

**SCIENTIFIC
LITERACY
CORE GROUP**

**MODULE –II
Class-IX**

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1. RATE OF EVAPORATION OF DIFFERENT LIQUIDS IN DIFFERENT SURFACE AREA/TEMPERATURES

Area: Frontiers of science and technology

Class: 9

Chapter : 1

Chapter Name : MATTER IN OUR SURROUNDINGS

Concept: Evaporation

Learning Outcomes:

Student will be able to :-

1. explain the scientific principle behind the phenomenon
2. apply scientific principle in daily life
3. communicate the findings and conclusions effectively.



We can understand the evaporation phenomenon in a best way through the following activities.

In the first activity we took different liquids e.g. acetone, ethanol, water and acetaldehyde and different laboratory apparatus having different surface area e.g. beaker, watch glass and conical flask. We took 10 ml of each liquid in these apparatuses and then observed the changes in their volume and temperature (if any) after the 30 minutes by keeping them in similar conditions. The observations were recorded in the table 1.

OBSERVATION TABLE :- VARIATION IN VOLUME OF LIQUIDS AFTER EVAPORATION IN DIFFERENT SURFACE AREA

Different surface area	Acetone (ml)	Ethanol (ml)	Water (ml)	Acetaldehyde (ml)
Beaker	9.5	9.7	9.9	9.5
Watch Glass	9.0	9.3	9.7	9.3
Conical Flask	9.5	9.6	9.9	9.5

Table:1

Name of liquid	Density	Mass of 10 ml each of different liquid $\text{MASS} = \text{DENSITY} \times \text{VOLUME}$	Mass of remaining liquid after 30 minutes at room temperature in respective beakers
Water	1 g/cc	10 gm	9.9 gm
Acetone	0.791 g/cc	7.9 gm	7.5 gm
Acetaldehyde	0.78 g/cc	7.8 gm	7.4 gm
Ethanol	0.789 g/cc	7.79 gm	7.6 gm

Table:2

In the second activity we again took 10 ml each of the different liquids e.g. acetone, ethanol, water and acetaldehyde in the same kind of apparatus i.e. beaker. We put these beakers having 10 ml each of different liquids in the same environment for 30 minutes. Here same environment means all beakers were placed in the 25⁰ C for 30 minutes and then their remaining volume were recorded (table 3). In similar way the process was repeated for 27⁰ C and so on. All the observations were recorded in the table 3.

VARIATION OF RATE OF EVAPORATION OF LIQUIDS AT DIFFERENT TEMPERATURES

Liquids (ml)	Temperatures (in Degree Celsius)			
	25 ⁰ C	27 ⁰ C	29 ⁰ C	31 ⁰ C
Acetone	9.5	9.3	9.0	8.8
Water	9.9	9.8	9.6	9.3
Acetaldehyde	9.5	9.3	9.2	9.0
Ethanol	9.7	9.4	9.2	8.9

Table:3

Based upon the above observations, now try to answer the following questions

Q1: which one of the following statements is true?

- A. Loss in mass is directly proportional to the rate of evaporation
- B. Loss in mass is inversely proportional to the rate of evaporation
- C. Loss in mass is independent of rate of evaporation
- D. None of the above

Q2: Is there any relation between the rate of evaporation and the surface area? Use the data given above to defend your answer.

Q3: Select the correct order of rate of evaporation for different liquids (table 1)

- A. Water < Ethanol < Acetaldehyde < Acetone
- B. Acetone < water < Acetaldehyde < Ethanol
- C. Water < Acetone < Ethanol < Acetaldehyde
- D. None of the above

Q4: Use the above data given in table 3 to show the relation between the change in temperature and rate of evaporation.

Q.5: How density of a liquid effects the rate of evaporation? use the data given above in order to support your answer.

Q.6 What are the factors that effect the rate of evaporation of a liquid? Use the data given above to support your answer.

Answer key:

1. A

2. Yes. Rate of evaporation is directly proportional to surface area. More the surface area more will be the rate of evaporation. highest in the case of watch glass

3. A

4. Rise in temperature will increase the rate of evaporation of liquid. Full credit if successfully uses the data to prove this relation.

5. denser the liquid lesser will be the rate of evaporation. full credits for correct reasoning and use of data given in tables

6. factors effecting the rate of evaporation. (full credit for mentioning any three)

i) density

II) surface area

III) temperature

iv) humidity

Item Description:

Q.No.	Q. Type	Competency	Knowledge	Context	Difficulty Level
1	close ended	Explaining phenomenon scientifically.	Content	Global	Low
2	Close ended	Explaining phenomenon scientifically.	Content	Global	Medium
3	Close ended	Evaluate and design scientific enquiry.	content	Global	Low
4	Close ended	Evaluate and design scientific enquiry.	content	Global	Low
5	Close ended	Evaluate and design scientific enquiry.	epistemic	Global	Medium
6.	Open ended	Evaluate and design scientific enquiry.	epistemic	Global	Low

2. ANALYSING PHYSICAL AND CHEMICAL CHANGES

Area - Frontiers of Science & Technology

Class: 9

Chapter : 2

Chapter Name : IS MATTER AROUND US PURE ?

Concept–Physical and Chemical Changes

Learning Outcomes:

Student will be able to :-

1. differentiate physical and chemical changes
2. apply this scientific principle in daily life.

Changes occurring around us can be physical or chemical a physical change is one in which physical properties of substance change without a change in its chemical composition. As a result a substance changes its form, but not its chemical composition.

Physical changes are usually reversible and temporary. Everyday examples of physical changes are drying of wet clothes tearing papers into pieces, melting of wax, chopping of wood and freezing of water to get ice.

A chemical change is one in which new and different substances are formed. The substance or substances formed have properties different from those of the materials that combined during the change. The change is usually irreversible and permanent.

Based on above information answer the following questions –

Q.No.1 Which are the following changes cannot be reversed?

- a) Hardening of cement b) Freezing of ice cream
c) Opening of a door d) Melting of chocolate.

Q.No.2 Pick the change that can be reversed?

- a) Cutting of tree b) Melting of Ghee
c) Burning of candle d) Blooming of flower.

Q.No.3 While lighting a candle, Ria observed the following changes-

- i) Wax was melting ii) Candle was burning
iii) Size of the candle reducing iv) Melted wax as getting solidified

Of the above, the changes that can be reversed are

- a) i& ii b) ii & iii
c) iii & iv d) i& iv

Q.No.4 Salt can be separated from its solution as

- a) Mixing of salt in water is a change that can be reversed by heating and melting of salt.
b) Mixing of salt in water is a change that can't be reversed.
c) It is permanent change.
d) It can be reversed by evaporation.

Answer Key:

1. a

2.b

3.d

4.d

Scoring:

1.Full credit :a ; No credit if Any other response

2.Full credit :b; No credit if Any other response

3.Full credit : d)i and iv; No credit if Any other response

4.Full credit :d ; No credit if Any other response

Item description:

Q.No	Q.type	Competency	Knowledge	Context	Difficulty level
1.	Close constructed	Interpret data and evidence scientifically	Procedural	Global	Medium
2.	Open ended	Interpret data and evidence scientifically	Content	Personal	Low
3.	Open ended	Explain phenomenon scientifically	Content	Global	Medium
4.	Close constructed	Interpret data and evidence scientifically	Content	Personal	Low

3. IS MATTER AROUND US PURE ?

Area : Frontiers of Science & Technology

Class: 9

Chapter : 2

Chapter Name : IS MATTER AROUND US PURE ?

Concept: Solubility

Learning Outcomes:

Student will be able to :-

1. analyse and interpret data scientifically
2. differentiate between saturated and unsaturated solutions
3. communicate the findings and conclusions effectively.

Solubility of a substance is given as grams of a substance dissolved in 100 grams of water to form a saturated solution.

A student studied the solubility of four different substances at different temperatures and collected the following data.

Temperature (in Kelvin)	283	293	313	333	353
Substance dissolved	Solubility				
A	22	33	63	104	166
B	37	37	37	38	38
C	36	37	41	45	53
D	25	38	42	54	64

Based on above information answer the following questions –

Q.No. 1 What mass of A would be required to produce its saturated solution in 50 grams of water at 313K?

Q.No. 2 Which salt has the highest solubility at 293 K?

Q.No.3 What is the effect of temperature on the solubility of salt ?

Q.No.4 On the solubility of which salt the effect of temperature is minimum?

Q.No.5 The student prepares a saturated solution of C at 353 K and then cools it to room temperature. What would he observe ?

Q.No. 6A saturated solution of salt C was prepared at 333K and then it was cooled to 293 K .
What mass of the salt would reappear ?

Answer Key:

- I) Full credit :31 g
- II) Full credit :D
- III) Full credit :It increases
- IV) Full credit :B
- V) Full credit :Crystals of salt C
Partial credit: solubility reduces
- VI) Full credit :8g

Item Description:

Q.No	Q.type	Competency	Knowledge	Context	Difficulty level
1.	Close constructed	Interpret data and evidence scientifically	Procedural	Personal	Medium
2.	Close constructed	Interpret data and evidence scientifically	Procedural	Personal	Low
3.	Open ended	Explain phenomenon scientifically	Content	Global	Medium
4.	Close constructed	Interpret data and evidence scientifically	Procedural	Personal	High
5.	Open ended	Explain phenomenon scientifically	Content	Global	Medium
6.	Close constructed	Interpret data and evidence scientifically	Procedural	Personal	High

4.BANANA OIL

Area : Frontiers Of Science And Technology

Class: 9

Chapter : 3

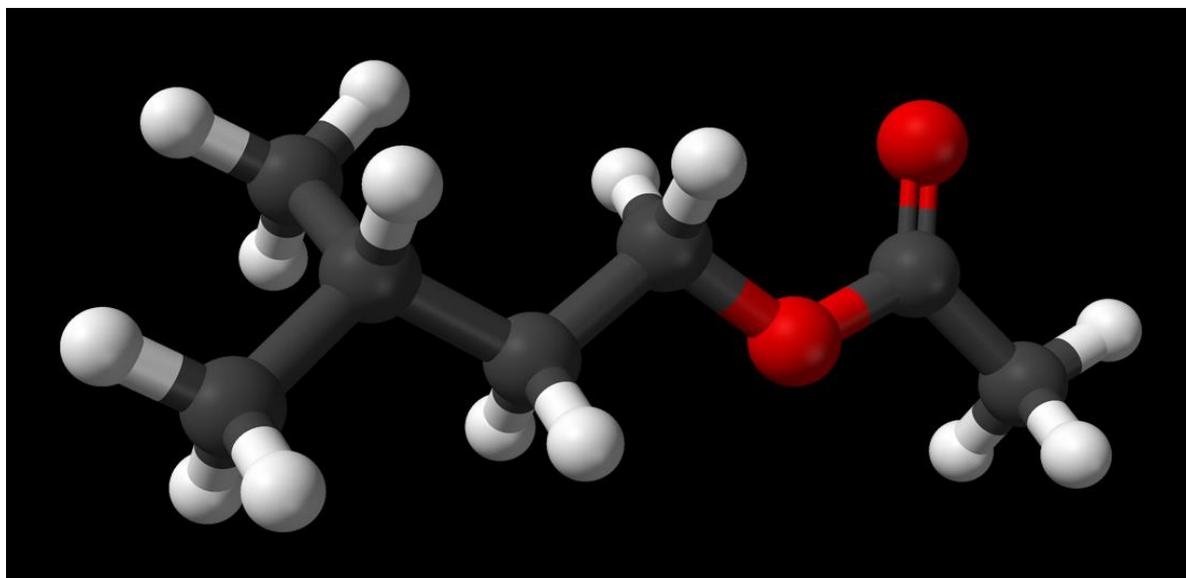
Chapter Name : ATOMS AND MOLECULES

Concept: Synthesis

Learning Outcomes:

Student will be able to :-

1. calculate the molecular mass and percentage of elements in compound
2. analyse and interpret the given data
3. use scientific symbols of elements and formulae of compounds.



Isoamyl acetate – an ester with molecular formula $C_7H_{14}O_2$, also called isopentyl acetate is a clear, colourless liquid with a pleasant fruity odour and taste of pears or bananas. When prepared for industrial or commercial use, it is often known as pear or banana oil. It is made commercially by reacting acetic acid with amyl alcohol $C_4H_9CH_2OH$. It is slightly soluble in water, and soluble in most



(a)



(b)

organic solvent.

It is a very popular additive for imparting a pleasant odour or smell to commercial products. Since 1976, the US Patent office has issued 1,174 patents for inventions that contain the compound.

When a bee stings, it leaves behind traces of isoamyl acetate at site of the sting surprisingly the bees release about 1 microgram of this compound in this sting. It then attracts other bees to the same site accounting for tendency for an individual to receive multiple stings at the same point on one's body.

One species of Japanese honey bees defends itself from attacks by hornet predators by surrounding the hornet with a ball that consists primarily of isoamyl acetate. The ball becomes so hot that the hornet dies.

It is also an irritant to the skin, eyes and respiratory and digestive systems.

QUESTIONS

- What is the molecular mass of the ester?
 - 74 u
 - 130u
 - 122u
 - 80u
- Calculate the mass of one molecule of ester in grams?
- Calculate the mass percentage of Carbon in the ester.
- How many molecules of isopentyl acetate will weigh one gram?
- How many moles and molecules of isopentyl acetate are released in a typical bee sting?

Answers:

- Score 2 if response is b
 - Score 0 for any other response

Answer key:

- 21.587×10^{-23}
- 64.61%
- 4.63×10^{21} molecules
- 7.692×10^{-9} Mol, 4.623×10^{15} molecules

Item Description:

Q. No.	Q. Type*	Competency**	Knowledge***	Context [#]	Difficulty level ^{##}
1	complex multiple choice	Explain phenomenon scientifically	Content	Local	Low
2	close constructed	Evaluate and design scientific inquiry	Epistemic	Local-National	Medium
3	close constructed	Evaluate and design scientific inquiry	Epistemic	Local-National	Medium
4	close constructed	Evaluate and design scientific inquiry	Epistemic	Local-National	Medium
5	close constructed	Interpret data and evidence scientifically	Content	Global	Medium

5. MY BEST FRIEND- CHEMISTRY

Area: Frontiers of Science & Technology

Class: 9

Chapter : 3

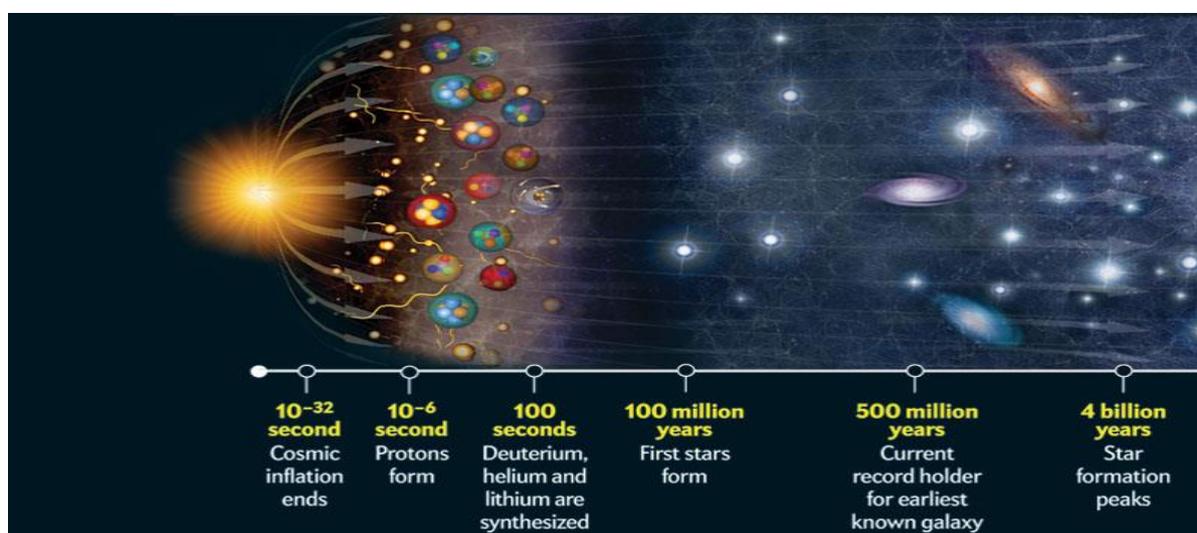
Chapter Name : ATOMS AND MOLECULES

Concept- Big-Bang Theory

Learning Outcomes:

Student will be able to :-

1. describe scientific discoveries
2. understand the concept of nuclear fusion
3. indentify phenomena of expanding universe and red shift.



Where on Earth!! No, Where and from when in the Universe we can distinctly say THIS is CHEMISTRY. In terms of chemical processes, nuclear process or chemical species- can you imagine any sphere of life which we can separate from contributions of chemistry or process which are a part of chemistry? Chemistry between people is also much in discussion nowadays!! Let us Go back to start of Universe. Time Zero. The Big Bang. The big bang is how astronomers explain the way the universe began. It is the idea that the universe began as just a single point, then expanded and stretched to grow as large as it is right now (and it could still be stretching). In 1927, an astronomer named Georges Lemaitre had a big idea. He said that a very long time ago, the universe started as just a single point. He said the universe stretched and expanded to get as big as it is now, and that it could keep on stretching. In 1929 the American astronomer Edwin Hubble discovered that the distances to far-away galaxies were proportional to their red shifts. Red shift occurs when a light source moves away from its observer: the light's apparent wavelength is stretched via Doppler effect towards red part of the spectrum. Hubble's observation implied that distant galaxies were moving away from us, as the furthest galaxies had fastest apparent velocities. If galaxies are moving away from us, reasoned Hubble, then at some time in the past, they must have been clustered close together. Hubble's discovery was the first observational support for Georges Lemaitre's Big Bang

theory of the universe. In the first moments after the Big Bang, the universe was extremely hot and dense. As the universe cooled, conditions became just right to give rise to the building blocks of matter – the quarks and electrons of which we are all made. A few millionths of a second later, quarks aggregated to produce protons and neutrons. Within minutes, these protons and neutrons combined into nuclei. As the universe continued to expand and cool, things began to happen more slowly. It took 380,000 years for electrons to be trapped in orbits around nuclei, forming the first atoms. These were mainly helium and hydrogen, which are still by far the most abundant elements in the universe. 1.6 million years later, gravity began to form stars and galaxies from clouds of gas. Heavier atoms such as carbon, oxygen and iron, have since been continuously produced in the hearts of stars and catapulted throughout the universe in spectacular stellar explosions called supernovae.

Questions

1. How does the Big Bang theory relate to chemistry?
2. The big bang theory explains the formation of the
 - a) Earth
 - b) Sun
 - c) Universe
 - d) Solar system
3. What does the Big-Bang theory suggest?
 - a) The universe was there
 - b) Universe is continually expanding
 - c) The milky way is the only solar system
 - d) The universe is collapsing
4. What were the original two elements in our universe?
 - a) Lithium and Carbon
 - b) Hydrogen and Neon
 - c) Helium and Chlorine
 - d) Hydrogen and Helium
5. How is the “Big-Bang” described?
 - a) Explosion
 - b) Expansion
 - c) Contraction
 - d) All above
6. As the galaxies move away from our galaxy, a shift on the electromagnetic spectrum is observed. This phenomenon is called _____
7. The universe is expanding! Explain

Answer key:

1. One of the primary successes of the **Big Bang theory** is its explanation for the **chemical** composition of the universe. The universe is mostly hydrogen and helium, with very small amounts of heavier elements.
2.
 - response Score 2 if response is c
 - Score 0 for any other
3.
 - Score 2 if response is b
 - Score 0 for any other response
4.
 - Score 2 if response is d
 - Score 0 for any other response
5.
 - Score 2 if response is b
 - Score 0 for any other response
6. Red shift

Item Description:

Q. No.	Q. Type	Competency	Knowledge	Context	Difficulty level
1	close constructed	Evaluate and design Scientific enquiry	procedural	Global	Medium
2	simple multiple choice	Explain phenomenon scientifically	Content	Global	Low
3	simple multiple choice	Explain phenomenon scientifically	Content	Global	Low
4	simple multiple choice	Explain phenomenon scientifically	Content	Global	Medium
5	simple multiple choice	Explain phenomenon scientifically	Content	Global	Medium
6	close constructed	Evaluate and design Scientific enquiry	procedural	Global	Medium
7	Open ended	Interpret data and evidence Scientifically	Epistemic	Global	Medium

6. SUBATOMIC PARTICLES

Area : Frontiers Of Science And Technology

Class: 9

Chapter : 4

Chapter Name : STRUCTURE OF THE ATOM

Concept: Structure of atom

Learning Outcomes:

Student will be able to :-

1. analyse and interpret data
2. draw conclusions from given data
3. calculate mass number, atomic number and number of subatomic particles.

Read the table carefully

Symbol	Mass number	Atomic number	Protons	Neutron	Electron
A	64	30	O	R	T
B	90	38	P	S	U
C	K	M	43	56	V
D	L	N	Q	44	36

Q. 1 Write the values from K to V

Q. 2 Which of the particle out of A ,B ,C, D is expected to be a cation and anion

Q.3 Suppose you are provided with two elements X AND Y. Which of these will be more reactive if atomic number of X is 18 and that of Y is 16.

Q. 4 Which subatomic particle is likely to decide the chemical reactivity of an element

Answer key:

Answer 1:

O = 30 R=34 C = 30

P= 38 S =52 U=36

K=99 M=43 V =43

L=79 N=35 Q=35

Answer 2: B AND D

Answer 3: Y is more reactive as valency of X is zero

Answer 4: electron in Valence shell

Item Description:

Q number	Q type	Competency	Knowledge	Context	Difficulty level
1	Close constructed	Interpret data and evidence scientifically	Epistemic	Personal	Medium
2	Close constructed	Interpret data and evidence scientifically	Epistemic	Personal	Medium
3	Close constructed	Interpret data and evidence scientifically	Epistemic	Personal	Medium
4	Close constructed	Interpret data and evidence scientifically	Epistemic	Personal	Medium

7. NUCLEAR MODEL OF ATOM

Area: frontiers of science and technology

Class: 9

Chapter : 4

Chapter Name : STRUCTURE OF THE ATOM

Concept: Structure of the atom

Learning Outcomes:

Student will be able to :-

1. describe scientific discoveries
2. analyse and interpret properties of subatomic particles.

Thomson's model could not provide satisfactory explanation for the stability of atom. In 1911, Rutherford performed series of experiments which lead to the new atomic model . His experiments involved the bombardment of alpha particles on thin gold foil. There was a narrow beam of alpha particles passing through a slit in a lead plate. The deflection of alpha particles was noted by placing a circular screen coated with zinc sulphide. Such a screen is also called fluorescent screen.

Q 1 If alpha particles are nucleus of helium then what kind of particles are expected to deflect them.

Q 2 A student proposed that in place of gold , the aluminium foil could be used as it is also malleable. What property of gold particles is he ignoring.

Q 3 The beam of alpha particles are passed by lead slit . What could be the probable reason for this supposing that lead absorbs the radioactive radiation.

Q 4 Can an experiment of this kind be able to detect neutral particles. Give reason .

Answer key:

Answer 1 : positively charged particles

Answer 2: The gold atom is heavy and it can sustain the alpha particles bombardment.

Answer 3: This is done to obtain a narrow beam of alpha particles.

Answer 4: no as the charged particles could only be deflected by the positively charged nucleus.

Item description

numb	Questions type	Knowledge	Context	Difficulty level
1	Interpret data and evidence scientifically	Epistemic	Personal	Medium
2	Evaluate and design scientific enquiry	Epistemic	Personal	Medium
3	Interpret data and evidence scientifically	Content	Personal	Medium
4	Explain phenomenon scientifically	Procedural	Personal	Medium

8.CELL AND IT'S ORGANELLES

Area: Frontiers of science and technology

Class: 9

Chapter : 5

Chapter Name : THE FUNDAMENTAL UNIT OF LIFE

Concept: Cell and it's organelles

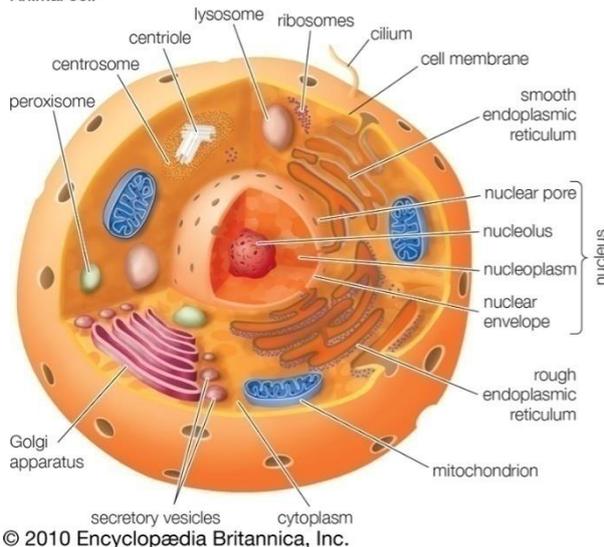
Learning Outcomes:

Student will be able to :-

1. design 3-D models of cells
2. draw and label the diagrams of cells
3. explain the structure and functions of cells and their organelles.

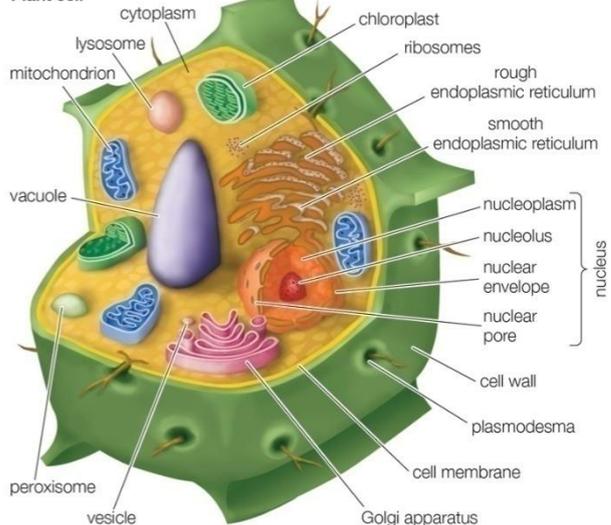
Typical animal cell and plant cell

Animal cell



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Plant cell



The cell is a basic structural, functional and biological unit of all known organisms. It contains many biomolecules such as proteins and nucleic acids. The environment outside the cell is separated from inside the cell by cell membrane. Some cells move throughout the body and other attached to one another. Cytoplasm and nucleus are two major compartments of cell. Cytoplasm contains structures that consume and transform energy and perform cell's functions. The nucleus contains cell's genetic material and the structures that control cell division and reproduces. Cell membrane regulates what passes in and out of the cell. The mitochondria are the tiny structures that provide the cell with energy.

Answer the following questions:

1. The structured organelles that contain genetic material is:

- (a) Cell wall
- (b) Ribosomes
- (c) Nucleus
- (d) Mitochondria

2. Protoplasm found inside the nucleus is known as:

- (a) Amyloplast
- (b) Nucleoplasm
- (c) Cytoplasm
- (d) Cell liquid

3. Cell sap is a:

- (a) Living content of the cell
- (b) Non-living content of the vacuole
- (c) Non-living content of the protoplasm
- (d) Living content of the cytoplasm

4. What do prokaryotic cell lack?

- (a) Cell membrane
- (b) Cytoplasm
- (c) Cell wall
- (d) Membrane bound nucleus

5. Which of the following is not considered as a part of the endomembrane system?

- (a) Vacuole
- (b) Lysosome
- (c) Golgi complex
- (d) Peroxisome

6. Animal cell different from plant cells in possessing:

- (a) Plastid
- (b) Golgi bodies
- (c) Vacuoles
- (d) Centrosomes

7. Cell was discovered by:

- (a) Robert Brown
- (b) Schleiden and Schwann
- (c) Leeuwenhoek
- (d) Robert Hook

8. Which of the following statement is true about the cell?

- (I) Mitochondria are powerhouse of cell
- (II) Smooth endoplasmic reticulum makes lipids
- (III) Prokaryotic genetic system has neither DNA nor histone
- (IV) Eukaryotic has chemically complexed cell wall

(a) (I), (III), (IV)

(b) (I), (II), (III)

(c) (I), (III)

(d) (I), (II)

9. Name the organelle which serves as a primary packaging area for molecules that will be distributed throughout the cell:

- (a) Mitochondria
- (b) Golgi apparatus
- (c) Plastids
- (d) Vacuole

10. Animal cell differ from plant cell in possessing:

- (a) Plastid
- (b) Golgi bodies
- (c) Centrosome
- (d) Vacuole

Item description:

Q.No.	Q. Type	Competency	Knowledge	Content	Difficulty level
1.	Simple MCQ	Explain phenomenon scientifically	Content	Global	Medium
2.	Simple MCQ	Explain phenomenon scientifically	Content	Global	Medium
3.	Simple MCQ	Explain phenomenon scientifically	Content	Global	Medium
4.	Simple MCQ	Explain phenomenon scientifically	Content	Global	Medium
5.	Simple MCQ	Explain phenomenon scientifically	Content	Global	Medium
6.	Simple MCQ	Explain phenomenon scientifically	Content	Global	Medium
7.	Simple MCQ	Explain phenomenon scientifically	Content	Global	Medium
8.	Simple MCQ	Evaluate and design scientific enquiry	Epistemic	Global	Medium
9.	Simple MCQ	Explain phenomenon scientifically	Content	Global	Medium
10.	Simple MCQ	Explain phenomenon scientifically	Content	Global	Medium

Answer Key:

1	c	6	D
2	b	7	D
3	b	8	d
4	d	9	b
5	d	10	c

9. ACTIVE AND PASSIVE MOVEMENT OF IONS

Area: Living System

Class: 9

Chapter : 5

Chapter Name : THE FUNDAMENTAL UNIT OF LIFE

Concept: Diffusion

Leaning Outcomes:-

Student will be able to :-

1. analyse and interpret data
2. explain osmosis
3. differentiate between osmosis and diffusion.

Scientists dipped a layer of plant cells in Concentrated salt solution (A solⁿ) and a mixture of salt solution and freshwater (B solⁿ) . They monitored the movement of sodium, chloride and potassium ions in both these cases and found that the concentration of water did not change. The observations of the scientists are given below:

Ions	Ion concentration		
	Plant Cell	Concentrated salt solution (A sol ⁿ)	Mixture of salt solution and fresh water (B sol ⁿ)
Sodium	70	400	40
Chloride	440	440	80
Potassium	667	13	2.4

Assuming that the cell membrane is fully permeable to these ions-

(a) Which ion will be able to enter through diffusion from the sea water, but will have to be transported actively inside, when kept in the Mixture of salt water and fresh water? Give reason.

.....
.....
.....

(b) Which of the ion will have to be transported actively in both solutions A and B? Give reason

.....
.....
.....

(c) How do plants survive in sea waters which have high ionic concentrations? Explain

.....
.....
.....

Answer Key:

(a) Sodium, as it will move passively from higher conc. in A soln to low conc. inside the cell but it has to moved inside actively when place in soln B as it needs to be moved from lower conc. to higher conc.

(b) Potassium, as its conc. is higher inside the cell as compared to Soln. A and Soln. B

(c) By the Process of Osmoregulation, performed by contractile vacuoles present inside the cell, they maintain the osmotic balance of the cell.

Scoring:

(a) Score 1 for correct response and 2 if explanation is correctly written.

(b) Score 1 for correct response and 2 if explanation is correctly written.

(c) Score 2 for correct explanation.

Item Description:

Q. No.	Q. Type	Competency	Knowledge	Context	Difficulty level
a	Closed constructed	Evaluate and design scientific enquiry	content	Global	Medium
b	Closed constructed	Evaluate and design scientific enquiry	content	Global	Medium
c	Closed constructed	Interpret data and evidence scientifically	content	Global	High

10. ENDOCYTOSIS

Area: Health

Class: 9

Chapter : 6

Chapter Name : TISSUES

Concept: Endocytosis

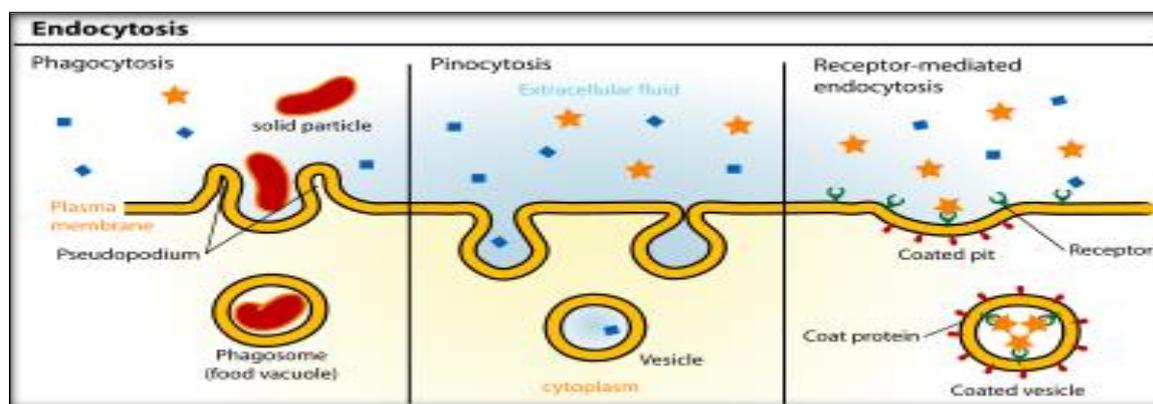
Learning Outcomes

Student will be able to :-

1. explain the process of endocytosis
2. apply imagination and draw the conclusions
3. relate the processes taking place in endocytosis.

Imagine you are a macrophage: a merciless white blood cell that stalks, amoeba-like, through the tissues of the body, looking for pathogens, dead and dying cells, and other undesirables. When you encounter one of these, your task is not just to destroy it, but to devour it whole. (Chomp!)

Q1. So imagining that you are a white blood cell, where would you be found in the human body?



(Source- Mariana Ruiz Villarreal [LadyofHats](https://en.wikipedia.org/wiki/Endocytosis) - Own work/https://en.wikipedia.org/wiki/Endocytosis)

How does a macrophage “eat” a pathogen or a piece of cellular debris? The cells need

bulk transport mechanisms, in which large particles (or large quantities of smaller particles) are moved across the cell membrane. These mechanisms involve enclosing the substances to be transported in their own small globes of membrane, which can then bud from or fuse with the membrane to move the substance across. For instance, a macrophage engulfs its pathogen dinner by extending membrane "arms" around it and enclosing it in a sphere of membrane called a food vacuole (where it is later digested).

Q2. Reading the above paragraph, Can you relate the above process to the mode of nutrition of a single celled organism that you may have read about? Name any one such organism. Write the steps of ingestion of food by the organism you have named.

Endocytosis (*endo* = internal, *cytosis* = transport mechanism) is a general term for the various types of active transport that move particles into a cell by enclosing them in a vesicle made out of plasma membrane.

Q3. Active transport is the transport in which energy of the cell is used. On the other hand in passive transport no energy is used. Then how does passive transport actually take place? Write your answer in the box given below-

Phagocytosis (literally, “cell eating”) is a form of endocytosis in which large particles, such as cells or cellular debris, are transported into the **Pinocytosis** (literally, “cell drinking”) is a form of endocytosis in which a cell takes in small amounts of extracellular fluid.

Q4. You all must have read about cell organelles. Which process out of phagocytosis or pinocytosis, the Lysosomes performs? Why?

Receptor-mediated endocytosis is a form of endocytosis in which receptor proteins on the cell surface are used to capture a specific target molecules i.e. the molecules that the cells need. However sometimes less friendly particles may gain entry by the same route. Flu viruses, diphtheria, and cholera toxin all use receptor-mediated endocytosis pathways to gain entry into cells.

(Source- <https://www.khanacademy.org/science/biology/membranes-and-transport/bulk-transport/a/bulk-transport>)

Q5. In the above text the word “Specific Target molecules” has been used. These target molecules are represented by a ☆ in the figure shown above, which are recognised by the receptors on the surface of plasma membrane. If you are a non friendly pathogen and want to seek entry into the cell, what would be your strategy?

Answer Key:

- (1) Blood and lymph
- (2) Amoeba, paramecium, algae (any one)

The process in which the food is ingested by these single celled organism which includes food approaching the organism, formation of finger like projections, these projections surround the food, form a food vesicle and then pinch off the membrane to ingest the food.

- (3) Passive transport takes place by diffusion.
- (4) Phagocytosis. Lysosomes engulf the worn out and dead parts of the cells and digests them to release nutrients.
- (5) Strategies can be any of the following-
 - I can take up the shape of a star
 - my surface has same protein as that of the useful materials.
 - I can change the surface of the cell, in which I want to enter.

Scoring:

- (1) Partial credit if any one option mentioned and full credit for both.
- (2) Partial credit for naming the organism correct and full credit for explaining the process.
- (3) No partial credit.
- (4) Partial credit for naming the process correct and full credit for explaining the reason.
- (5) Any one strategy full credit,

Item Description:

Q. No.	Q. Type	Competency	Knowledge	Context	Difficulty level
1	Closed constructed	Explain the process scientifically	content	Personal	Low
2	Open constructed (human coded)*	Explain the process scientifically	content	Personal	Medium
3.	Closed constructed	Explain the process scientifically	content	Personal	Medium
4.	Closed constructed	Explain the process scientifically	content	Personal	Medium
5.	Open constructed (human coded)	Explain the process scientifically	content	Personal	High

*human coded question is the one that is open ended, can have multiple answers hence the examinee checks and can take responses other than given in the answer key.

11. BLOOD A CONNECTIVE TISSUE

Area : Health

Class: 9

Chapter : 6

Chapter Name : TISSUES

Concept: Connective Tissues

Learning Outcomes :-

Student will be able to :

1. understand the role of blood in regulating the body temperature
2. explain the various functions of blood in a human body
3. draw information from mentioned figure.

Blood is a specialized body fluid. It has four main components: plasma, red blood cells, white blood cells, and platelets. Blood has many different functions, such as transporting oxygen and nutrients to the lungs and tissues; forming blood clots to prevent excess blood loss, carrying cells and antibodies that fight infection; bringing waste products to the kidneys and liver, which filter and clean the blood and regulating body temperature



The figure above shows one type of blood cells performing a specialised function. Observe the figure and answer the questions given below

Q1. What is happening in the figure given above? Draw conclusion from the figure.

.....

Q2. How do you think the process depicted above helps maintain a balanced internal environment?

.....

Answer Key:

(a) The blood cells are eating the infection causing organisms. We can conclude that these are the white blood cells that fight infection. The process may be referred to as phagocytosis.

(b) This helps to keep our body free from infections that are present around us. Thus helping in maintaining a healthy internal environment.

Scoring:

(a) 1 score for writing what is happening. 2 scores if explanation is also given

Item Description:

Q. No.	Q. Type	Competency	Knowledge	Context	Difficulty level
1	Closed constructed	Explain the process scientifically	content	Personal	Low
2	Closed constructed		content	Personal	Medium

12. RELATIONSHIP BETWEEN TEMPERATURE AND EXERCISE

Area: Health

Class: 9

Chapter : 6

Chapter Name : TISSUES

Concept: Muscle's Activities

Learning Outcomes:-

Student will be able to :

1. analyse and interpret the data
2. design the experiment and record data
3. draw conclusions regarding effects of exercise on human body temperature.

A student sets up an experiment to study the effect of muscle activity on body temperature. The student decides to use the school gym as the site of the experiment and ensures that the internal temperature of the gym is maintained at 25⁰ C, while the experiment is being conducted. He chooses 5 boys and 5 girl volunteers as participants. He gives the following instructions to the participants and asks them to eat one plate rice and daal 2hrs before beginning the exercise. Then he asks them to run at the same speed on the treadmill for 15mins. After that he measures their body temperature for 8 days and notes them in the table below:

Participants	Gender	Temperature in °F							
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Participant 1	Male	98.6	98.8	98.7	98.8	98.6	98.5	98.7	99
Participant 2	Male	98.8	98.6	98.7	98.8	98.6	98.7	98.8	99
Participant 3	Male	98.7	98.7	98.9	98	98.6	98.7	98.6	99
Participant 4	Male	98.9	98.6	98.8	98.9	98.7	98.9	98.8	98.6
Participant 5	Male	98.5	98.5	98.4	98.6	98.7	98.9	98.7	98.6
Participant 6	Female	99	98.7	98.6	98.5	98.7	98.9	98.7	99
Participant 7	Female	100	100	101	100	99	98	98.6	98.7
Participant 8	Female	98.7	98.7	98.7	98.9	98.7	98.7	98.7	98.6
Participant 9	Female	98.6	99	98.6	98.9	98.6	98.6	98.7	98.6
Participant 10	Female	97	98	98.6	99	98.7	98.6	98.7	98.6

After the experiment the student comes to the following conclusion :

The body temperature of only those females who put in all energy while exercising increases after exercising.

Read the above carefully and answer the following:

- (a) Identify the control variables in the above experiment.

.....
.....
.....

(b) What is the main fault in the design followed by the student?

.....
.....
.....

(c) Do you agree with the conclusion made by the student? Give reasons.

.....
.....
.....

Answer Key:

- (a) Controls are diet, time before which the food should be eaten, temp of the gym, type of exercise, duration of exercise.
- (b) Initial temperature of the body was not taken, Sweating and other factors that help maintain body temperature were not taken into account.
- (c) the conclusion seems incorrect as the design of the experiment was faulty hence we cannot be sure of the results/ it might be that the initial body temp of that particular is high in general/ that participant may be suffering from fever.

Scoring:

- (a) 0.5 for every correct control identified. 2 scores if any four identified.
- (b) 1 scores for any one fault identified in the design. 2 scores if any two identified.
- (c) 1 score if disagree. 2 scores if any reason discussed.

Item Description:

Q. No.	Q. Type	Competency	Knowledge	Context	Difficulty level
a	Closed constructed	Evaluate and design scientific enquiry	procedural	global	Medium
b	Open ended	Evaluate and design scientific enquiry	procedural	global	Medium
c	Open ended	Interpret data and evidence scientifically	Epistemic	global	High

13.AVES

Area: Natural Resources

Class: 9

Chapter : 7

Chapter Name : DIVERSITY IN LIVING ORGANISMS

Concept: Preen glands

Learning Outcomes :-

Student will be able to:-

1. explain the process of sweating/secretion
2. relate these processes with metabolic rate.

Aves are bipedal, warm blooded animals..Skin is covered with feathers with bare skin patches on legs, feet, and face. No sweat glands except oil or preen gland at base of tail .Birds have the highest body temperatures of any animal with the highest metabolic rate in terms of energy needed per gram of body mass.

Q1.Birds do not have sweat glands but some physical characteristics and certain behaviors help birds in hot climates to keep cool.

Select the correct option/s and give suitable reasons:

- i) Rapid respiration rate.
- ii) Bare skin patches on the legs, feet, and face.
- iii) They may also hold their wings away from their bodies.
- iv) Just like dogs, wild birds open their bills and pant
- v) Some tropical birds have large bills with a rich blood supply.

Q2. The gland that secretes the oily substance which keeps the feather waterproof

- i) sudoriferous gland ii) preen gland iii) both i and ii iv) none of these

Birds have white and red muscle fibres. White muscles are not well supplied with capillaries and do not contain much myoglobin to help store oxygen. The red muscle fibres have high concentration of myoglobin. **Myoglobin**, like the the hemoglobin in our red blood cells, binds oxygen.

Q 3. What kind of muscles long distance migratory birds should have for sustained flight? Select the correct option supported with appropriate reason

- i) White muscle fibres suitable for powerful and fast contractions but tire quickly.
- ii) Red muscles fibres can do slow and steady work but do not tend to fatigue.
- iii) White muscle fibres can do slow and steady work but tire quickly.
- iv) Red muscles are suitable for powerful and fast contractions but tend to fatigue.

Answer/Key (Aves)

Ans 1.All are correct Reason : allow greater heat dissipation full credit ,any other response no credit

Ans 2 ii full credit,any other response no credit

Ans 3.ii fullcredit , any other response no credit

Item description

Q.No	Q.Type	Competency	Knowledge	Context	Difficulty level
1	Complex multiple	Scientific enquir	epistemic	Global	High
2	Simple multiple	Scientific enquir	content	Global	Medium
3	multiple	Scientific enquir	content	Global	High

14. FUNGI

Area: Natural Resources

Class: 9

Chapter : 7

Chapter Name : DIVERSITY IN LIVING ORGANISMS

Concept: Types of fungi

Learning Outcomes

Student will be able to

1. classify different types of fungi
2. understand the germination process of uninucleate.

Agaricus primary mycelium originates by the germination of uninucleate basidiospores carrying either + or - strain. The cells are uninucleate i.e. monokaryotic. It is short lived and becomes bi-nucleate by fusion of two compatible hyphae. The secondary mycelium originates from primary mycelium and produces the fruiting body called basidiocarp above the ground

Q1. The nature of hyphae of the fruiting body is dikaryotic or monokaryotic. Give reason for your answer

Q2 Identify the nature of spores produced by the basidiocarp and they are the product of which type of cell division

- i) Uninucleate and meiosis
- ii) binucleate and mitosis
- iii) Multinucleate and meiosis
- iv) uninucleate and mitosis

Q3. Which of the following statements about mushrooms is not correct

- i) Cell wall is made of chitin
- ii) They contain glycogen and oil as stored food material
- iii) They are saprophytes
- iv) Photosynthetic pigments are present

Q4 Write Yes or No against each of the following statements about lichens.

1. Mycobionts live in symbiotic association with phycobiont
2. Symbiotic association between a fungus and roots of a vascular plants
3. They are extremely sensitive to air pollution
4. They release organic acid that cause weathering of rocks

Answer/ Key(Fungus)

- 1) Dikaryotic as fusion of two hyphae full credit , any other response no credit
- 2) i) full credit ,any other response no credit
- 3) iv) full credit ,any other response no credit
- 4) Yes, No,Yes,Yes full credit , any other response no credit

Item Description:

Q.No	Q.Type	Competency	Knowledge	Context	DifficultyLevel
1	Close constructed	Interpret data	content	Global	High
2	Simple multiple	Scientific enquiry	content	Global	Medium
3	Simple multiple	Scientific enquiry	content	Global	Medium
4	Simple multiple	Scientific enquiry	Epistemic	Global	Medium

15.MOTION

Area: Frontiers Of Science And Technology

Class: 9

Chapter : 8

Chapter Name : MOTION

Concept: Speed

Learning Outcomes:-

Student will be able to :-

1. apply scientific concept in everyday life
2. calculate distance, speed and time by using the given data
3. analyse and interpret the data.

Feroz and his sister Sania go to school on their bicycles. Both of them start at the same time from their home but take different times to reach the school although they follow the same route. Table shows the distance travelled by them in different times	Distance covered by Feroz and Sania at different times on their bicycles		
	Time	Distance travelled by Feroz (km)	Distance travelled by Sania (km)
	8:00 am	0	0
	8:05 am	1.0	0.8
	8:10 am	1.9	1.6
	8:15 am	2.8	2.3
	8:20 am	3.6	3.0
	8:25 am	-	3.6

Based on the above information try to answer the following questions:-

Q.1 Which two variables regarding motion are shown in the above information?

.....

Q.2 Who reaches the school first? Can you explain scientifically the reason for reaching the school first?

.....
.....

Q.3 Calculate total time taken by

(i) Feroz

.....
.....

(ii) Sania

.....
.....

Q.4 What is average speed (In Km/Hours) of

(i) Feroz

.....
.....

(ii) Sania

.....
.....

Item Description:

Q no .	Question type	Competen cy	Knowledg e	Context	Difficult y level
Q1	Closed constructed	Interpret data and evidence scientificall y	Content	Personal	Low
Q 2	Open Ended	Interpret data and evidence scientificall y	Content	Personal	Medium
Q 3	Closed constructed	Interpret data and evidence scientificall y	Procedural	Personal	Medium
Q4	Closed constructed	Interpret data and evidence scientificall y	Procedural	Personal	High

Answer/Scoring key:

Answer 1 Distance and time.

Answer 2 Feroz, Because his speed is more than Sania.

Answer 3 (i) Feroz took 20 Minutes

(ii) Sania took 25 Minutes

Answer 4 (i) For Feroz

$$\text{Total Time} = 20 \text{ Minutes} = \frac{20}{60} = \frac{1}{3}$$

$$\text{Total Distance} = 3.6 \text{ Km}$$

$$\text{Average Speed} = \frac{3.6}{\frac{1}{3}} = 3.6 \times 3 = 10.8 \text{ Km/Hour}$$

(ii) For Sania

$$\text{Total Time} = 25 \text{ Minutes} = \frac{25}{60} = \frac{5}{12}$$

$$\text{Total Distance} = 3.6 \text{ Km}$$

$$\text{Average Speed} = \frac{3.6}{\frac{5}{12}} = 3.6 \times \frac{12}{5} = \frac{43.2}{5} = 8.64 \text{ Km/Hour}$$

16. WAS ARISTOTLE RIGHT?

Area: Frontiers of Science And Technology

Class: 9

Chapter : 9

Chapter Name : FORCE AND LAWS OF MOTION

Concept: Laws of Motion

Learning Outcomes:

Student will be able to:-

1. apply learning in hypothetical situations
2. analyse and interpret different variables involved in motion
3. exhibit values of rational thinking.

The famous Greek philosopher Aristotle who lived in the 4th century B.C. (384-322) is known, not without reason, as The Father of Science. His contribution to the development of natural science including physics is tremendous. However, Aristotle's views and deductions do not coincide with those accepted now. Let us take one of his arguments as an example.

He argued that a stone falls with a certain velocity. If we fix another stone on top of the original one, then the upper stone will push the lower one, so the lower one will fall faster.

Meanwhile, it has now been strictly established that all bodies, irrespective of their mass, fall with same acceleration, i.e. in a given interval of time their velocities increase by the same value.

Q1. If Aristotle was right then the mass of the upper stone is the only acceleration provider to the lower mass?

.....
.....

Q2. How can you involve Newton's laws in this phenomenon?

.....
.....

Q3. If the motion is horizontally accelerated, what do you say about Aristotle's argument?

.....
.....

Q4. What is then the error Aristotle made?

.....
.....
.....

Item Description

Q.No	Q. Type	Competency	Knowledge	Context	Difficulty Level
1	Closed constructed	Interpret data and evidence scientifically	Content	Personal	Medium
2	Closed constructed	Scientific enquiry	Epistemic	Global	Medium
3	Closed constructed	Explain Phenomenon scientifically	Procedural	Global	High
4	Closed constructed	Scientific enquiry	Content	Personal	High

Answer Key:

Q1. No

Q2. Second law for fall of bodies and Third law when interaction of bodies during fall

Q3. Then he would have been correct because then acceleration may not be large than here during free fall.

Q4. Aristotle assumed that the upper stone only pushes the lower stone. In reality, the upper stone not only (or, to be more precise, not so much) sets the lower stone in motion as sets itself in motion.

17. DROPPING BALLS OF DIFFERENT SIZES

Area: Frontiers Of Science And Technology

Class: 9

Chapter : 9

Chapter Name : FORCE AND LAWS OF MOTION

Concept: Free Fall Under Gravity

Learning Outcomes:-

Student will be able to:-

1. analyse and interpret the motion of an object
2. record and report experimental data objectively.

As an attention-getter, you might want to start with the “bounce/no-bounce” balls to show that identical-looking balls can have drastically different properties. The observation that balls of different sizes fall together can be conveniently demonstrated by dropping several balls from a common height of about 6 feet, and observing their simultaneous impacts. Be sure to include at least one very light ball- say, a ping-pong ball—to see the importance of air resistance. Surprisingly, you will probably not notice any difference between a ping-pong ball and a denser ball, although you will notice a sizable difference when you replace the ping-pong ball with the small Styrofoam ball. (the circumstances under which air resistance becomes important)

You should also try dropping one object while simultaneously launching another with some initial horizontal velocity. One easy method of doing this uses a stick and two blocks of wood. Place block A near the edge of a desk and block B on top of a stick that projects over the edge of a desk. You can propel block A horizontally by sweeping the stick into it. If block B is originally placed on the part of the stick that projects out beyond the desk, block B falls straight down during the stick’s horizontal sweep. Since the blocks begin their descent almost simultaneously, their impacts with the floor should also be simultaneous, since an object’s vertical acceleration is independent of its horizontal speed if air resistance is negligible.

You can easily show that the horizontal and vertical motions are not independent when air resistance is important by repeating the two-block demonstration using two small Styrofoam balls: the ball propelled at a high horizontal velocity lands after the one that falls straight down, because it experiences a greater retarding force in the vertical direction owing to its higher velocity.

Q1. By dropping balls of different sizes from the same height, you can show that they fall together, unless one has an extremely low density or small size. True or false?

Also justify your answer.

Q2. Draw schematic diagram showing placement of stick in the method discussed to project balls simultaneously?

Q3. What do you think that air resistance to motion depends upon velocity of body moving through it? Yes/no?

Q4. Is the statement “horizontal velocity causes vertical retardation” true or false. Justify.

Q5. What do you think is the reason behind simultaneous striking of balls of different types on ground?

Item Description

Q.No	Q. Type	Competency	Knowledge	Context	Difficulty Level
1	Closed constructed	Explain Phenomenon scientifically	Epistemic	Global	Medium
2	Closed constructed	Evaluate and design Scientific enquiry	Content	Personal	Low
3	Closed constructed	Explain Phenomenon scientifically	Procedural	Global	High
4	Closed constructed	Explain Phenomenon scientifically	Procedural	Global	High
5	Closed constructed	Evaluate and design Scientific enquiry	Epistemic	Personal	Medium

Answer Key:

Q1. True

Q3. yes

Q4. true

Q5. Same acceleration for all masses

18. OCEAN OF THE WORLD, WHERE NO ONE SINKS

Area : Frontiers Of Science And Technology

Class: 9

Chapter : 10

Chapter Name : GRAVITATION

Concept: Buoyancy

Learning Outcomes:-

Student will be able to:-

1. apply the interdependence and interrelationship amongst density, volume and forces involved.
2. apply the scientific concept in daily life

source: Newspaper article



Surely you can drown in the ocean if you do not swim. People also take care of their safety on the shores of the sea. Many people are afraid of the ocean because they do not swim. Reading this news, you will be surprised that there is such a sea in the world, in which no one ever sinks.

Worldwide, famous 'Dead Sea', is in Jordan and Israel. This sea is also called 'Salt Sea'. The amount of salt in this ocean is so much that its water is extremely saline. This is the reason why there is no plant or animal in it. This sea is also known as the world's deepest salt water lake.

Its name is 'Dead Sea' because it has lost everything around it, i.e. there is no tree or plant, and there is no fish in the sea. It contains lots of poisonous minerals such as magnesium chloride, calcium chloride, potassium chloride etc. According to the information, the sea is 67 kilometres long and 18 kilometres wide.

Answer the following questions:

1. What is the relation between people floating in dead sea and its salt content?
2. List the two factors that affect buoyancy.

3. When a ship enters a sea from a river

- a) it rises a little b) it sinks a little c) it remains at the same level
d) it rises or sinks depending on the material it is made of

4. A body immersed in a liquid will rise to the surface if the buoyant force acting on it is

- (a) greater than its actual weight
(b) less than its actual weight
(c) equal to its actual weight
(d) equal to zero

Answer Key

1. The salt content increases the density of the water to an extent that all bodies in dead sea have density lesser than its water. Thus, people float and do not sink .

FC if completely correct explanation

PC for incomplete explanation

NC for wrong answer.

2. Density of fluid and volume of body .

FC for correct ans

PC if one factor is correct

NC for incorrect answee

3.a

FC or NC

4.a

FC or NC

Item Description:

Q No.	Q Type	Competency	Knowledge	Context	Difficulty level
1	Closed question	Interpret data and evidence scientific ally	Content	Global	Medium
2	Closed question	Evaluate and design scientific enquiry	Content	Global	Medium
3	MCQ	Use scientific evidence	Epistemic	Global	Medium
4	MCQ	Interpret data and evidence scientific ally	Content	Global	Medium

19. GRAVITY AND SPEED

Area : Frontiers Of Science And Technology

Class: 9

Chapter : 10

Chapter Name : GRAVITATION

Concept: Gravity

Learning Outcomes:-

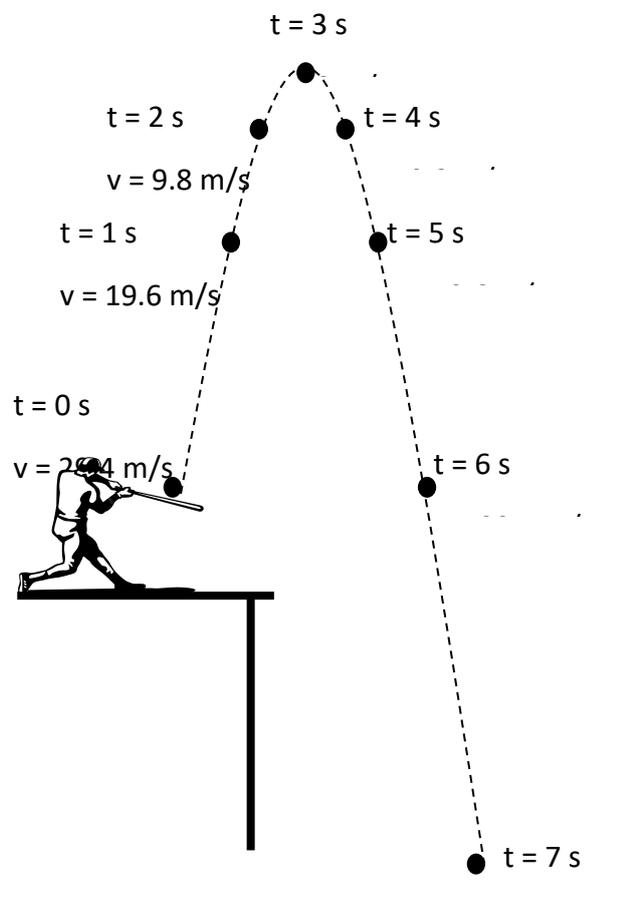
Student will be able to:-

1. use equations of motion to calculate various physical quantities involved
2. analyse and interpret given figure to draw conclusions
3. apply scientific principle in daily life.

Gravity is constantly pulling downward. If you throw a ball up, it will be decelerated by gravity. As the ball moves upward, gravity will cause its speed to decrease by 9.8m/s each second.

If an object is moving downward, it will be accelerated by gravity. Its speed, v , will increase by 9.8m/s each second.

The strength of the acceleration due to gravity is given the symbol, g , and it is equal to 9.8m/s^2 .



Q1. The ball in figure one started out at a speed of 29.4 m/s and took 3 seconds to reach its maximum height. At a time of 3 seconds the speed of the ball was 0 m/s.

If the beginning speed had been 39.2 m/s (instead of 29.4 m/s), how many seconds would it have taken to reach a speed of 0 m/s?

Q2. During each second of free fall, the speed of an object

- a) increases by the same amount
- b) changes by increasing amounts each second
- c) remains constant
- d) doubles each second

Q3. The reason that a 5kg rock falls no faster than a 10 kg rock in free fall is that

- a) a 10kg rock has greater acceleration
- b) a 5 kg rock has greater acceleration
- c) the force of gravity is same for both
- d) the force / mass ratio is same for both

Q4. If a rock fell off of a cliff, how fast would the rock be going after 2 seconds?

Q5. Which equation could be used to answer the above question?

- a) $v = g \cdot t$ b) $v = g + t$ c) $v = g \cdot t^2 + 2$ d) $v = 2(t + g)$

Q6. If a ball is thrown upward at an initial velocity of 45.9 m/s, how many seconds will it take for the ball to reach its maximum height?

Q7. The picture doesn't show us what happens after 7 seconds. At a time of 8 seconds, how fast would the ball be going?

Answer Key:

Q1. 4 seconds

FC for correct answer and NC for incorrect answer

explanation: Speed is decreasing uniformly with each passing second.

thus, starting from 39.2m/s speed at $t= 0s$

29.4 m/s speed at $t= 1s$ and so on

Q2. a FC for correct answer and NC for incorrect answer

Q3.d FC for correct answer and NC for incorrect answer

Q4. 19.6m/s FC for correct answer and NC for incorrect answer

explanation:

$$v = u + gt$$

$$u = 0$$

$$g = 9.8\text{m/s}^2$$

$$t= 2s$$

$$v = 0+ 9.8 \times 2$$

$$= 19.6\text{m/s}$$

Q5. a FC for correct answer and NC for incorrect answer

Q6.4.68 s

explanation:

initial velocity= 45.9m/s

final velocity at maximum height = 0m/s

$$v= u + gt$$

$$0= - 45.9+9.8 \times t$$

$$45.9/9.8 = t$$

$$t=4.68s$$

Q7. 49m/s FC for correct answer and NC for incorrect answer

explanation:

As the ball comes down, its velocity increases uniformly.

At $t=4 s$,velocity = 9.8m/s

At $t = 5 s$,velocity is $9.8+ 9.8 = 19.6 \text{ m/s}$

.At $t= 8s$,velocity = $39.2+ 9.8 = 49\text{m/s}$

Item Description :

Q No.	Q Type	Competency	Knowledge	Context	Difficulty level
1	Closed question	Interpret data and evidence scientifically	Epistemic	Global	Medium
2	MCQ	Interpret data and evidence scientifically	Content	Global	Medium
3	MCQ	Evaluate and design scientific enquiry	Epistemic	Global	High
4	Closed	Interpret data and evidence scientifically	Content	Global	Easy
5	MCQ	Evaluate and design scientific enquiry	Content	Global	Easy
6	Closed	Use scientific evidence	Content	Global	Medium
7	Closed	Interpret data and evidence scientifically	Epistemic	Global	High

20. COMMERCIAL UNIT OF ENERGY

Area: Frontiers of Science and Technology

Class: 9

Chapter : 11

Chapter Name : WORK AND ENERGY

Concept: Unit and Measurement

Learning Outcomes:-

Student will be able to:-

1. calculate the BoT units (energy/tariff) consumed in a month from electricity bill
2. differentiate the electrical energy consumed in domestic and commercial sites.
3. apply scientific concept in daily life.

To express large quantities of energy we use a bigger unit of energy called kilowatt hour (kW h). What is 1 kW h? Let us say we have a machine that uses 1000 J of energy every second. If this machine is used continuously for one hour, it will consume 1 kW h of energy. Thus, 1 kWh is the energy used in one hour at the rate of 1000 J s^{-1} (or 1 kW).

$$1 \text{ kW h} = 1 \text{ kW} \times 1 \text{ h}$$

$$= 1000 \text{ W} \times 3600 \text{ s}$$

$$= 1000(1\text{Js}^{-1}) \times 3600 \text{ s}$$

$$= 3600000 \text{ J}$$

$$1 \text{ kW h} = 3.6 \times 10^6 \text{ J.}$$



The energy used in households, industries and commercial establishments are usually expressed in kilowatt hour. For example, electrical energy used during a month is expressed in terms of 'units'. Here, 1 'unit' means 1 kilowatt hour.

Based upon the knowledge gained from above information and your day to day life experiences answer the following questions:-

Q. 1 Name the unit used for measuring and expressing large quantities of Energy.

.....

Q. 2 (i) 1 Hour = seconds

(ii) 1KW = Js^{-1}

(iii) 1KWh = J

Q. 3 Electrical energy used in house, factories etc. during a month is expressed in terms of

.....

Q. 4 An electric bulb of 60 W is used for 6 h per day. Calculate the 'units' of energy consumed in one day by the bulb.

Item Description:

Q no .	Question type	Competency	Knowledge	Context	Difficulty level
Q1	Closed constructed	Interpret data and evidence scientifically	Content	Personal	Low
Q 2	Closed constructed	Interpret data and evidence scientifically	Content	Personal	Medium
Q 3	Open ended	Interpret data and evidence scientifically	Procedural	Personal	Medium
Q4	Closed constructed	Interpret data and evidence scientifically	Procedural	Local	High

Answer/Scoring key:

Answer 1 1KWh.

Answer 2 (i) 3600 seconds

(ii) 1000

(iii) 3.6×10^6

Answer 3 Unit or KWh both are correct.

Answer 4 Power of electric bulb = 60 W

= 0.06 kW. Time used, $t = 6$ h

Energy = power \times time taken = $0.06 \text{ kW} \times 6 \text{ h} = 0.36 \text{ kW h} = 0.36$ 'units'.

The energy consumed by the bulb is 0.36 'units'.

21. AN ELEPHANT'S SILENT CALL

Area : Frontiers Of Science And Technology

Class: 9

Chapter : 12

Chapter Name : SOUND

Concept: Frequency of Sound

Learning Outcomes:-

Student will be able to:-

1. differentiate between infrasonic and ultrasonic sounds
2. apply scientific concept in everyday life e.g. how much sound absorbent materials will be required to cover the walls of a large room
3. record and report experimental data objectively.

Several animals species are able to hear frequencies well beyond the human hearing range .Some dolphins and bats ,for example , can hear frequencies upto 100000Hz.Elephants can hear sound at 14-16Hz while whales can hear sound as low as 7HZ (in water).

1.a)Elephants communicate with each other using sound. We cannot hear these sounds. Which sound waves are produced by them?

.....

b). Which of the following statements is the reason that we cannot hear them?

Circle the correct option

A. the amplitude of their sound wave is too high.

B .the frequency of their sound wave is too low.

C. the speed of their sound wave is too fast .

2.There are two elephants A&B standing at a distance of 2500m from each other. Elephant A emits communication sound, when elephant B hears it calls back. Elephant A hears the answering call from elephant B. Show that the minimum time for elephant A to call and hear an answer from elephant B is about 15 sec.(speed of sound is 340m/sec)

.....
.....
.....

Answer key:

1.a) infrasonic b) B

Item Description:

Q no .	Question type	Competency	Knowledge	Context	Difficulty level
Q1	Closed constructed	Explain phenomenon scientifically	Content	Personal	Low
Q 2	Closed constructed	Explain phenomenon scientifically	Content	Personal	Medium

22. SOUND

Area : Frontiers of Science & Technology

Class: 9

Chapter : 12

Chapter Name : SOUND

Concept: Production and Propagation of Sound Energy

Learning Outcomes:-

Student will be able to:

1. explain the processes and phenomena
2. communicate the findings and conclusions effectively.

Some mechanical energy is required to make an object vibrate .Sound energy cannot be produced at its own .The mechanical energy of vibrating object travel through a medium and finally reaches our ear.

In each of the following questions statement of Assertion is given, followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as:

Q1. Instructions:

- A) If both assertion and reason are true and reason is the correct explanation of assertion.
- B) If both assertion and reason are true but reason is not the correction explanation of assertion.
- C) If assertion is true but reason is false.
- D) If assertion is falsebut reason is true.

i) Assertion: A piece of paper place on the surface of water moves up and down when a wave is generated in water.

Reason: Waves carry energy and not matter.

ii) Assertion: When two persons talk on the moon they cannot hear each other .

Reason: The audible limit for a normal human being is 20Hz to 20 kHz.

Q2. Two friends were playing an identical guitar whose strings were adjusted to give notes of same pitch .Will the quality of the two notes be the same or different. Give reason to support your answer.

Q3.A burglar alarm is not loud enough. An engineer adjusts it so that it produces a note of the same pitch which is louder. What effect does it have on the amplitude and frequency?

	Amplitude	Frequency
A	Larger	Larger
B	Larger	Same
C	Same	Larger
D	Same	Same

Answer key:

- I. A
- II. B

2. The quality of notes need not be same. Pitch of a note is determined solely by its frequency whereas quality depends upon the number, distribution

and relative intensity of the different harmonics and overtones. All these factors need not be same when the two notes have the same pitch .

3.B

Item Description :

Q No.	Q Type	Competency	Knowledge	Context	Difficulty level
1	Closed constructed	Explain phenomenon scientifically	Content	Personal	Low
2	Closed constructed	Explain phenomenon scientifically	Content	Personal	Medium
3	Closed constructed	Explain phenomenon scientifically	Content	Personal	Medium

23. CHARACTERISTICS AND IMPORTANT LESSONS FROM THE CORONAVIRUS DISEASE 2019 (COVID -19)

Area: Health

Class: 9

Chapter : 13

Chapter Name : WHY DO WE FALL ILL ?

Concept: Communicable Pandemic Diseases

Learning Outcomes:-

Student will be able to:-

1. analyse and interpret given figure
2. communicate the findings and conclusions effectively
3. relate the processes and phenomena with the cause and effect of the diseases
4. understand the interrelationship among various living beings in the spread of a pandemic.

What is a coronavirus ?

This virus belongs to a family of viruses known as coronaviruses. Named for the crown-like spikes on their surfaces, they infect mostly bats, pigs and small mammals. But they mutate easily and can jump from animals to humans, and from one human to another. In recent years, they have become a growing player in infectious-disease outbreaks world-wide.

Seven strains are known to infect humans, including this new virus, causing illnesses in the respiratory tract. Four of those strains cause common colds. Two others, by contrast, rank among the deadliest of human infections: **Severe Acute Respiratory Syndrome**, or SARS, and Middle East Respiratory Syndrome, or MERS.

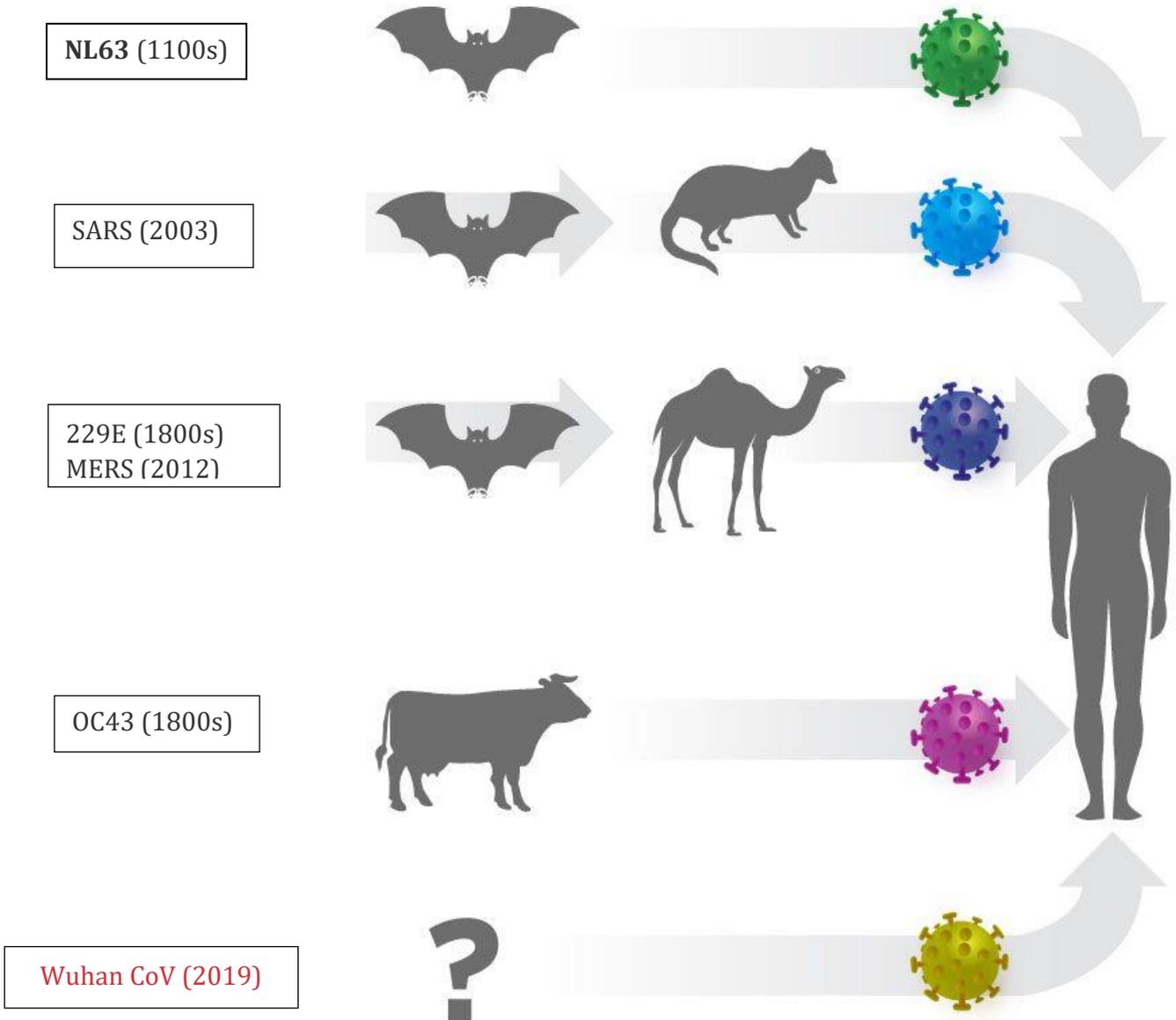
This new virus is called severe acute respiratory syndrome coronavirus 2, or Sars-CoV-2. The disease it causes is called Covid-19. (The number stands for 2019, the year it emerged.)

What are the symptoms of the illness and how do you know if you have it?

The virus infects the lower respiratory tract. Patients initially develop a fever, cough and aches, and can progress to shortness of breath and complications from pneumonia. Other reported symptoms include fatigue, sore throat, headache, and nausea, with vomiting and diarrhoea. Some people become only mildly ill, or are infected but don't get sick. Others are mildly ill for a few days, then rapidly develop more severe symptoms of pneumonia. Some patients haven't had a fever initially or might develop a "walking pneumonia," meaning they might spread their infection to others because they aren't sick enough to be in a hospital.

Epidemic Potential

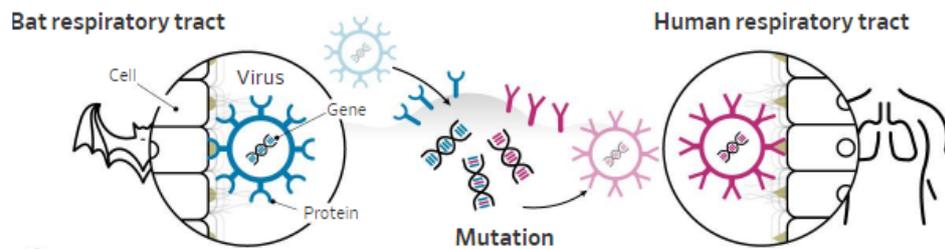
Coronaviruses are jumping increasingly from animals to humans, creating new threats



Coronaviruses: From Animals to Humans

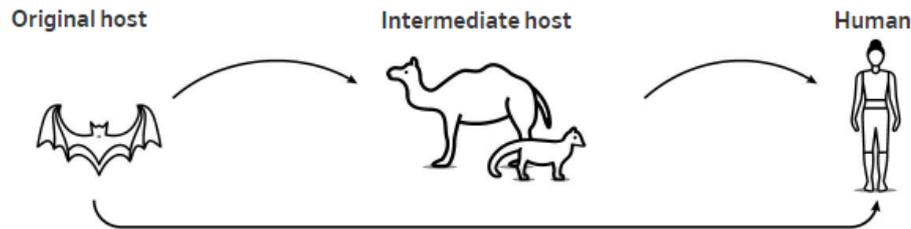
Researchers aren't sure how the novel coronavirus first infected people in China, but the viruses that cause SARS and MERS, which originated in bats, provide clues.

1. Proteins on the outer shell of the virus allow it to latch onto cells in the host's respiratory tract. The proteins' shapes are determined by the virus's genes.
2. To infect new hosts, the virus's genes undergo mutations that alter its surface proteins, allowing them to latch onto the cells of new species.



3

In the case of SARS, the virus jumped from bats to civet cats before gaining the ability to infect humans. In the case of MERS, camels served as the intermediate host.



4

Coronaviruses can also jump directly to humans, without mutating or passing through an intermediate species.

5

Researchers have found the novel coronavirus likely originated in bats, but haven't pinpointed the source of transmission to humans.

How is the virus spread among humans?

It transmits through “respiratory droplets” when an infected person speaks, coughs or sneezes, according to the WHO. The droplets spread through the air and can land on another person’s mouth or nose, or possibly be inhaled into their lungs, infecting them. The droplets can also settle on nearby surfaces like a desk, counter, or doorknob, where they can survive for a period. A person can become infected by touching a contaminated surface, then touching their mouth, nose or eyes.

Respiratory droplets are heavy and don’t travel far in the air, so transmission is believed to occur mostly through close contact, meaning within 6 feet of an infected person.

Scientists are also investigating whether the new coronavirus might spread through urine or faeces. Tests have found it in the digestive tract of some patients. The WHO has said it doesn’t believe so-called faecal-oral transmission to be a driver of transmission of Covid-19.

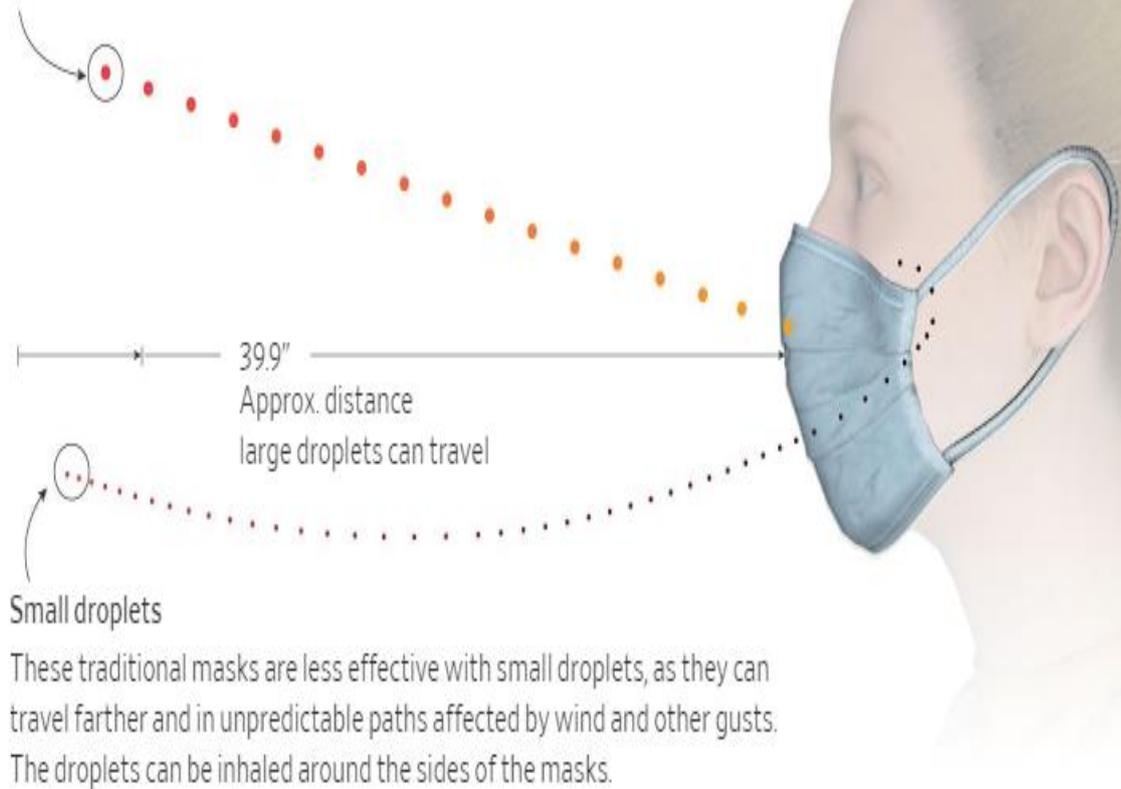
How Effective Are Masks?

The World Health Organization and other experts report that a mask’s efficacy in social settings is inconclusive. But some health experts and mask makers say that properly used, the N95 respirator mask can guard against the new coronavirus.

Airborne

Large droplets

Surgical masks are highly effective against large airborne droplets.



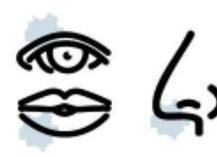
Touch

A coronavirus can also be transmitted by touching an object where airborne droplets have settled.

The viruses can survive briefly on surfaces depending on conditions of humidity and temperature.

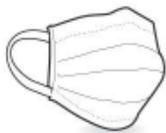


Wearing a mask prevents direct contact with nose and mouth, and could protect a user who may have touched a contaminated area.

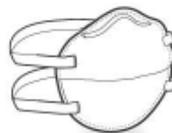


Masks

Frequently changing disposable masks, and washing your hands after, are important steps to avoid contamination from pathogens that cling to the outer surface.



Surgical masks don't offer full protection against airborne viruses. They don't fully seal off the nose and mouth.



N95 masks offer more protection. But they only work if they fit properly, and aren't suitable for children or people with facial hair.

Sources: BMC Infectious Diseases; The Journal of Hospital Infection

What else can I do to protect myself?

The most important thing you can do is wash your hands frequently, for at least 20 seconds each time. Wash them regularly when you are at the office, when you come home, before you eat, and other times that you are touching surfaces. You can also use an alcohol-based hand sanitizer. Don't touch your eyes, nose or mouth—viruses can enter your body that way. Wipe down objects and surfaces

frequently with household cleaner, which will kill the virus. Maintain a distance from people who are sick.

How close is it to becoming a pandemic?

Since 2009 there have only been five declarations of international public health emergencies: the swine flu pandemic in 2009, a polio outbreak in 2014, the Western Africa Ebola outbreak in 2014, the Zika virus outbreak in 2015 and another Ebola outbreak in the Democratic Republic of the Congo in 2019.

The WHO's definition of pandemic is not as clear as its definition of a international public health emergency. The organisation defines a pandemic as a "worldwide spread of a new disease" – a criterion that Covid-19 seems to fulfil.

Q1. The virus Sars-CoV-2. belongs to the group of

- (i) Corona virus
- (ii) HIV
- (iii) Rhino
- (iv) TMV

Q2. The symptoms of coronavirus include

- (i) Mild cold and cough
- (ii) Cold, cough, mild fever leading to pneumonia like symptoms
- (iii) Fatigue, headache, cough, cold, mild fever leading to pneumonia like symptoms
- (iv) Fever and headache

Q3. How did the virus jump over from animals to humans?

Q4. Students were advised to wash their hands frequently and to maintain distance from people suffering from influenza like symptoms

Q5. Surgical Masks are always not effective in preventing droplet infections, how far is this statement true.

Q6. Since 2009 there have only been five declarations of international public health Emergencies. Do you think COVID-19 will also fall in this category.

Answer key

1. (i) Corona virus
2. (iii) Fatigue, headache, cough, cold, mild fever leading to pneumonia like symptoms
3. Coronaviruses are jumping increasingly from animals to humans, creating new threats

To infect new hosts, the virus's genes undergo mutations that alter its surface proteins, allowing them to latch onto the cells of new species.

4. The students were advised to wash their hands frequently and keep away from infected persons because Coronavirus transmits through "respiratory droplets" when an infected person speaks, coughs or sneezes. The droplets spread through the air and can land on another person's mouth or nose, or possibly be inhaled into their lungs, infecting them.

The droplets can also settle on nearby surfaces like a desk, counter, or doorknob, where they can survive for a period. A person can become infected by touching a contaminated surface, then touching their mouth, nose or eyes.

5. Surgical masks don't offer full protection against airborne virus as they do not completely seal of mouth and nose.
6. Covid-19 has been designated as a pandemic as it has continued to spread to different nations, causing emergency situation.

Item description

S.no	Q. Type	Competency	Knowledge	Context	Difficulty Level
1	Simple multiple type	Explain phenomenon scientifically	Content	Global	Low
2	Simple multiple type	Explain phenomenon scientifically	Content	Global	Low
3	Closed constructed	Explain phenomenon scientifically	Content	Global	Medium
4	Closed constructed	Explain phenomenon scientifically	Procedural	personal	High
5	Open ended	Interpret data and evidence scientifically	Procedural	Global	High
6	Open ended	Evaluate and design scientific enquiry	Epistemic	Global	High

24. DISEASES: MEASLES, CHICKEN POX, POLIO, RABIES

Area : Health

Class: 9

Chapter : 13

Chapter Name : WHY DO WE FALL ILL ?

Concept: Communicable Disease

Learning Outcomes:-

Student will be able to:-

1. communicate the findings and conclusions effectively
2. relate processes and phenomena with cause and symptoms of the diseases
3. apply the scientific concept in daily life.

1. Measles & Chickenpox

Naveen and Sonu are suffering from a disease and they were placed in an isolated, well ventilated room. Naveen had a fever with itchy red rashes on the first day. The rashes turned into blisters in a day or two. The blisters first appeared on the abdomen and face and then spread to almost everywhere on the body on the other hand Sonu had high fever, sore throat, cough, red eyes, pinkish red rashes mostly on the chest.

Q1. What might be the disease they are suffering from?

Score 2 for chicken pox (Naveen) & Measles (Sonu)

Score 1 for Chicken Pox or measles

Score 0 for Allergy

Q2. Name the pathogen that causes the disease?

Score 2 if answer is virus

Score 0 if answer is any other

Q3. Name the common mode of transmission of these disease?

a. Physical contact b. Contaminated droplets in the air

c. Both a & b d. By looking at a person

Score 2 if answer is c

Score 1 if answer is a or b

Score 0 if answer is d

Q4. Is there any preventive vaccine?

Score 2 if the answer is chicken pox vaccine for chicken pox and MMR for measles.

Score 1 if answer is MMR or Chickenpox Vaccine

Score 0 if any other answer

Q5. Naveen and Sonu should be isolated? Give reason.

Score 2 if answer is both yes disease is contagious

Score 1 if answer is either yes or disease is contagious

Score 0 if answer is no or any other answer

2. Polio

Poliomyelitis, or polio is an infectious disease caused by the poliovirus, which affects your spinal cord and brainstem. Although in the vast majority of cases a poliovirus infection is harmless, if it makes its way into your *brain* or *spinal cord* it can cause paralysis, and even death.

The grey matter in the ventral (or anterior) horn largely contains motor neurons that are responsible for the movement of the muscles you use to swallow, breath, and keep your blood circulating, as well as those in your trunk, arms and legs. The motor neurons in this area are particularly susceptible to poliovirus infection.

Because poliovirus can survive for weeks outside the human body, it can also be transmitted through contaminated water and food. For these reasons, is most easily spread in communities with poor infrastructure, poor sanitation and crowded living conditions, and young children are at particularly high risk of infection. The risk of infection is also higher when your immune system is not fully functional, such as when you are very young, old or pregnant.

The poliovirus typically enters your body through your nose or mouth and almost immediately infects the cells lining these cavities (your pharynx), as well as your intestines, where it begins to reproduce. After about a week, it can spread to your tonsils and other parts of your immune system, where it multiplies rapidly. Eventually poliovirus may break out into your bloodstream and if this happens, it is transported widely around your body.

Q1. Polio virus chiefly effects which part of our body?

- a. spinal cord
- b. Brain stem
- c. Joints
- d. Bones

Score 2 If both a & b are correct

Score 1 if either a and b are correct

Score 0 for any other answer

Q2. The motor neurons that are responsible for the movement of the muscles we use to swallow and breathe are present in

- a. White matter
- b. Grey Matter
- c. Dorsal horn
- d. Ventral horn

Score 2 If both b & d are correct

Score 1 if either b and d are correct

Score 0 for any other answer

Q3. Answer yes or no

a. If a person has HIV he will for sure suffer from polio

b. if a person has got his tonsils removed he will definitely suffered from polio

Score 2 If answer is a. yes b. No

Score 1 for anyone correct answer

Score 0 for wrong answer

Q4. Rahul went to the hospital to visit his friend who is suffering from polio along with his wife and 5 yrs old child. Who is most likely to suffer from polio and why?

.....
.....

Score 2 If answer is child, weak immune system of the child

Score 1 for either child or Weak immune system

Score 0 for any vague answer

Q5. Polio virus enters the body through

a) Nose b) Mouth c) Both a and b d) anus

Score 2 if c is correct

Score 1 if either of a & b is correct

Score 0 if answer is d

Q6. Why polio virus can easily spread through contaminated air and water.

Because polio virus can survive for weeks outside the human body

Score 2 polio virus can survive for weeks outside the human body

Score 0 for any other vague answer

3. Rabies

A mad dog bit Sam. Sam did not take any antiviral injections. Some days later he get irritated, excessive salivation and fear of water. Sam's father asked the doctor what is the reason behind it. The doctor explained dog bite introduces the virus into the skin. This virus begins to replicate in the striated muscles at the wound site for hours or weeks. Then this virus shifted to nervous system via sensory nerves. It reaches the brain where it replicates in the neuronal cells and the patient dies of Cardiac arrest.

Q 1. Name the disease

0 marks - Vague answer

1 marks – Viral disease

2 marks – Rabies

Q 2. How does the virus enter the body?

2 marks – Virus enters through wounds (broken cells) and then reach the striated muscle.

1 mark – Virus enters into the cell or any broken cell

0 marks – vague answer

Q 3. Is the antibodies present against this virus in newborn infant?

2 marks – No

1 mark – May be

0 mark – Vague

Q 4. Name the vaccine for Rabies.

2 marks – Rabies Vaccine

1 mark – vaccine

0 mark – Vague

Q 5. How do doctors handling rabies treatment protect themselves?

- a. Strong Immune System
- b. Taken antirabies vaccine
- c. Balanced Diet
- d. Both A and B

Q 6. Why rabies is fatal if no treatment is taken after a week or more?

2 marks – When striated cell infected with virus then nervous tissue damage then in this case it is fatal without any treatment

1 marks – striated muscles only infected

0 mark – any other answer

Item Description :-

MEASLES AND CHICKEN POX

S.NO	QUESTION TYPE	COMPETENCY	KNOWLEDGE	CONTEXT	DIFFICULTY LEVEL
1	CLOSE CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	LOW
2	CLOSE CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	LOW
3	CLOSE CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	MEDIUM
4	CLOSE CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	MEDIUM
5	OPEN CONSTRUCTED	EVALUATE AND DESIGN SCIENTIFIC ENQUIRY	CONTENT	GLOBAL	MEDIUM

Item Description :-**POLIO**

S.NO	QUESTION TYPE	COMPETENCY	KNOWLEDGE	CONTEXT	DIFFICULTY LEVEL
1	CLOSE CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	LOW
2	CLOSE CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	LOW
3	OPEN CONSTRUCTED	INTERPRET DATA AND EVIDENCE SUCCESSFULLY	CONTENT	GLOBAL	LOW
4	OPEN CONSTRUCTED	EVALUATE AND DESIGN SCIENTIFIC ENQUIRY	CONTENT	GLOBAL	MEDIUM
5	CLOSE CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	PROCEDURA L	GLOBAL	MEDIUM
6	CLOSE CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	MEDIUM

Item Description :-**RABIES**

S.NO	QUESTION TYPE	COMPETENCY	KNOWLEDGE	CONTEXT	DIFFICULTY LEVEL
1	CLOSED CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	LOW
2	OPEN CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	LOW
3	OPEN CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	MEDIUM
4	CLOSED CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	MEDIUM
5	CLOSED CONSTRUCTED	EXPLAINED PHENOMENA SCIENTIFICALLY	CONTENT	GLOBAL	MEDIUM

25. MALARIA: CHALLENGES AND OVERVIEW

Area: Health

Class: 9

Chapter : 13

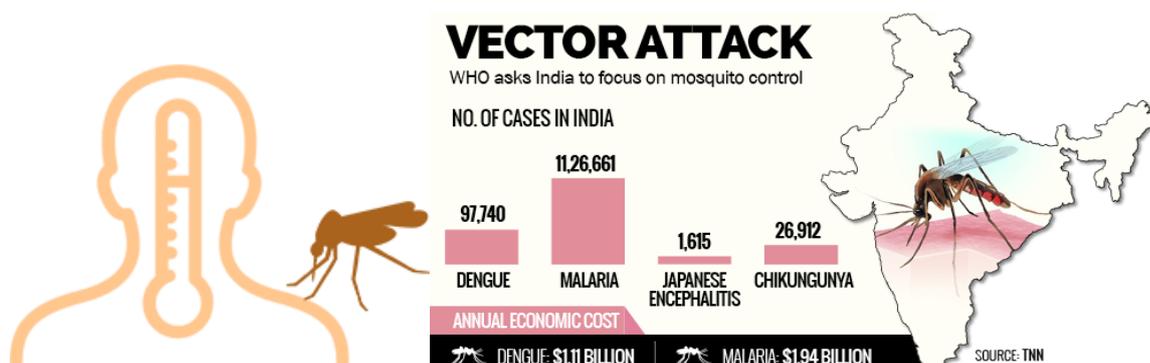
Chapter Name : WHY DO WE FALL ILL ?

Concept: Infectious Disease By Protozoan Parasites

Learning Outcomes:-

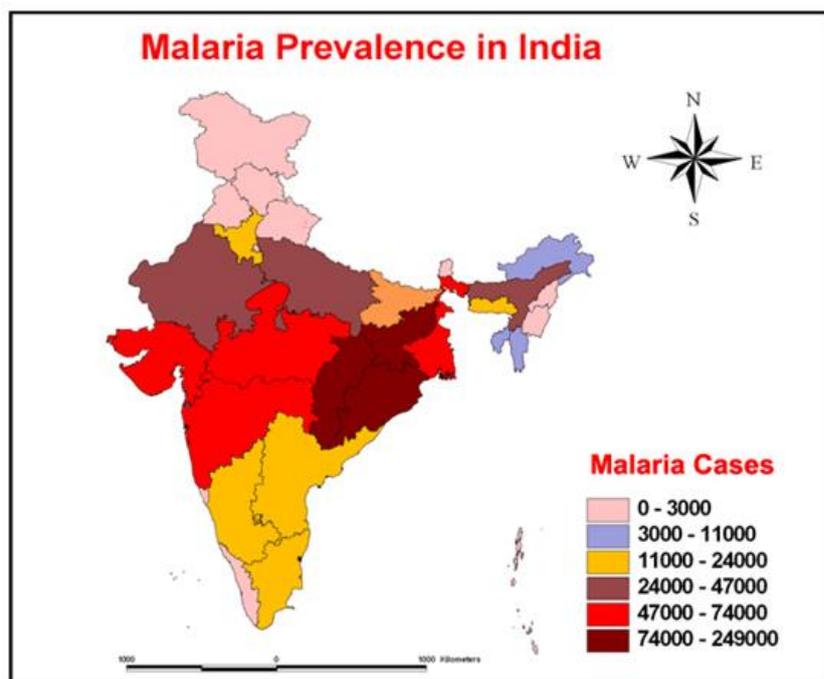
Student will be able to:-

1. analyse and interpret the given figure
2. relate the processes and phenomena with cause and symptoms of diseases
3. apply scientific concept in daily life
4. differentiate between infectious diseases and non-infectious diseases.

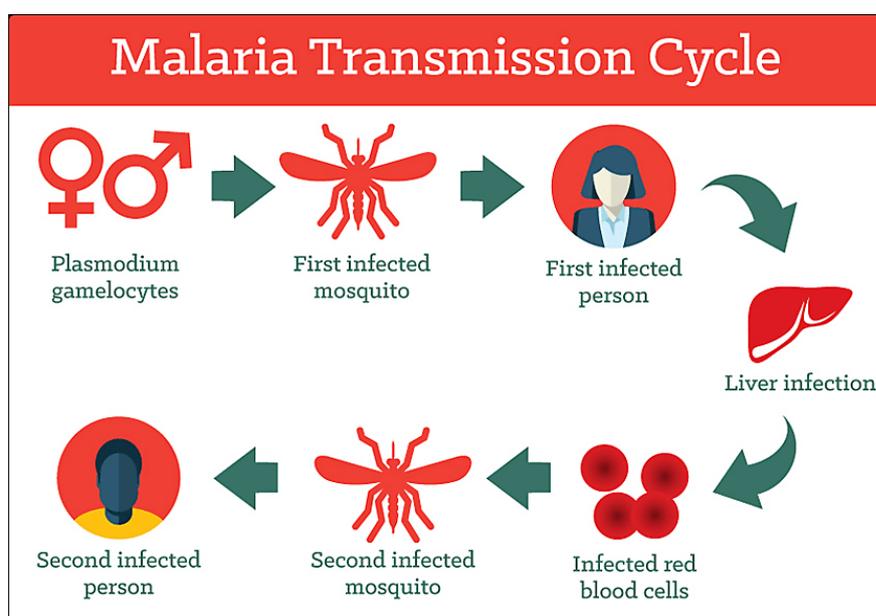


The Government of India is committed to eliminating malaria by 2027. The National Vector Borne Disease Control Programme, an umbrella programme for prevention and control of vector borne diseases, aims to reduce the morbidity and mortality due to malaria and improve the health and quality of life. The national strategy on malaria control has undergone a paradigm shift following the introduction of new interventions for case management and vector control. However, much more needs to be done to scale up malaria control interventions to ensure those suffering from malaria get correct, affordable and complete treatment.

Q1. WHO has asked India to focus on mosquito control. From how many diseases could we be protected if this became a reality.



Q2. The incidence of malaria is seen to be quite high in some Indian states. Which are these states which show the highest and what could be the reason.



Q3. Elimination of mosquitoes is a sure way of prevention of malaria. Justify.

Some Details of the Pathogen, symptoms of the disease and prevention

Organism type	Protozoan Protist- <i>Plasmodium vivax</i> , <i>Plasmodium. falciparum</i> , <i>Plasmodium ovale</i> , <i>Plasmodium malariae</i>
Pathogen	Most deaths from <i>Plasmodium falciparum</i> and <i>P. vivax</i> . 3 other species cause malaria.
Mode of transmission	<ul style="list-style-type: none"> • The vector, the female Anopheles mosquito, is active from dusk throughout the night and dawn. • A single bite can cause infection. Mosquito distribution is likely to increase with global warming, which suggests the incidence of malaria in temperate climates might increase. • The continued presence of malarial infection relies on high human and mosquito density. • Male mosquitoes feed on plant nectar, not blood, so they are not vectors of <i>Plasmodium</i>.
Affected tissue	<p>In humans, when the skin is pieced as the mosquito feeds:</p> <ul style="list-style-type: none"> • Plasmodium enters blood in the mosquito’s saliva and travels to liver • Asexual reproduction in hepatocytes produces more individuals. • More red blood cells are infected. • Infected red blood cells burst, coinciding with symptoms • Male and female gametes form. <p>In the mosquito, following a blood meal: Gametes fuse to form zygotes Asexual reproduction occurs <i>Plasmodium</i> migrates to the mosquito’s salivary glands</p>
Prevention	<ul style="list-style-type: none"> • Insecticide-treated nets • Insecticide spraying indoors, especially the walls, where mosquitos rest • Draining or covering stagnant, still water e.g. water tanks, especially urban area reduce areas where larvae develop • Fish (<i>Gambusia</i> sp) introduced to eat larvae • Infecting mosquitos with the bacterium Wolbachia blocks Plasmodium development in mosquitos • X-irradiating male mosquitos to sterilise them

Q4. The prevalence of malaria would increase in temperate climate in the coming years. What could be the possible reason.

Q5. Male mosquitoes do not cause malaria, still sterilizing them would help reducing malaria cases.

Q6. It is a popular belief that If we sleep under the mosquito net during night chances of occurrence of malaria are highly reduced. Justify

Q7. Two biological control methods have been suggested for mosquitoes in the above reading material. One represents the prey predator relationship and the other Parasite host relationship. Identify the organisms.

Answers Key:

1. Malaria, Dengue, Chicken Guinea, Japanese encephalitis
2. Odisha, Meghalaya, Bihar, Chhattisgarh, Mizoram. The reason being conducive temperature and rainfall.
3. Elimination of mosquito would result in removal of the vector which carries the *Plasmodium* sp. Thus helping in breaking the mode of transmission of the pathogen.
4. Global warming is resulting in increase of temperature globally. Increased temperature may result in promoting breeding of mosquitoes in temperate countries.
5. Sterilizing the male mosquito will prevent the production of eggs and thus reducing mosquito population.
6. Mosquitoes are active not only during night but also during early morning and evening.
7. **Prey predator relationship**-*Gambusia* fish and mosquito larvae

Parasite and host relationship- Bacterium *Wolbachia* blocks *Plasmodium* development in mosquitoes

Item Description:

Q.No	Q. Type	Competency	Knowledge	Context	Difficulty Level
1	Close constructed	Explain phenomenon scientifically	Content	National	Low
2	Open ended	Explain phenomenon scientifically	Content	National	Medium
3	Close constructed	Explain phenomenon scientifically	Procedural	Global	Low
4	Open ended	evaluate and design scientific enquiry	Procedural	Global	Medium
5	Close constructed	evaluate and design scientific enquiry	Procedural	Global	Medium
6	Open ended	Evaluate and design scientific enquiry	Procedural	Personal	Medium
7	Close constructed	Explain phenomenon scientifically	Content	Global	High

26. TROPICAL RAIN FORESTS

Area- Natural Resources

Class: 9

Chapter : 14

Chapter Name : NATURAL RESOURCES

Concept-Nutrient cycles in tropical rain forests

Learning Outcomes:-

Student will be able to:-

1. draw the flow chart of biochemical cycle
2. apply the scientific concept in daily life such as intercropping and crop rotation
3. relate the processes and phenomena with cause and effect.

Impact of deforestation on nutrient cycles in Tropical rain forests.

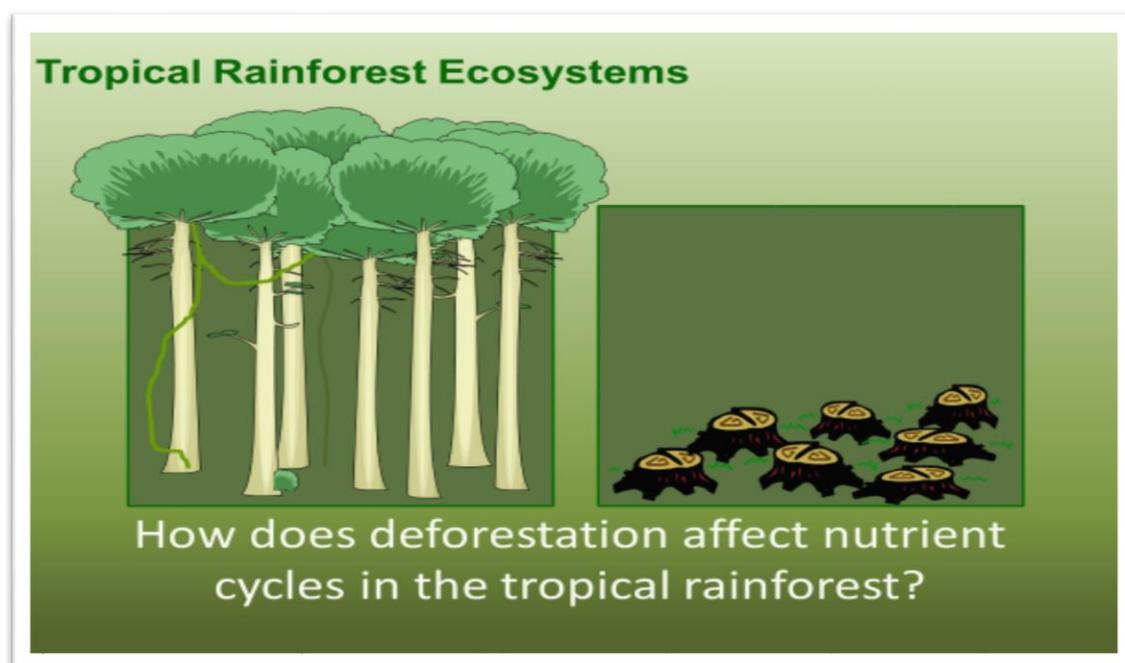


Figure 1: Shows the movement of nutrients around a tropical rainforest ecosystem.

Figure 1. Nutrient Cycle in a tropical rainforest

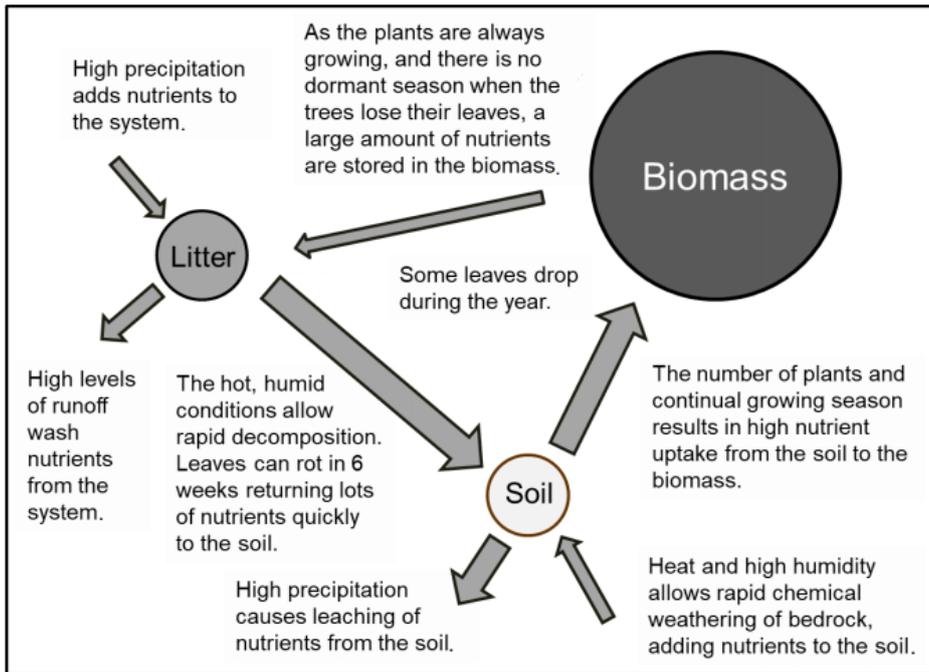
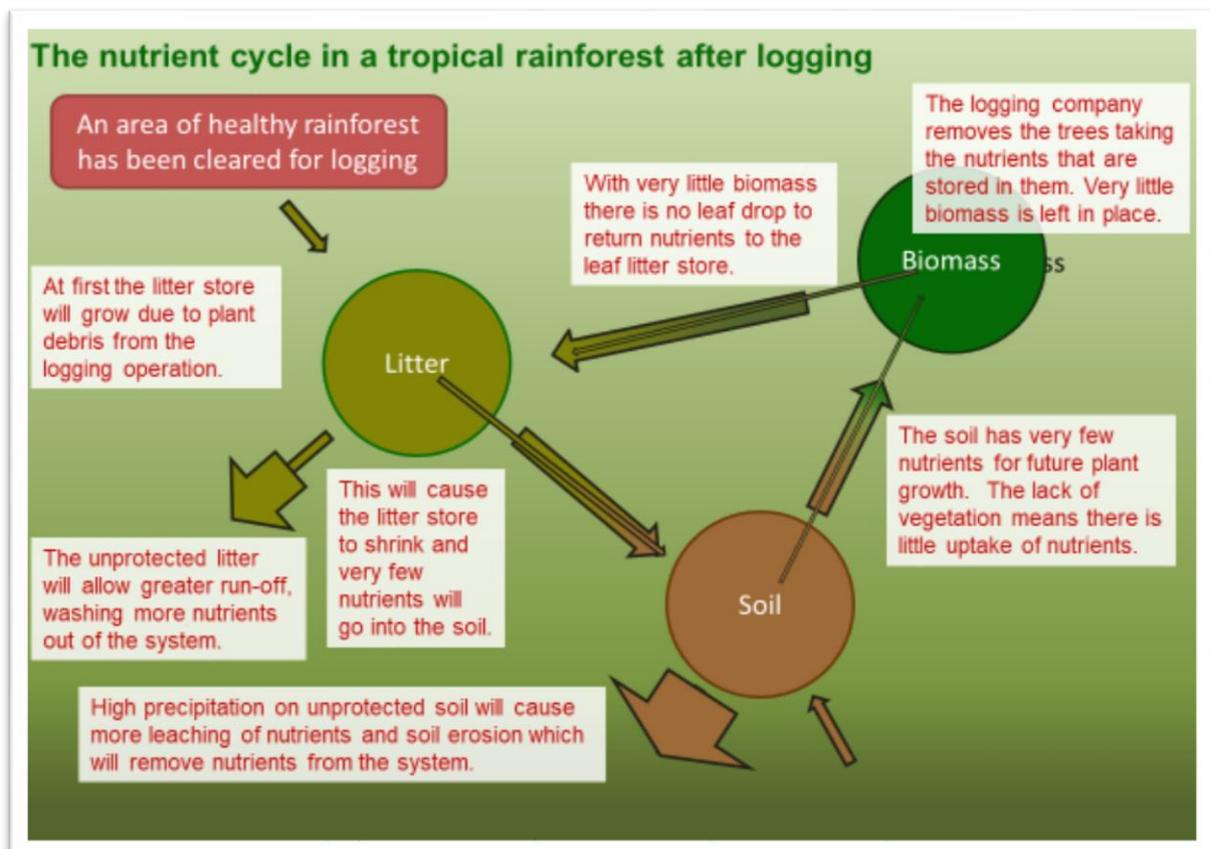


Figure 2 Nutrient cycle in a tropical rainforest after logging.



Questions

Q1. An area of healthy rainforest had been cleared for logging. The logging company removed

the trees and transported them to the factories. How did this effect the total biomass of the area.

Q2. The nutrient pool in the soil depleted, correlate it with logging of the forests.

Q3. If there was high precipitation in a deforested area what would be the possible impacts.

Q4. In your opinion what will be the future of this tropical rainforest.

Q5. Does this mean there should be no cutting of trees or do we an alternative for sustainable development.

Answer Key.

1. Since the trees were cut and they were the major contributors of the biomass. Very little biomass was left in the forest.
2. The nutrient pool reduced as there was very little biomass and no leaf fall to add to the litter store.
3. High precipitation would cause more loss (leaching of nutrients and soil erosion which would remove nutrients from the system.
4. The tropical rainforest would not be able to regrow as there would be very less nutrients to support plant growth.
5. Cutting of trees should be accompanied by vigorous afforestation which would restore the biomass of the forest and logging should be done very prudently.

Item Description

Q.No	Q Type	Competency	Knowledge	Context	Difficulty level
1	Closed Constructed	Evaluate and design scientific enquiry	Epistemic	Global	Medium
2	Closed Constructed	Evaluate and design scientific enquiry	Epistemic	Global	Medium
3	Close constructed	Evaluate and design scientific enquiry	Epistemic	Global	Medium
4	Open ended	Evaluate and design scientific enquiry	Epistemic	Global	High
5	Open ended	Evaluate and design scientific enquiry	Procedural	Global	High

27. HOW ARE ECOSYSTEMS DAMAGED BY PEOPLE? - RHINO POACHING IN SOUTH AFRICA

Area- Natural Resources

Class: 9

Chapter : 14

Chapter Name : NATURAL RESOURCES

Concept-Endangered Animals

Learning Outcomes:-

Student will be able to:-

1. analyse data and interpret graphs/figures
2. calculate the variation in population of Rhino using the data given
3. communicate the findings and conclusions effectively.



Rhinos are mega -herbivores which are found in parts of Africa and Asia. At the start of the 20th century there were over 500,000 rhinos in the world, but hunting drastically reduced this number. At one time, the southern white rhino was as low as 50 individuals in the wild. However, conservation measures have allowed it to increase to over 20,000 individuals. Since 2008 there has been a sharp rise in the illegal killing of rhinos for their horn, especially in South Africa.

There are five species of rhino left in the wild in the world.

Species	Estimated Population
Black Rhino	5,055
White Rhino	20,405
Greater One -Horned Rhino	3,333
Sumatran Rhino	Less than 100
Javan Rhino	61

Table 1. Global Rhino population

Over 93% of white Rhinos are found in South Africa. The Northern White Rhino is a subspecies which has only three individuals. The one male and two females are guarded 24 hours a day but it is likely that the subspecies will become extinct.

The following world map given below shows the distribution of Rhinos world over.

Figure 1. Global distribution of Rhino 2016

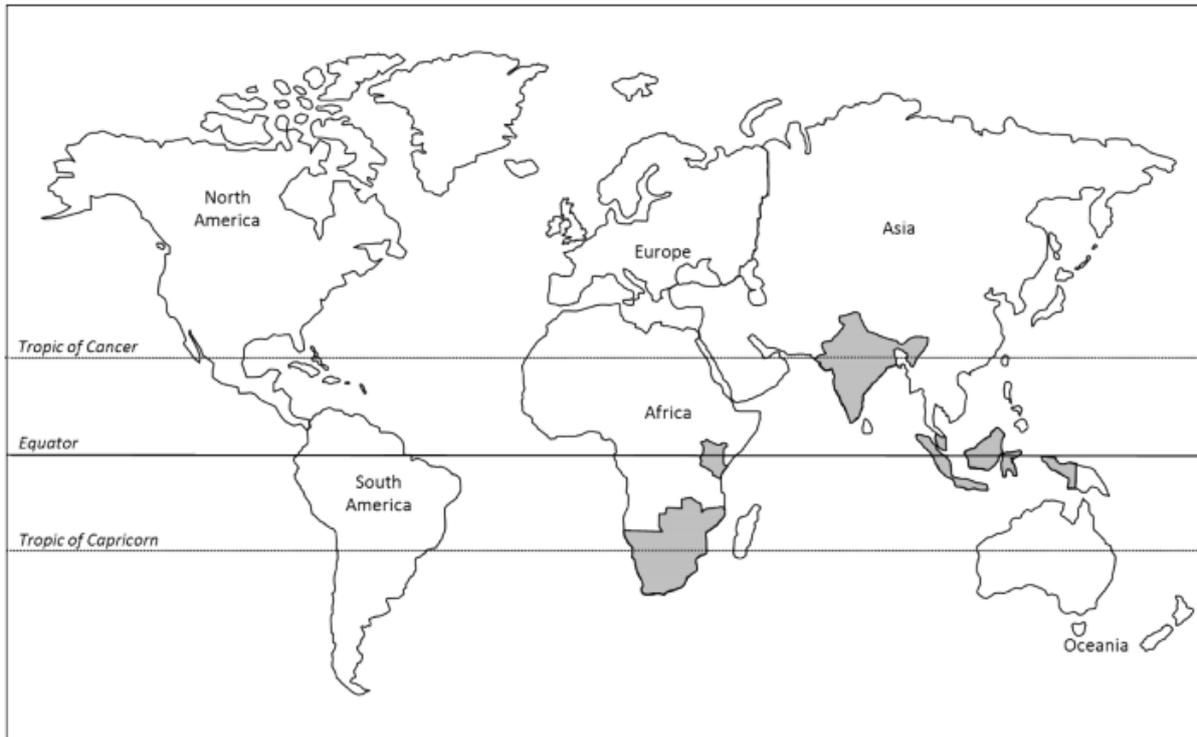


Figure 1. Global distribution of Rhino 2016

- Rhino horn is made from keratin, the same material as human fingernails and hair.
- Traditionally it was used in Chinese medicine as it was thought to cure fevers. It has even been suggested as a cure for hangovers and cancer. There is no medical evidence to support its effectiveness as a cure.
- Today its main use is to display it as a status symbol by wealthy businessmen. Much of the recent growth in use has been in Vietnam. Rhino horn can fetch over £43,000 a kilo which is more expensive than gold.
- Poachers use helicopters, night vision glasses, drugs, high power rifles and chainsaws to track rhinos, kill them and remove the horn.

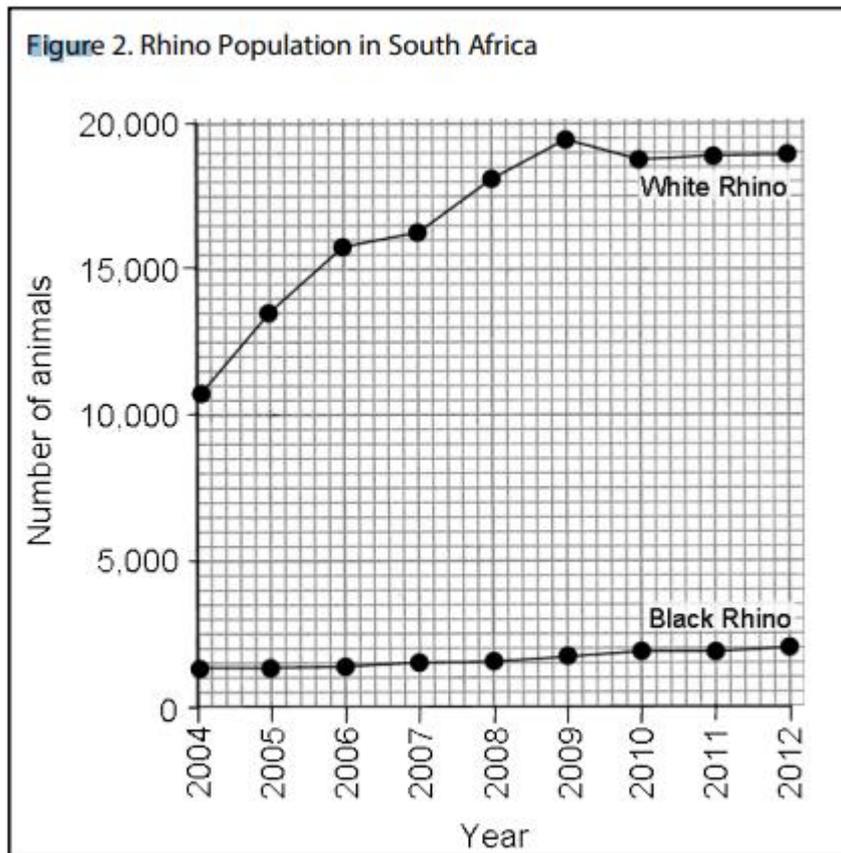


Table 2. Changes in the rhino population of South Africa

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
White Rhino	10,796	13,555	15,941	16,273	18,352	19,409	18,780	18,796	18,910	The next official census of the rhino population takes place in September 2016		
Black Rhino	1,328	1,384	1,456	1,512	1,587	1,678	1,916	1,915	2,044			
Total	12,124	14,939	17,397	17,785	19,939	21,087	19,696	20,711	20,954			
Illegally killed	10	13	24	13	83	122	333	448	668	1,004	1,215	1,175

Questions

Q1. Use Figure 1 to describe the distribution of rhinos found in the world.

Q 2. Suggest ways in which the map in Figure 1 could be improved to show the distribution of rhinos more accurately.

Q3. Use Figure 2 and Table 2 to describe the trends in the population of rhinos that live in South Africa.

Q 4. In 2004, the percentage of the rhino population that was killed illegally was;

$$10/12,124 \times 100 = 0.08\%$$

What was the percentage of the population killed in 2012?

Q5. Calculate the change in the size of the rhino population for each year. Which was the first year when the number of Rhino illegally killed was greater than the increase in the rhino population.

Answer key:

- Rhinos are found in Africa, Indian subcontinent, Indonesia, Sumatra and Java.
- The Rhinos are actually found in South Africa, Namibia, Zimbabwe, Kenya, India, Nepal, Indonesia, Sumatra and Java.
- The initial population of Black Rhino in South Africa was around 1,328 which increased to about 2,044 by the year 2012.
The White Rhino's initial population was around 10,796 in 2004 which steadily increased to 19,409 by 2009 but then it started reducing fell down to 18,910. This was due to higher number of illegal poaching.

4. The percentage of the Rhino population that was killed illegally in 2012 was;

$$668/20,954 \times 100 = 3.18\%$$

5. The change in population size was as follows

Year	Total Population	Birth	Illegally killed	Impact on population
2004	12124	-	10	
2005	14939	2815	13	Increasing
2006	17397	2458	24	Increasing
2007	17785	388	13	Increasing
2008	19939	2154	83	Increasing
2009	21087	1148	122	Increasing
2010	19696	-1391	333	Decreasing
2011	20711	1015	448	Increasing
2012	20954	243	668	Decreasing

The year 2010 was the first year when the number of Rhinos killed illegally was more than the births.

Item Description:

Q.No	Q Type	Competency	Knowledge	Context	Difficulty level
1	Closed Constructed	Evaluate and design scientific enquiry	Content	Global	Medium
2	Open ended	Evaluate and design scientific enquiry	Content	Global	Medium
3	Close constructed	Evaluate and design scientific enquiry	Content	Global	Medium
4	Open ended	Evaluate and design scientific enquiry	Procedural	Global	High
5	Open ended	Evaluate and design scientific enquiry	Procedural	Global	High

28.THE FISH FARMING INDUSTRY OF INDIA

Area: Natural Resources

Class: 9

Chapter : 15

Chapter Name : IMPROVEMENT IN FOOD RESOURCES

Concept: Improvement in Food resources

Learning Outcomes:

Student will be able to:-

1. explain the processes of improvement in food resources
2. communicate the processes/techniques involved in the production of fishes
3. apply this scientific concept in daily life.



Total fish production in India in 2018 is estimated at 6.24 million metric tons (MMT), which is close to two-thirds of the total fish production in the country from both capture and culture sources. The growth in the fish farming sector mainly comes from the freshwater aquaculture sector, as marine finfish culture is hardly practiced on a large scale. About 12.8 percent of total animal protein consumed in India comes from freshwater fish.

Historically, the Indian freshwater fish farming was based on a multi-species system. Natural fish food organisms were generated by adding organic and inorganic manure to water and the multi-species utilize this food based on the trophic system in the pond.

A combination of Indian major carps – including catla (*Labeo catla*), rohu (*Labeo rohita*) and mrigala (*Cirrhinus mrigala*) – were used as the main target species for culture, as well as a few Chinese carp species like silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*) and occasionally common carp (*Cyprinus carpio*). The very high level of technology developed for induced breeding of carps and the abundance of agri-byproducts used as supplemental feed led to the rapid development of freshwater aquaculture in the country.

For a long time, India did not change from this type of fish farming. Nutritionally poor feed ingredients in loose form were fed to fish using feed bags or by directly broadcasting it into the ponds. The feed conversion ratios (FCR) in this type of feeding systems range from 3 to 4 kg of feed to 1 kg of fish production. Fish are normally harvested at 1 to 1.2 kg body weight after 8 to 10 months. They are marketed in iced condition to important consumption markets, which are about 24 to 48 hours away by road.

Q. No.1.Name the method of obtaining fish from natural resources.

Q. No.2.Which technique is used by fish breeders to get economically important fish which generally do not breed in captive conditions?

Q. No.3.What are the two traditional ways of feeding the fish?

Q. No.4.Why a combination of carps like catla rohu and mrigals are chosen in fish farming?

Q. No.5. Why are fish marketed in iced locations?

Q. No.6. A fish was harvested with a weight of 500 gms. Will it be beneficial for the fish breeder. How much should be the minimum weight of the fish when it could be harvested?

Answer key:

Answer1: Score 2 if the answer is capture fishing.

Score 0 for any other answer.

Answer2: Score 2 if the answer is induced breeding.

Score 0 for any other answer.

Answer3: Score 2 for

- a) Ingredients in loose form were fed to fish in feed bags.
- b) Directly broadcasting it in the ponds.

Score 1 for either a or b.

Answer4: Score 2 for they have different feeding zone and different feeding habits and hence do not compete for food.

Score 1 for different feeding zones/ different feeding habits.

Answer5: Score 2 to prolong the shelf life and slow down the action of enzymes and bacteria.

Score 0 for any other vague answer.

Answer6: Score 2 for

- a) No,it will not be beneficial.
- b)Minimum weight should be 1kg or 1000 grams.

Score 1 for either a or b.

Item Description:

Q.No.	Q. Type	Competency	Knowledge	Context	Difficulty level
1	Close Constructed	Explain phenomenon scientifically	Content	Global	Low
2	Close Constructed	Explain phenomenon scientifically	Content	Global	Medium
3	Close Constructed	Explain phenomenon scientifically	Content	National	Medium
4	Close Constructed	Explain phenomenon scientifically	Content	National	Medium
5	Close Constructed	Evaluate and design Scientific enquiry	Procedural	Global	High
6	Close Constructed	Interpret data and evidence scientifically	Procedural	Global	High

29. SUSTAINABILITY

Area: Natural Resources

Class: 9

Chapter : 15

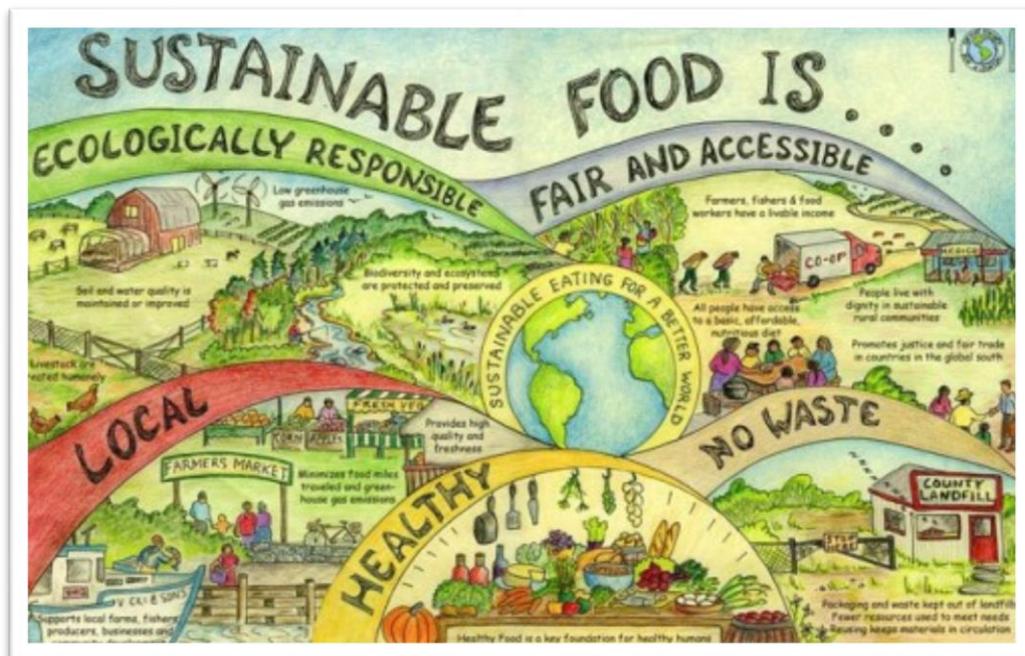
Chapter Name : IMPROVEMENT IN FOOD RESOURCES

Concept: Sustainability

Learning Outcomes:

Student will be able to:-

1. draw conclusions such as effect of green house gases on atmosphere
2. explain the various processes involved in food processing such as packaging, marketing etc.
3. communicate the findings and conclusions effectively regarding healthy food.



Carbon footprint relates to the emission of greenhouse gases such as Carbon Dioxide (CO₂), Nitrous Oxide (N₂O) and Methane (CH₄) that are released to the atmosphere during growing, rearing, farming, processing, transporting, storing, cooking and serving food on your plate.

The further in the world the food has to travel the more of the toxic gas is being released into the air. By buying and using locally grown or produced food we reduce our carbon footprint, helping the environment.

Healthy Sustainable Diets

How can we achieve a healthy diet that is rich in nutrition but also sustainable?

How can we produce more food for a growing population with fewer resources such as land, water and fuel? The first thing we have to address before even attempting these questions is to understand the Food Global System. In essence, this is how we ALL get our food.

It's the way we feed a population. It is the process of growing, harvesting, processing, packaging, transporting, marketing, consumption and disposal of food and food related items. The global concern is that the demand for food is ever increasing by an ever increasing population, and if no action is taken many food sources could be exhausted. The world population is expected to grow from 7 billion to over 9 billion by 2050. To continue to provide the world with food as currently takes place would be viewed as being unsustainable. The WWF (World Wildlife Fund <http://www.wwf.org.uk>) states that the food that we eat has a massive impact not just on our health but also on the health of our planet.

We are already consuming natural resources at a faster rate than the planet's capacity to replenish them. Things need to change. In order to understand some of the proposed changes by government and other organisations, it is important to understand food.

Food plays a vital role not only every single day for nourishment and energy, but also plays a role in culture and society. Nearly 1 billion people are food insecure. They are unable to produce or buy sufficient quantities of nutritious foods. In some way or another, to produce food we must rely on natural resources such as water, healthy fertile soil or the sea. How can you help? There is no overriding single solution to the global food system. Several initiatives have produced action that will require many years of invested time in order to begin to see a change.

The WWF Livewell 2020 campaign suggests that the following six simple rules can make a change, and that these are easily adopted by individuals now.

Six simple rules can make a difference to our health and the planet

- 1. Eat more plants** – enjoy vegetables and whole grains!
- 2. Eat a variety of foods** – have a colourful plate!
- 3. Waste less food** – one third of food produced for human consumption is lost or wasted.
- 4. Moderate your meat consumption, both red and white** – enjoy other sources of proteins such as peas, beans and nuts.
- 5. Buy food that meet a credible certified standard**
- 6. Eat fewer foods high in fat, salt and sugar** – keep foods such as cakes, sweets and chocolate as well as cured meat, fries and crisps to an occasional treat. Choose water, avoid sugary drinks and remember that juices only count as one of your 5-a-day however much you drink.

Questions

Q1. What factors contribute to the sustainability of food?

Q2. Which are the greenhouse gases associated with food consumption?

Q3. List the six simple rules that can help towards changing the global food system and making it more sustainable. 6. Do you agree with these rules? Explain your answer.

Q4. In your opinion, what is the most important factor when trying to eradicate greenhouse gases and improve a more sustainable environment.

Q5. What is the environmental impact of importing food from across the world? Can you find any solutions to these issues?

Q6. Suggest a healthy and sustainable diet that can be adopted by people in order to reduce the impact of greenhouse gases.

Answers Key:

1. It's the way we feed a population. It is the process of growing, harvesting, processing, packaging, transporting, marketing, consumption and disposal of food and food related items.
2. The Greenhouse gases such as Carbon Dioxide (CO₂), Nitrous Oxide (N₂O) and Methane (CH₄) are released to the atmosphere during growing, rearing, farming, processing, transporting, storing, cooking and serving food on our plate.
3. Six ways in which we can improve our life style is
 - Eat more plants
 - Eat a variety of foods
 - Waste less food
 - Moderate your meat consumption, both red and white
 - Buy food that meet a credible certified standard
4. It's the way we feed a population. It is the process of growing, harvesting, processing, packaging, transporting, marketing, consumption and disposal of food and food related items.
5. The further in the world the food has to travel the more of the toxic gas is being released into the air.

By buying and using locally grown or produced food we reduce our carbon footprint, helping the environment

6. Plenty of greens, multigrain, fruits, nuts, unprocessed food and locally grown fruits and vegetables in the diet.

Item Description:

Q.No	Q Type	Competency	Knowledge	Context	Difficulty level
1	Closed Constructed	Explain phenomenon Scientifically	Content	Global	Medium
2	Close constructed	Explain phenomenon scientifically	Content	Global	Medium
3	Close constructed	Interpret data and evidence scientifically	Content	Global	Medium
4	Open ended	Evaluate and design scientific enquiry	Procedural	Global	Medium
5	Open ended	Evaluate and design scientific enquiry	Procedural	Global	Medium
6	Open Ended	Explain phenomenon scientifically	Content	Personal	Medium

