

Few examples of what can be skipped in interest of time:
- Knowing specifics of processes like 'spinning', 'weaving', 'knitting' etc.
- What 'winnowing' or 'sieving' is and where it is used.
- What herbs, shrubs and trees are and examples of each of them.

Are students learning with understanding? Try asking them this question.
The bulb is glowing in the circuit shown below in Figure P.
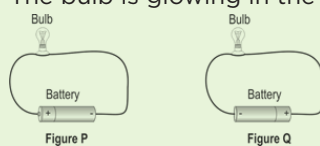
Figure P   Figure Q

If the battery is connected the other way (as shown in Figure Q), what will happen?
A. The bulb will blow or fuse out.
B. The bulb will glow but less brightly.
C. The bulb will glow in exactly the same way.
D. The bulb will not glow, but not get damaged

14245 students attempted this question. Only 37.5% students got this question correct (option C). Around 40% students think that the bulb will not glow, but not get damaged (option D).
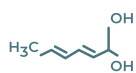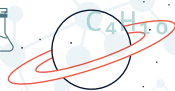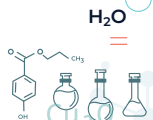
Nutrition in Plants
- Plants produce food through a process called photosynthesis.
- During photosynthesis, water and carbon dioxide are combined to form carbohydrates while oxygen is released as a by-product.
- Most living organisms other than plants, depend directly or indirectly on the food produced through photosynthesis.

Nutrition in Animals
- The main parts of the human digestive system.
- The digestion of starch begins in the mouth.
- The digestion of proteins happens mainly in the stomach.
- The digestion of fats happens mainly in the small intestine.
- The digested food is absorbed by the blood in the small intestine.
- The excess water in the food is absorbed by the large intestine.
- Liver and pancreas secrete digestive juices and help in digestion, but food does not pass through them.
- Grass-eating animals like cattle have special bacteria in their digestive system that help to digest cellulose.

Heat
- Sense of touch is not a reliable way to check the hotness or coldness of an object.
- The measure of hotness or coldness of an object is called temperature.
- Temperature can be measured using the expansion of a liquid in a thermometer.
- Heat flows from a hotter object to a colder object.
- Transfer of heat from one end of an object to the other is called conduction.
- Some materials conduct heat well while other materials do not.
- Heat can be transferred by the movement of a fluid – this is called convection.
- Heat can be transmitted without a medium, through radiation. This is how Sun's heat reaches us.
- Woollen clothes keep us warm because the air trapped in the wool is a poor conductor of heat and prevents the loss of body heat.

Acids, Bases and Salts
- Acids are sour in taste.
- Bases are bitter in taste and soapy to touch.
- An acid and a base neutralise each other to produce salt and water.
- Indicators show different colour in acidic, basic and neutral solutions.
- Acids turn blue litmus red, bases turn red litmus blue.

Physical and Chemical Changes
- Properties such as shape, size, colour and state are physical properties.
- A change in the physical properties is called a physical change.
- No new substance is formed in a physical change.
- A change in which a new substance is formed is a chemical change.
- Rusting of iron is a chemical change because the product rust is a new substance, different from iron.

Weather, Climate and Adaptations to Climate
- The condition of the atmosphere at a place at a given time is called weather.
- The long-term weather pattern of a place is called climate.
- Animals living in polar climate have thick fur to protect them from the cold, and wide feet to walk on snow.

Wind, Storms and Cyclones
- Wind blows from a high-pressure region to a low-pressure region.
- Warm air is lighter than cool air, and rises up.
- High wind speed reduces air pressure.

Soil
- The breaking down of rocks by the action of wind, water and heat is called weathering.
- The rotting dead matter in the soil is called humus.
- The main types of soil are sand, clay and loam.
- Depending on the composition, different types of soil have different water-holding capacity.

Respiration in Organisms
- The breakdown of food to release energy happens in all the cells of the body.
- Cellular respiration can happen with or without oxygen.
- In the presence of oxygen, glucose is broken down into carbon dioxide and water.
- During intense exercise, muscle cells run out of oxygen and respire anaerobically, breaking glucose into lactic acid.
- In other organisms like yeast, anaerobic respiration produces alcohol by breaking down glucose.
- During inhalation, the diaphragm moves down making the chest cavity larger and causes air to move into the lungs. During exhalation, the diaphragm moves back up making the chest cavity smaller and causes air to move out of the lungs.
- The air breathed out contains around 16% oxygen and 4% carbon dioxide.
- Plants respire, all the time.

Grade 7

Essential Concepts | Science

Transportation in Animals and Plants

- Blood contains three main types of cells – RBCs which contain haemoglobin and transport oxygen, white blood cells which fight against infections and platelets which help in clotting.
- There are two types of blood vessels – arteries which carry blood away from the heart and veins which carry blood towards the heart.
- Arteries divide into very small blood vessels called capillaries which bring the blood into contact with different tissues.
- The heart has four chambers – two upper chambers called atria and two lower chambers called ventricles.
- The partition between the chambers prevents the mixing of oxygen-rich blood with carbon dioxide-rich blood.
- Waste substances are removed from the blood in the blood capillaries in the kidneys.
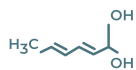- The wastes form urine, which is transported to the urinary bladder through the ureters.
- In plants, xylem transports water and dissolved minerals while phloem transports food substances.
- The continuous evaporation of water from leaves is called transpiration. It helps to pull water up through xylem.

Reproduction in Plants

- Plants can reproduce sexually or asexually.
- When new plants are produced from roots, leaves, stem and buds, it is called vegetative propagation, a form of asexual reproduction.
- Reproduction through the production of seeds is sexual reproduction.
- Flowers are the reproductive parts of a plant.
- The male gametes are produced in the anther while the female gametes are produced in the ovary.
- The transfer of pollen from anther to stigma is called pollination.

Motion and Time

- Speed is equal to the distance covered divided by the time taken.
- When an object repeats its motion in equal intervals of time, it is said to be in periodic motion.
- The to-and-fro motion of a simple pendulum is periodic motion. It is also called oscillatory motion.
- The commonly used units of speed are m/s and km/h.
- The motion of an object can be represented on a distance-time graph.

Electric Current and Its Effects

- Symbols of electric components.
- Electric current flows only through a complete circuit.
- Electric current heats the wire through which it flows.
- The heating effect of electric current is used in a fuse to protect circuits against excess current.
- A magnetic needle gets deflected when kept near a current-carrying wire.
- A coil of wire acts like a bar magnet when current passes through it, and is called an electromagnet.

Light

- An image that can be obtained on a screen is called a real image. A virtual image cannot be obtained on a screen.
- The image formed by a plane mirror is virtual, erect, laterally inverted and of the same size as the object.
- The nature of images formed by concave and convex mirrors.
- The nature of images formed by concave and convex lens.
- White light is made of several colours and can be split into the components by a prism.

Water: A Precious Resource

- The amount of freshwater available on the Earth is a very small proportion of the total quantity of water.
- Groundwater aquifers take a long time to replenish.
- Water cycle

Few examples of what can be skipped in interest of time:

- Definition of autotrophic and heterotrophic nutrition
- Life cycle of the silk moth
- Burning of magnesium
- The function of an odometer

Are students learning with understanding? Try asking them this question.

A magnet is cut in the middle (along the dotted line) as shown below. Assuming no magnetism is lost in the process of cutting, the new end of the left piece (indicated by the arrow) will be attracted to _____ pole of another bar magnet.
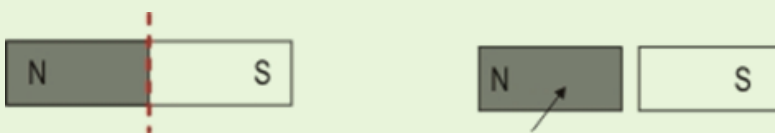
A. the north
B. the south
C. both the north and the south
D. neither the north nor the south

25213 students attempted this question. Around 35% students selected the correct answer, option A. Around 36% students think that the piece indicated will be attracted to the south pole. They don't seem to understand that when a bar magnet is cut, each piece acts like a bar magnet and so the end indicated will act like a south pole. Instead, these students seem to be going merely by the 'N' indicated on the bar and think that it will be attracted to the south pole.

Grade 8

Essential Concepts | Science

Crop Production and Management
- Plants get various minerals from the soil. Three of them – N, P and K – are particularly important and needed in significant quantities.
- Crop rotation is a technique used to allow the minerals in the soil to be replenished.
- Advantages and disadvantages of chemical fertilisers and organic manures.

Microorganisms: Friend or Foe
- Not all microorganisms are harmful. Some bacteria help in making curd and in fixing soil nitrogen. Some fungi help in fermentation.
- Some microorganisms cause diseases. They are called pathogens.

Synthetic Fibres and Plastics
- A polymer is a substance whose particles are made of several repeating units.
- Polymers can be natural or synthetic.
- Synthetic fibres are generally water resistant.
- Synthetic fibres may easily melt near a fire, so they should not be worn in the kitchen.
- Plastics are of two types: thermosetting which cannot be remoulded, and thermoplastics which can be remoulded.
- Plastics are non-biodegradable, so they should be recycled if possible and their use must be minimised.

Materials: Metals and Non-Metals
- Metals are generally hard, lustrous, malleable, sonorous and good conductors of heat and electricity.
- Both metals and non-metals react with oxygen to form oxides. Generally metallic oxides are basic while non-metallic oxides are acidic.
- Metals react with acids to form hydrogen gas.
- A more reactive metal displaces a less reactive metal from a solution of its compound.

Coal and Petroleum
- Coal was formed from the dead remains of plants which got buried deep under the soil millions of years ago.
- Petroleum was formed from the dead remains of marine organisms that got buried under the sea bed millions of years ago.
- Petroleum is a mixture of many substances and is separated into its components by a process called refining. Petrol, diesel and cooking gas are such separated components.
- Natural gas is found along with petroleum and is the cleanest fossil fuel.

Combustion and Flame
- Combustion is the reaction of a substance with oxygen to release heat.
- The lowest temperature at which a substance catches fire is called ignition temperature.

Substances with very low ignition temperature are called inflammable substances.
- Fire can be controlled by removing one of the three requirements of fire – fuel, air or ignition temperature.
- Water should not be used to extinguish electrical fires. Carbon dioxide should be used instead.
- Not everything burns with a flame. Substances which do not vaporise on heating burn without a flame.

Conservation of Plants and Animals
- Deforestation has severe environmental consequences such as droughts and desertification.
- Endemic species are those species of plants and animals which are found exclusively in a particular area.
- Species whose population has decreased drastically and face the threat of extinction are known as endangered species.
- The sum total of all the biotic and abiotic factors comprising a habitat is called an ecosystem.

Cell – Structure and Function
- Cells are the basic structural and functional unit of life.
- The size and shape of a cell is related to its function, not to the size of the organism.
- The cell membrane separates the contents of a cell from the surroundings. It regulates the entry and exit of substances to and from the cell.
- Plant cells have an additional cell wall which gives extra protection to the plant cells.
- The nucleus contains genetic information which helps in the inheritance of characteristics from parents to oŁspring.
- Cells of a leaf have small green bodies called chloroplasts which are a type of plastids. These contain chlorophyll and carry out photosynthesis.

Reproduction in Animals
- Male gametes are called sperms and are produced in the male reproductive organs called testes.
- Female gametes are called ova and are produced in the female reproductive organs called ovaries.
- During fertilisation in humans, a sperm fuses with an ovum inside the female organism's body to form a zygote.
- The zygote develops into an embryo and gets implanted in the uterus.
- The stage of development when the body parts are identifiable is called foetus.
- In some other animals such as frogs and fish, fertilisation happens outside the female
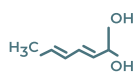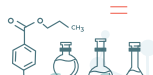
organism's body (external fertilisation).
- In some organisms, the larvae develop into adults through a series of drastic changes. This is called metamorphosis.

Reaching the Age of Adolescence
- During puberty, boys and girls become capable of reproduction.
- The changes during puberty are brought about by the male hormone or testosterone in boys and the female hormone or oestrogen in girls.
- In female humans, the reproductive phase starts at puberty and lasts till about 45-50 years of age.
- One ovum matures and is released by the ovaries every 28-30 days. If fertilisation does not occur, the lining of the uterus along with blood is shed by the body. This is called menstruation.
- The sex of a baby is determined by the sex chromosomes of the gametes that fuse. A female has two X chromosomes while a male has an X chromosome and a Y chromosome.

Force and Pressure
- A push or pull on an object is called force.
- A force brings about a change in the state of motion of an object.
- A force can change the shape of an object.
- Forces which act between objects in contact with each other are called contact forces. E.g. friction. Forces which act between objects not in contact with each other are called non-contact forces. E.g. gravity, magnetism.
- The force acting on a unit area is called pressure.
- Liquids and gases exert pressure on the walls of a container.
- The pressure exerted by the air due to its weight is called atmospheric pressure.

Friction
- Force due to friction opposes the relative motion of two surfaces in contact.
- Friction is caused by the irregularities in the two surfaces in contact.
- The force required to overcome friction when an object just begins to move is called static friction.
- The force required to keep an object moving with a constant speed is called sliding friction. This is usually smaller than static friction.
- In some cases, friction is beneficial, while in others it is undesirable.
- Lubricants are used to reduce friction.
- When one body rolls over another, the resistance to its motion is called rolling friction. This is less than sliding friction.
- Fluids also exert a force due to friction on objects moving inside them.
- Streamlined shapes are used for objects that move in air or water, to minimise fluid friction.

Sound
- Sound is produced when an object vibrates.
- Sound cannot travel through vacuum.
- The number of vibrations (oscillations) per second is called the frequency of oscillation.
- Human beings can usually hear sound having frequency between 20 Hz and 20,000 Hz.
- Amplitude is a measure of how large each vibration is. The loudness of sound depends on amplitude.

Chemical Effects of Electric Current
- Water usually contains small amounts of dissolved salts and other impurities which make it a good electrical conductor. Distilled water is a poor conductor.
- A chemical reaction can be made to happen when electric current passes through a solution.

Some Natural Phenomena
- Lightning is a discharge of electricity on a massive scale.
- There are two types of charges – positive and negative. Like charges repel while unlike charges attract.
- An electroscope can be used to check whether an object is electrically charged or not.

Light
- When light is reflected oŁ a surface, angle of incidence is equal to the angle of reflection.
- The human eye has a lens which forms a real image on the retina.

Stars and the Solar System
- The phases of the Moon occur due to its revolution around the Earth.
- Light year is a very large unit of distance that is equal to the distance travelled by light in a year.
- A group of stars with a recognisable shape is called a constellation.
- The Solar System consists of the Sun, eight planets and their satellites, asteroids and comets.

Pollution of Air and Water
- The main cause of pollution of air are exhaust from vehicles and factories.
- Some of the pollutants such as carbon dioxide are greenhouse gases which cause global warming.
- Chlorofluorocarbons damage the ozone layer which protects us from ultraviolet radiation from the Sun.
- Water is polluted mainly due to eŸuents fr om industries and runoŁ of chemical fertilisers from agricultural fields.
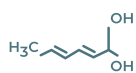
Few examples of what can be skipped in interest of time:

- Specific examples of synthetic fibres and plastics
- Uses of metals and non-metals
- Extraction of petroleum in an oil well
- Details of the electrolysis of water
- Detailed information about the constituents of the Solar System

Are students learning with understanding? Try asking them this question.

Given below is a diagrammatic representation of a process taking place in the human body.
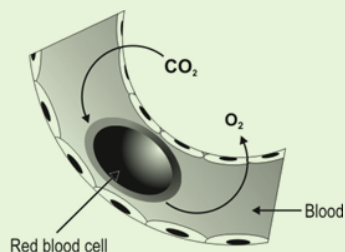
In which of these regions/organs could it be occurring?
1. lungs | 2. Heart | 3. brain

A. only in 1
B. only in 2
C. only in 2 and 3
D. in all – 1, 2 and 3

22131 students attempted this question. Around 21% students selected the correct answer, option D. Around 38% students selected option A and 29% students selected option B indicating that they have a misconception that the gaseous exchange happens only in certain organs. They don't understand that it happens in all the parts of the body.

Grade 9

Essential Concepts | Science

Matter in Our Surroundings
- Matter is made of particles which are in continuous motion.
- Temperature is a measure of the kinetic energy of the particles.
- Particles of matter attract each other.
- The properties of solids, liquids and gases can be understood in terms of the arrangement of the particles.
- At melting and boiling points, the temperature of a substance remains the same even when it continues to be heated. The excess heat goes into overcoming the forces of attraction.
- Applying pressure can help in liquefying a gas.
- Evaporation happens at all temperatures, boiling happens only at the boiling point.

Is Matter Around Us Pure?
- Based on the size of solid particles in a solid-liquid mixture, it can be classified as a solution, a colloid or a suspension.
- A solution is homogeneous, cannot be separated using a filter paper and does not scatter light. The particles do not settle down.
- A colloid is heterogeneous, cannot be separated using a filter paper and scatters light. The particles do not settle down.
- A suspension is heterogeneous, can be separated using a filter paper and scatters light. The particles settle down if left undisturbed.
- The solid components of a colloid can be separated by centrifugation.
- Two miscible liquids can be separated by distillation based on the difference in their boiling points.
- An element is a substance that cannot be broken down into simpler substances through a chemical reaction.
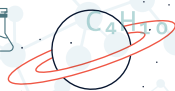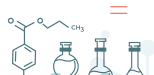- A compound is formed when two or more elements react with each other; the compound has properties which are distinct from those of the combining elements.

Atoms and Molecules
- Mass can neither be created nor destroyed in a chemical reaction.
- The atoms of each element have a characteristic atomic mass.
- Valency is the combining capacity of an atom of an element.
- Valency can help in finding the molecular formula of a compound.
- The sum of the masses of all the atoms in a molecule is called molecular mass.
- A mole of a substance is that quantity having mass numerically equal to the molecular mass, but in grams.
- The number of particles in one mole of any substance is 6.022×10^{23} (Avogadro constant).

Structure of the Atom
- Most of the mass of an atom Is concentrated in the nucleus of the atom, which contains positively charged protons and neutral neutrons.
- Negatively charged electrons orbit the nucleus in discrete shells.
- The number of electrons that can be accommodated in each shell can be determined by the $2n^2$ rule.
- Atoms generally gain, lose or share electrons to attain an octet of electrons in the outermost shell to become stable.
- The number of protons in the nucleus of an element is called atomic number.
- The total number of protons and neutrons in the nucleus is called mass number.
- In nature, there can be atoms of the same element with different mass number, these are called isotopes.

The Fundamental Unit of Life
- The outer covering of a cell which separates it from the surroundings is called the cell membrane; it regulates the entry and exit of substances to and from the cell.
- Substances like oxygen and carbon dioxide difuse across the cell membrane, from a region of high concentration to a region of lower concentration.
- Osmosis is the difiusion of water from a region of high concentration (low solute content) to a region of lower concentration (high solute content)
- Plant cells have an additional outer layer made of cellulose called cell wall; it allows plant cells to withstand a higher internal pressure.
- The nucleus contains genetic material and plays a central role in cellular reproduction.
- Cellular respiration is carried out by mitochondria; in plant cells, photosynthesis is carried out by chloroplasts.

Tissues
- A group of cells similar in structure and function is called a tissue.
- In plants, there are two broad types of tissues – meristematic and permanent. Meristematic tissue is found in buds and can differentiate into any other type of tissue.
- There are four main types of tissues in animals – epithelial, connective, muscular and nervous.
- Blood is a type of connective tissue.

Diversity of Living Organisms
- The classification of living organisms is related to their evolution.
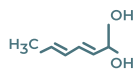
Grade 9

Essential Concepts | Science

Motion
- Displacement is the shortest path between the final and initial positions.
- Velocity is equal to the displacement divided by time.
- Acceleration is equal to the change in velocity divided by time.
- The accelerated motion of an object in a straight line can be described using the three equations of motion.
- The motion of an object can be represented on a distance-time graph or a velocity-time graph.
- Displacement is equal to the area under the velocity-time graph.

Laws of Motion
- An object will continue to be in a state of rest or uniform motion unless there is an unbalanced force acting on it.
- Momentum is the product of mass and velocity.
- Force, mass and acceleration are related by the equation $F = ma$
- When a force is applied by object A on object B, an equal and opposite force is applied by object B on object A.
- Total momentum is conserved during a collision.

Gravitation
- Any two objects exert a force of gravitation on each other given by $F = Gm_1m_2/d^2$
- For objects on or near the surface of the Earth, the acceleration due to gravity can be considered constant; $g = GM/R^2$
- Density of a substance is equal to the mass divided by volume.
- When an object is fully or partially immersed in a fluid, it experiences an upward force that is equal to the weight of the fluid displaced by it.

Work and Energy
- Work done is the product of force and displacement.
- Energy is the capacity to do work.
- Energy of an object due to its motion is kinetic energy; $KE = \frac{1}{2} mv^2$
- The energy stored in an object due to its shape or position is potential energy; gravitational PE of an object at a height = mgh
- Total amount of energy remains constant.
- Power is the rate of doing work; power = work/time

Sound
- Sound waves are longitudinal waves – the vibrations take place along the direction of propagation.
- A sound wave can be described by its frequency, wavelength and speed.

Why do We Fall Ill
- Viruses do not have life processes of their own but use the host cells for replication, so they are di,cult to eliminate using drugs.
- Vaccination is the use of weakened or dead pathogens to stimulate an immune response from the body for protection against diseases.

Natural Resources
- The main elements important for life get transferred repeatedly between the biotic and abiotic components in the form of biogeochemical cycles – nitrogen cycle, carbon cycle, oxygen cycle

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Few examples of what can be skipped in interest of time:
- Sublimation and deposition
- Chromatography
- Derivation of kinetic energy equation
- Improvement of crop varieties
- Animal husbandry

Are students learning with understanding? Try asking them this question.
Which of the following can lose heat to another body?
1. hot water at a temperature of 80°C
2. water at room temperature of 30°C
3. ice at a temperature of -10°C

A. only 1, because it is above room temperature
B. only 3, because it loses heat on melting
C. only 1 and 2 because they are above 0°C
D. All- 1, 2 and 3, can lose heat when in contact with a body at a lower temperature.

11302 students attempted this question. Only 40% students selected the correct answer, option D. Almost equal number of students selected options A, B and C indicating difierent misconceptions like only objects above room temperature can lose heat, only objects with temperature greater than 0 degrees can lose heat or ice loses heat on melting.
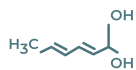
Grade 10

Essential Concepts | Science

Chemical Reactions and Equations
- In a balanced chemical equation, the number of atoms of each element on the LHS and RHS should be equal.
- Based on the nature of the changes happening to the reactants, chemical reactions are broadly classified as combination, decomposition, simple displacement and double displacement.

Acids, Bases and Salts
- Metals react with acids to form salt and hydrogen.
- Metal carbonates and bicarbonates react with acids to form salt, water and carbon dioxide.
- Metal oxides and hydroxides react with acids to form salt and water.
- Acids and bases produce ions on dissolving in water.
- pH scale is used to measure the hydrogen ion concentration which indicates the strength of acids and bases.

Metals and Non-metals
- Generally metal oxides are basic and non-metal oxides are acidic.
- A more reactive metal displaces a less reactive metal from a solution of its salt.
- A metal reacts with a non-metal by donating electrons to the non-metal and forming ionic bonds.

Carbon and Its Compounds
- Carbon atoms attain stability by sharing four electrons and forming covalent bonds.
- Carbon forms a large number and variety of compounds due to its tetravalency, ability to form double and triple bonds and to link up with other carbon atoms.
- A functional group is a group of atoms attached to a carbon chain, giving a compound its special properties.

Periodic Classification of Elements
- In the modern periodic table, elements are arranged in the increasing order of their atomic numbers.
- The period and group which an element belongs to indicate the electronic configuration of the atoms of the element.
- Generally the metallic character of an element increases down a group and decreases across a period.

Life Processes
- The energy released in respiration is used to synthesise a molecule called ATP which drives all the processes of the cell.
- The filtering of wastes from the blood happens in a special structure in the kidneys called a nephron.

Control and Coordination
- The transmission of information in the nervous system happens with the help of special cells called neurons.
- In certain dangerous situations, decisions and actions are taken by reflex arcs and not by the brain.
- Most of the information processing happens in the brain.

How Do Organisms Reproduce?
- DNA in the cells transmit hereditary information from parents to offspring.

Heredity and Evolution
- Sexual reproduction gives rise to a large variation in the characteristics of the offspring.
- Each individual organism produced by sexual reproduction has two sets of genes, one set inherited from each parent.
- Inherited traits can be dominant or recessive. Recessive traits are passed on to the offspring only when both the parents have the same trait.
- When two populations of the same species get separated and large changes accumulate over time, they may not be able to interbreed. In such cases, a new species is said to have been formed.

Light – Reflection and Refraction
- Rules for tracing the path of rays after reflection by spherical mirrors.
- Characteristics of images formed by spherical mirrors when object is kept at different positions.
- Mirror formula and magnification
- Snell's law of refraction
- Relationship between refractive index of a medium and speed of light in that medium.
- Rules for tracing the path of rays after refraction by spherical lenses.
- Characteristics of images formed by spherical lenses when object is kept at different positions.
- Lens formula and magnification
- Power of a lens

Human Eye and the Colourful World
- Some defects of vision are caused by defects in the lenses and can be corrected by using appropriate external lenses - myopia, hypermetropia, presbyopia.
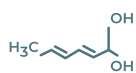
Grade 10

Essential Concepts | Science

Electricity

- Current is the charge flowing through a conductor per unit time.
- Potential difference between two points is the work done to move a unit charge from one point to the other.
- Ohm's law – for a given conductor at a constant temperature, the current flowing through it is directly proportional to the voltage between its ends.
- The resistance of a conductor is directly proportional to its length and inversely proportional to the cross-sectional area.
- For a series circuit with three resistances R1, R2 and R3, equivalent resistance R = R1 + R2 + R3.
- For a parallel circuit with three resistances R1, R2 and R3, equivalent resistance is given by 1/R = 1/R1 + 1/R2 + 1/R3
- Heat produced in a conductor Q = V x I x t

Magnetic Effects of Electric Current

- Circular magnetic field lines exist around a straight conductor carrying a current.
- The magnetic field lines of a circular loop of current resemble those of a bar magnet.
- A stronger magnetic field is produced if there are many turns of wire in the coil.
- The presence of a magnetic substance like soft iron inside the coil also makes the field stronger.
- A magnetic field exerts a force on a current carrying conductor. The direction of the force is given by the Fleming's left-hand rule.
- An electric current is induced in a coil when a magnet is moved in and out of the coil. The direction of induced current is given by the Fleming's right-hand rule.

Few examples of what can be skipped in interest of time:

- Occurrence of metals and their extraction
- Action of soaps and detergents
- Spore formation
- Design of electric motor and generator
- Fossils

Are students learning with understanding? Try asking them this question.

Tissues were taken from the intestine and from the lungs of a cow. Which of the following will be the same for the cells of these tissues?

1. size | 2. shape | 3. function | 4. DNA

A. only 1
B. only 4
C. only 1, 2 and 3
D. all – 1, 2, 3 and 4

10675 students attempted this question. Around 66% students selected the correct answer, option B. Around 14% students selected option D, indicating the misconception that all the cells of the body are identical.
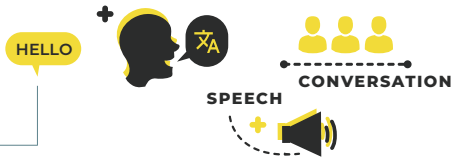
Grade 1

Essential Concepts | English

LISTENING AND SPEAKING

Students:

- Listen to, understand and use non-verbal cues to understand and draw inferences.
- Listen to and understand different phonemic sounds, simple words and sentences used in various everyday situations (e.g. 'bat', 'toy', 'food', etc).
- Listen to and show understanding of stories read aloud by drawing or answering simple questions (name of the character, story events).
- Sing or recite simple songs or poems with actions.
- Listen carefully and take dictations of simple words.
- Talk about self and everyday situations using simple sentences relevant to the situation or context ('Good evening', 'Sorry', What is your name?').
- Look at pictures or familiar objects and say 2–3 sentences about them in own words.

READING AND WRITING

Students:

- Recognise letters A–Z and their sounds.
- Recognise small and capital letters.
- Read simple words ('cat', 'pot', 'tap') and sentences with the help of pictures.
- Identify characters and sequence of events of a text read with the teacher.
- Relate reading to personal experiences and respond through drawing.
- Form letters of the right shape and size.
- Use correct spacing between letters, words and sentences.
- Write simple words and sentences on familiar topics (e.g. 'my school', 'my family', etc.).

VOCABULARY AND GRAMMAR

Students:

- Begin a sentence with a capital letter and end it with a full stop.
- Learn sight words.
- Learn the use of 'a', 'an' and 'the'.
- Learn the use of nouns as 'naming words', verbs as 'action words' and adjectives as 'describing words'.
- Learn the use of pronouns of gender and number.

Are students learning with understanding? Try asking them these questions.

Listen to the story and answer the questions below.

Tom is a cat. He likes to catch rats to eat. One day, Tom could not catch any rat. He then went to find milk. He found a bowl full of milk. Tom drank the milk and went away happily.

What was Tom searching for at the start of the story?
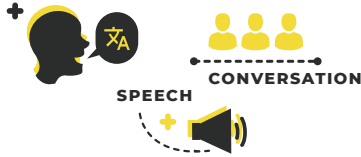Answer: _____

How did Tom feel in the end?
Answer: _____

The questions test if students can comprehend the given text and answer the questions based on it. Here, since the questions are not direct or ask for details from the story verbatim, students will need to understand what the text is saying and answer the questions.

Essential Concepts | English

LISTENING AND SPEAKING

Students:

- Listen to, understand and use non-verbal cues to understand and draw inferences.
- Listen to and understand different phonemic sounds, simple words and sentences used in various everyday situations (e.g. 'play', 'cloud', 'catch' etc).
- Listen to and show understanding of stories read aloud by drawing or asking and answering simple questions (name of the character, story events).
- Sing or recite simple songs or poems with actions.
- Listen carefully and take dictations of simple blend words.
- Talk about self and everyday situations using simple sentences relevant to the situation or context ('Please', 'Thank you', What are you doing?').
- Listen to stories and say 2–3 sentences about them.

READING AND WRITING

Students:

- Recognise and write small and capital letters.
- Read blended words ('fly', 'stop', 'blow') and sentences with the help of pictures.
- Understand the main idea, details and sequence of events of a text read with the teacher.
- Relate reading to personal experiences and ask questions.
- Draw based on reading of simple text.
- Form letters of the right shape and size.
- Use correct spacing between letters, words and sentences.
- Write phrases and sentences using adjectives and pronouns ('Tom ran fast', 'She is a tall girl').
- Write rhyming words.

VOCABULARY AND GRAMMAR

Students:

- Begin a sentence with a capital letter and end it with a full stop.
- Learn sight words.
- Learn homonyms, antonyms, synonyms.
- Use 'a', 'an' and 'the' appropriately.
- Learn the uses of common and proper nouns, countable and uncountable nouns.
- Use pronouns of gender and number appropriately.

Are students learning with understanding? Try asking them this question.

Rearrange the words below to make a meaningful sentence.

is cooking, my, in, mother, the kitchen

The question tests if students can rearrange the words to form a meaningful sentence. A good rubric can be used to capture how many words or which part of the sentence the student is struggling with and remediation can be planned accordingly.

Grade 3

Essential Concepts | English

LISTENING AND SPEAKING

Students:

- Listen to, understand and use non-verbal cues to understand and draw inferences.
- Listen to and develop phonemic awareness, understand simple words and sentences used in various everyday situations (e.g. greetings, instructions etc).
- Listen to and show understanding of stories read aloud by drawing or asking and answering simple questions (moral of story, story sequence).
- Sing or recite simple songs or poems with actions.
- Listen carefully and take dictations of short sentences accurately.
- Engage in conversations with teachers, friends and family using simple sentences and responses (e.g.'What is your name?', 'My name is Meenu.').
- Respond to questions asked in class on stories read.
- Listen to new words and indicate objects or people being referred to.

READING AND WRITING

Students:

- Recognise and write words in small and capital letters.
- Read a short story or poem with some fluency and understanding.
- Recognise the main idea and details and rearrange events by sequence.
- Read and engage with short stories or simple poems.
- Read different kinds of short texts such as myths, folktales, fairytales.
- Write with proper spacing and punctuation.
- Write short sentences using ideas from personal experience.
- Write answers based on a given text after understanding it.
- Write rhyming words, homophones.

VOCABULARY AND GRAMMAR

Students:

- Learn and use high-frequency words.
- Learn and use homonyms, antonyms, synonyms.
- Learn commonly-used proverbs and idioms (e.g. An apple a day keeps the doctor away.).
- Learn to use collective nouns and material nouns.
- Understand and apply the functions of nouns, pronouns, verbs, adjectives and adverbs.
- Distinguish between definite and indefinite articles and their appropriate uses.

Are students learning with understanding? Try asking them this question.

Which of these is a complete sentence?
A. The big black box.
B. The puppy barks.
C. Want to see a movie?
D. Have finished drawing.

26349 students attempted this question. This question checks students' understanding of sentence formation. Only B contains the elements of a sentence - subject and verb part of a sentence (The puppy barks.). 28% of the students selected the correct answer, option B. 21% of the students seem to have chosen C (Want to see a movie?) because that is a colloquial way of asking a question. They have missed the missing subject - Do you want to see a movie? Around 24% of the students have chosen 'The big black box.', being fooled by the punctuation befitting a sentence.
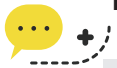
Grade 4

Essential Concepts | English

LISTENING AND SPEAKING

Students:

- Listen to, understand and use non-verbal cues to understand and draw inferences.
- Listen to and understand complex words and sentences spoken in school/class, and answer questions.
- Understand instructions, announcements made outside of the learning space.
- Listen to poems, songs, riddles, tongue twisters, short stories, skits, films.
- Listen to and engage in discussions and conversations with interest.
- Respond to instructions, orders, requests, questions, rules of games.
- Take dictation of a small text, list of items.
- Introduce oneself and talk to people using short simple the sentences.
- Participate in role plays, skits, poetry recitation.
- Describe places, likes and dislikes, and tell short narratives.

READING AND WRITING

Students:

- Read simple sentences and short texts independently and with fluency.
- Read the text, understand the content and identify main ideas.
- Understand the meanings of words in the given context.
- Enjoy reading short texts beyond the given text materials and relate ideas with their experiences.
- Read aloud and silently.
- Write answers to questions based on given text materials.
- Write short narratives on personal experiences/short sequence of events or descriptions.
- Write sentences to form a paragraph and organise the sentences.
- Write stories from one's imagination or memory.

VOCABULARY AND GRAMMAR

Students:

- Recognise and explain the meaning of common proverbs (e.g. Burn the candle at both ends).
- Learn to use subject-verb agreement.
- Use an apostrophe to show singular possession and know the difference between plurals and possessives.
- Apply the functions of the parts of speech in a sentence.
- Make use of linking words (e.g. 'because', 'and', 'also' etc.).
- Use definite and indefinite articles appropriately.

Are students learning with understanding? Try asking them this question.

Doves and pigeons are <u>similar</u> birds, but pigeons are bigger.

The underlined word means that doves and pigeons _____.

A. are common
B. are colourful
C. look small
D. look alike

24486 students attempted this question. This question tests students' ability to arrive at meanings of words based on the context. When we say 'doves and pigeons are similar birds', it means that they look alike in many ways. Only around 31% of the students selected the correct answer, option D. 30% of the students seem to have wrongly chosen option A, assuming that they are found commonly, everywhere. But 'common' in no way means 'similar' or 'look like each other'. Students who have chosen options B and C have been unable to deduce the meaning of 'similar' using clues from the given context.

Grade 5

Essential Concepts | English

LISTENING AND SPEAKING

Students:

- Listen to, understand and use non-verbal cues to understand and draw inferences.
- Listen to and understand complex words and sentences, and ask and answer questions.
- Follow announcements, instructions, rules in and beyond the learning space.
- Listen to and understand films, skits, narration, story telling.
- Listen to and engage in conversation with people from the immediate environment.
- Respond to questions based on the given text.
- Take dictation of an unseen passage, list of things.
- Talk about oneself and one's surroundings, describe places and things, express likes and dislikes.
- Participate in different events such as role-play, poetry recitation, plays.
- Ask simple questions about people, places or things in the immediate environment.

READING AND WRITING

Students:

- Read seen and unseen texts and long passages with fluency.
- Understand the narrative and identify the main ideas.
- Read and understand the meanings of unfamiliar words based on context.
- Read for pleasure, enjoy reading short texts beyond given text materials.
- Read aloud and silently.
- Write answers to textual questions after understanding the given text.
- Write a short paragraph on any given topic or a list of things in an organised and sequential manner.
- Write stories, descriptions or narratives in a coherent manner.
- Write in one's own words, summarize in short sentences or a short paragraph.

VOCABULARY AND GRAMMAR

Students:

- Use different vocabulary in different contexts. for e.g. cookery, travel, sports etc.
- Understand and use subject-verb agreement correctly.
- Understand and use adverbs and their kinds.
- Apply the functions of the parts of speech in a sentence.
- Get acquainted with and understand the use of irregular verbs in their simple and continuous tense (break, broke, broken; eat, ate, eaten).
- Use conjunctions, prepositions, and interjections correctly.

Are students learning with understanding? Try asking them this question.

Fact: Dengue and Chikunguniya are spread by the aedes mosquito, which bites during the day. Proper care needs to be taken to <u>reduce</u> the chances of getting infected by these diseases.

The word that can replace 'reduce' in the passage is _____.
A. lessen
B. rescue
C. protect
D. prevent

24807 students attempted this question. This question checks students' knowledge of synonyms based on context clues. 29% of the students selected the correct answer, option A. The passage says that proper care needs to be taken to 'reduce' or 'lessen' the chance of getting ill with dengue by not allowing mosquitoes to harm us. Around 36% of the students selected option D. They have probably chosen 'protect' as the answer, under the assumption that by protecting oneself, we can avoid getting infected with dengue and chikungunya and are not really registering that the question asks for the word which means the same as 'reduce'. Get students to choose familiar words in passages and list as many words as possible that mean the same as the words in question.
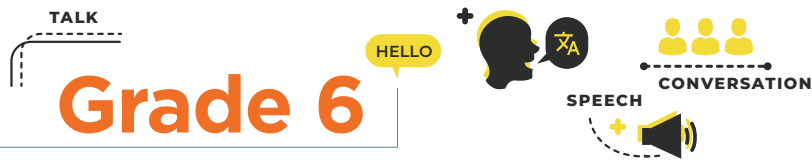
Essential Concepts | English

LISTENING AND SPEAKING

Students:

- Listen to and understand non-verbal cues and respond by speaking.
- Listen to, understand and respond to complex words and sentences and ask for clarification or elaboration of ideas.
- Follow language used in various contexts (school, market, airport, TV shows, TV/radio news, oral/telephonic communication, etc).
- Listen to, understand and enjoy English used in various genres (songs, poems, stories, drama, jokes, riddles, tongue-twisters, etc).
- Listen to and use language appropriate to the audience (family, friends, shopkeepers, teachers, etc) and purpose: to persuade, explain or express an opinion (speeches, debates, presentations, etc).
- Listen to, differentiate between and respond to statements and questions, orders and requests based on tone, stress, etc.
- Listen to readings or instructions and take dictations.
- Narrate personal experiences and show an interest in listening to the experiences of others.
- Ask questions based on written/spoken texts and the immediate environment, and respond appropriately to questions (orally summarise stories, identify main idea, etc.).
- Participate in different events such as role-play, poetry recitation, plays.

READING AND WRITING

Students:
- Read a variety of seen and unseen texts with fluency.
- Read and understand different texts (including tables, diagrams, maps, etc) and identify the main idea, sequence of events, etc.
- Read and relate texts to personal experiences and real life.
- Engage with different kinds of texts (stories, news reports, book reviews, advertisements, etc) and appreciate their different forms and features (titles, headlines, subtitles).
- Deduce the meanings of unfamiliar words and phrases by reading them in context.
- Ask questions based on reading.
- Respond in writing to a variety of prompts (emails, letters, poems, stories, essays, lists, etc) keeping in mind the conventions of the individual format (beginning, middle, and end; to and from address, etc).
- Write answers to textual questions based on comprehension and inference.
- Take dictation for different purposes.

VOCABULARY AND GRAMMAR

Students:
- Use appropriate vocabulary in different contexts (e.g. environment, history, sports, etc.).
- Understand the use of antonyms, synonyms and homonyms.
- Make correct use of linking words such as 'firstly', 'then', 'later', 'finally', etc. to link sentences to indicate passage of time.
- Use context as a clue to the meaning of a word or phrase (idioms, proverbs, figures of speech).
- Use dictionaries and a thesaurus.
- Use the correct spelling for frequently-used words.
- Understand grammatical forms in context (noun, verb, adjective, adverb, pronoun, determiners, etc).

Grade 6

TALK
HELLO
SPEECH
CONVERSATION

Essential Concepts | English

Are students learning with understanding? Try asking them this question.

Seeing the financial condition of his family, Abhilash is reconsidering his decision to go abroad. So, Abhilash is now _____.

Which of these BEST completes the given sentence?
A. thinking on this feet
B. collecting his thoughts
C. having second thoughts
D. putting his thinking cap on

25354 students attempted this question. The question requires students to understand the context explained in the given sentence to be able to choose the correct idiom to sum-up the situation. 28% of the students selected the correct answer, option C. C is the correct answer as Abhilash is reconsidering or is doubting whether he should go abroad or not. The most crucial word in the sentence is 'reconsidering' which explains what the correct answer should be. 25% of the students selected option D. Option D is not the correct answer as the sentence explains a situation where Abhilash is reflecting on the merit of a decision that he has already taken. Almost 45% of the students selected options A and B, again indicating that they may not have been able to comprehend the given context correctly.

Grade 7

Essential Concepts | English

LISTENING AND SPEAKING

Students:

- Listen to and understand non-verbal cues and respond by speaking.
- Listen to, understand and respond to complex phrases and sentences and ask for clarification or elaboration of ideas.
- Understand and respond to language used in various contexts (cinema hall, market, train station, TV shows, TV/radio news, oral/telephonic communication, etc).
- Listen to, understand and enjoy English used in various genres (songs, poems, stories, drama, lectures, etc).
- Listen to and use language appropriate to the audience (family, friends, teachers, in public spaces, etc) and purpose: to persuade, explain/provide information, or express an opinion (speeches, debates, presentations, etc).
- Listen to, differentiate between and respond to statements and questions, orders, requests and opinions based on tone, stress, etc.
- Listen to and use onomatopoeic sounds (crash! boom!).
- Narrate personal experiences and show an interest in listening to the experiences of others and ask questions.
- Ask questions based on written or spoken texts and respond appropriately to questions on given texts.
- Recite poems, songs, dialogues and use them in new contexts.
- Compare English proverbs and idioms with those of the home language.

READING AND WRITING

Students:

- Read a variety of texts covering different themes and registers (stories, poems, charts, maps, newspaper reports, etc) for comprehension and inference and ask questions based on them.
- Read and connect text with real life and personal experiences.
- Engage with different kinds of texts (stories, news reports, book reviews, advertisements, etc) and appreciate their different forms and features (titles, subtitles).
- Compare and contrast ideas in and between texts.
- Deduce the meaning of unfamiliar words and phrases by reading them in context.
- Identify the main idea and details.
- Respond in writing to a variety of prompts (emails, letters, poems, articles, etc) keeping in mind the conventions of the individual format (beginning, middle, and end; to and from address, etc).
- Summarise or paraphrase a text.
- Write answers to textual questions based on comprehension and inference.
- Take dictation for different purposes.

VOCABULARY AND GRAMMAR

Students:

- Use linking words such as 'however', 'therefore' etc. to link sentences to indicate flow of ideas.
- Use context as a clue to the meaning of a word or phrase.
- Develop a further understanding of imagery and figures of speech.
- Use pronouns in the proper case and reflexive pronouns appropriately
- Use dictionaries and a thesaurus.
- Form and use perfect verb tenses to convey time, sequence.
- Identify and understand the difference between phrases and clauses in simple, compound and complex sentences.
- Understand the difference in the function of an active and a passive voice.
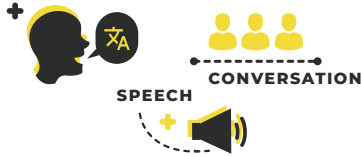
Essential Concepts | English

Are students learning with understanding? Try asking them this question.

Ants are not hoodwinked by spiders that mimic their appearance. They chase and kill the mimic when they spot one.

The word 'hoodwinked' means _____.
A. captured
B. deceived
C. protected
D. destroyed

24340 students attempted this question. This question was intended to assess students' ability to identify the correct synonym for the word 'hoodwinked'. Around 24% of the students selected the correct answer, option B. Option B is correct as the word in question means 'deceived'. Around 35% of the students selected option A. They may have arrived at the wrong answer probably because they misread the context. They have understood the word to mean 'captured' probably because of the words, 'chase and kill the mimic'. But that would completely alter the meaning of the sentence.

Grade 8

Essential Concepts | English

LISTENING AND SPEAKING

Students:

- Listen to and understand non-verbal cues and respond by speaking.
- Listen to, understand and respond appropriately to complex phrases and sentences and ask for clarification or elaboration of ideas.
- Understand, respond to and analyse language used in various contexts (cinema hall, market, train station, TV shows, TV/radio news, oral/telephonic communication, etc)
- Listen to, understand and enjoy English used in various genres (songs, poems, stories, drama, lectures, speeches etc).
- Listen to and use language appropriate to the audience (family, friends, teachers, in formal spaces, etc) and purpose: to persuade, explain/provide information, or express an opinion (speeches, debates, presentations, etc).
- Listen to, differentiate between and respond to statements and questions, orders, opinions, suggestions and requests based on tone, stress, etc.
- Listen to and co-relate onomatopoeic sounds (crash! boom!).
- Narrate personal experiences and show an interest in listening to the experiences of others and respond appropriately to questions.
- Ask questions based on written or spoken texts and respond appropriately to questions on given texts.
- Recite poems, songs, dialogues and use them in new contexts.
- Respond to questions using question tags (You are hungry, aren't you?).
- Understand and use English proverbs and idioms.

READING AND WRITING

Students:

- Read a variety of texts covering different themes and registers (stories, poems, book reviews, newspaper reports, etc) for comprehension, inference, and analysis; ask questions based on them.
- Read and connect text with real life and personal experiences.
- Engage with different kinds of texts (stories, news reports, book reviews, advertisements, etc) and appreciate their different forms and features (titles, captions, subtitles, table of contents).
- Compare and contrast ideas in and between texts.
- Deduce the meaning of unfamiliar words and phrases by reading them in context.
- Identify the main idea and details.
- Respond in writing to a variety of prompts (emails, letters, poems, diary entries, articles, etc) keeping in mind the conventions of the individual format (beginning, middle, and end; to and from address, etc).
- Analyse theme, point of view, characters, plot, use of dialogue, style (suspense, humour) in texts.
- Express real life and personal experiences through writing.
- Write answers to textual questions based on comprehension and inference.

VOCABULARY AND GRAMMAR

Students:

- Use linking words such as 'although', 'nevertheless' etc. to link sentences to indicate flow of ideas.
- Use context as a clue to the meaning of a word or phrase.
- Develop a further understanding of imagery and figures of speech and use them in writing.
- Use correct tenses and parts of speech.
- Use dictionaries and a thesaurus.
- Transform sentences from simple to complex/compound sentences.
- Understand Direct and Indirect Speech.
- Demonstrate the ability to transform from one voice to the other.

Are students learning with understanding? Try asking them this question.

He has a reputation of being _____. Can he be <u>trusted</u> to tell the truth?

Which of these is OPPOSITE in meaning to the underlined word and will complete the sentence meaningfully?
A. guilty
B. boastful
C. distrustful
D. unreliable

21226 students attempted this question. The question is intended to determine the students' ability to identify the antonym of the word 'trusted'. Around 29% of the students selected the correct answer, option D. Option D is correct as 'unreliable' is the word opposite in meaning to 'trusted'. An unreliable person is one who is undependable, not worthy of being trusted. Almost 39% of the students selected option C. Students choosing option C (distrustful) are familiar with opposites formed by adding the prefix (dis) to the word given as in *dishonest, disown, disrespect* etc. But they have failed to understand that 'distrustful' is a different word with a different connotation. A distrustful person is one who is not disposed or willing to believe. In short , he is likely to be 'suspicious' and 'doubting' by nature. Students who have chosen options A and B probably have been unable to understand the context correctly.
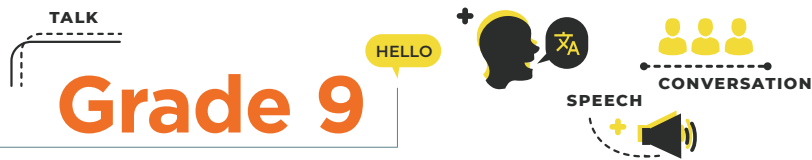
Grade 9

Essential Concepts | English

LISTENING AND SPEAKING

Students:

- Listen to and understand non-verbal cues and respond by speaking.
- Respond appropriately to English words and sentences used in various contexts (news, films, oral/telephonic communication, etc.) and ask for clarification.
- Listen to, understand and enjoy English used in various genres (songs, poems, stories, drama, jokes, riddles, tongue-twisters, etc.).
- Listen to, differentiate between and respond to statements and questions, opinions and suggestions based on tone, stress, etc.
- Listen to and recall important points made in the a speech, dialogue or passage.
- Understand the context, pronunciation and vocabulary of a spoken piece.
- Narrate personal experiences; listen to the experiences of others.
- Ask questions based on written or spoken texts and respond appropriately to questions on given texts.
- Make short notes of ideas presented in a talk or a lecture.
- Speak with fluency with correct pronunciation.
- Present ideas in an organised and sequential manner.

READING AND WRITING

Students:

- Read a variety of texts covering different themes (stories, poems, book reviews, newspaper reports, etc) for comprehension, inference, and analysis.
- Read and understand ideas presented in texts.
- Analyse theme, point of view, characters, plot in texts.
- Read and relate to ideas in and between texts.
- Engage with different kinds of texts (stories, book reviews, etc) and appreciate their different forms and features (titles, captions).
- Read and connect text with real life and personal experiences and discuss verbally.
- Identify details and sequence of ideas and events while reading.
- Understand the difference in various narrative styles, points of view, and effects on the reader.
- Write a coherent and meaningful answer to the questions based on the text.
- Complete a story, write a persuasive piece, description, narrative or discursive essay.
- Write essays which are complete, with an introduction, body and conclusion.

VOCABULARY AND GRAMMAR

Students:

- Develop understanding of functional grammar, structure and use.
- Review parts of speech, figures of speech, subject-object agreement.
- Use tenses in various forms.
- Use Phrasal Verbs.
- Distinguish and use Direct–Indirect Speech.
- Understand Active/Passive voice.
- Transform sentences from simple to complex/compound sentences.
- Use a dictionary and a thesaurus.

TALK

HELLO
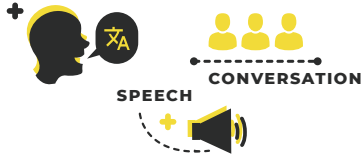
SPEECH

CONVERSATION

Grade 9

Essential Concepts | English

Are students learning with understanding? Try asking them this question.

Shalini was deep into a book in her room upstairs. The sudden sound of the doorbell jarred on her ears. She placed her book face down on the chair and hurriedly ran downstairs. As she reached the bottom of the stairs, she stepped on her sister's roller skates. She cried out in agony as she fell and broke her leg.

What is the MAIN IDEA in the lines above?
A. Shalini broke her leg while running.
B. Shalini's sister forgot to put away her skates.
C. Shalini's interest in books caused the accident.
D. Shalini was in a lot of pain when she broke her leg.

15191 students attempted this question. This particular question tests the students' ability to infer the gist of the small excerpt. Only around 19% of the students selected the correct answer, option A. Though option A is the correct answer, a majority of the students have selected options B and C. Option B could most likely be a conditioned response that finds its roots in the instructions given at home by parents. In order to teach a child to keep their things in order, they are often given examples of cause and consequence. (E.g. If you do not put your shoes away, you'll trip and fall.) Option C, which is equally popular might be assumed from the first line of the passage itself. Phrases like 'deep into a book' and 'hurriedly ran' when put together in a sentence, could possibly lead students to believe that option C is correct. Students who have chosen option D have failed to understand the main idea of the excerpt and have chosen an option that is not factual given the excerpt.

Grade 10

Essential Concepts | English

LISTENING AND SPEAKING

Students:

- Listen to and understand non-verbal cues and engage in a discussion.
- Respond appropriately to English words and sentences used in various contexts (speeches, news, films, oral/telephonic communication, etc.) and ask for clarification or elaboration of ideas.
- Listen to, understand and enjoy English used in various genres (songs, poems, stories, drama, speech, presentation, etc.).
- Listen to, differentiate between and respond to statements and questions, orders and requests based on tone, stress, etc.
- Listen to and recall important points made in a speech, dialogue, or passage and summarise.
- Understand the context, pronunciation and vocabulary, and respond to questions on a spoken piece.
- Narrate personal experiences, listen to the experiences of others and engage in conversation or discussion.
- Ask questions based on spoken texts or discussions and respond appropriately to questions on given texts.
- Make detailed notes of ideas presented in a speech, a discussion, a talk or a lecture and summarise.
- Speak with fluency with correct pronunciation, pauses, and wider vocabulary.
- Present ideas in an organised and sequential manner and make connections beyond the text.

READING AND WRITING

Students:

- Read a variety of fiction and non-fiction texts covering different themes and registers (stories, poems, book reviews, newspaper reports, etc) for comprehension, inference, and analysis and ask questions based on them.
- Compare and contrast ideas in and between texts.
- Analyse theme, point of view, characters, plot, use of dialogue, style (suspense, humour) in texts.
- Trace the development of plot, character, imagery, action and setting.
- Engage with different kinds of texts (stories, news reports, book reviews, advertisements, etc) and appreciate their different forms and features (titles, captions, subtitles, table of contents).
- Read and connect text with real life and personal experiences and write a reader response.
- Organise, describe, narrate, report, explain, persuade or argue, and sequence ideas and events while reading.
- Understand the difference in various narrative styles, points of view, and effects on the reader.
- Write answers and essays which are complete, with an introduction, body and conclusion with evidence and examples.
- Complete a story, write a persuasive piece, description, narrative or discursive essay.
- Understand and write an analysis of how language is used differently in various contexts – fiction and non-fiction.

VOCABULARY AND GRAMMAR

Students:

- Develop and apply understanding of functional grammar, structure and use.
- Review parts of speech, figures of speech, subject-object agreement.
- Use tenses in various forms, understand perfect tenses.
- Understand use of adverbs of time.
- Use Direct–Indirect Speech.
- Use Active/Passive voice.
- Correctly use prepositions and verbs; correctly transform sentences.
- Use a dictionary and a thesaurus.

Essential Concepts | English

Are students learning with understanding? Try asking them this question.

Read the conversation given below.

Arun: The chocolates in this shop are very expensive, aren't they?
Manav: _____?

Which of the following options shows the correct sentence that can go in the blank?
A. Yes, but the variety of chocolates they stock are very good, aren't they?
B. Yes, but the variety of chocolates they stock is very good, aren't they?
C. Yes, but the variety of chocolates they stock are very good, isn't it?
D. Yes, but the variety of chocolates they stock is very good, isn't it?

7852 students attempted this question. Around 34% of the students selected the correct answer, option D. Around 26% of the students selected option C, indicating the confusion they have around using the correct singular or plural form (*is* or *are*). Since the options talk about the 'variety', the appropriate verb would be '*is*' and not '*are*'. Around 24% of the students selected option A, indicating a similar confusion and also about whether to use 'isn't it' or 'aren't they' at the end.

Educational
Initiatives