

2003 Biology - I Answers

Que. No.	Ans. No.	Que. No.	Ans. No.	Que. No.	Ans. No.	Que. No.	Ans. No.	Que. No.	Ans. No.	Que. No.	Ans. No.
01.	2	11.	2	21.	3	31.	4	41.	1	51.	1
02.	5	12.	4	22.	5	32.	3	42.	3	52.	1
03.	1	13.	1	23.	2,5	33.	2	43.	2	53.	3
04.	4	14.	4	24.	1	34.	5	44.	2	54.	4
05.	3	15.	2	25.	2	35.	1	45.	all	55.	3
06.	1	16.	3	26.	4	36.	1	46.	5	56.	1
07.	5	17.	2	27.	2	37.	4	47.	3	57.	5
08.	4	18.	4	28.	3	38.	2	48.	4	58.	4
09.	4	19.	5	29.	3	39.	1	49.	3	59.	5
10.	1	20.	5	30.	2	40.	2	50.	4	60.	2

2003 Biology II Answers

Part A - Structured Essay

01.

(A) (i) Kingdom, Division/ phylum, Class, Order, Family, Genus, Species [or the reverse order]

- (ii) • It is the naturally occurring taxon which can produce fertile offspring when interbred.
• It is a group of organisms having many common characteristics and differs from other groups of organisms in same features

(iii) It is a way of identifying an organism using two names-that is by a generic name and a specific name/ epithet

- (iv) • Binomial nomenclature ensures precise identification of the organism
• The common name of an organism varies from place to place, and is expressed in different forms in different languages
• It is the scientific form of naming which is accepted world wide.

- (B) (i) 2. Body segmented B
Body unsegmented D
3. Wings present E
4. Eyes stalked C
Eyes not stalked A

(ii) Dichotomous key

(iii) D/ Starfish

- (iv) A. Arthropoda
C. Arthropoda
E. Arthropoda
B. Annelida
D. Echinodermata

- (v) • presence of tube - feet.
• Penta-radial symmetry
• Pedicellaria which are minute, pincer-like structures that help to keep the body surface free of debris and may also help in capturing food.
• Ambulacral region alternating with interambulacral regions.
• Madreporite- which is a sieve through which sea water enters the water vascular system.

- (C) (i) • Anthophyta/Angiosperm
Pterophyta
Bryophyte
Cycadophyta
Lycophyta

- (ii) • presence of photosynthetic pigments like chlorophyll a, b and carotenoids/photosynthetic nutrition
• Body differentiated into stem, root and leaves/ highly differentiated body
• Cellulose cell wall present
• Main storage substance is starch
• True tissues present
• Multicellular
• Eukaryotic cellular organization

(iii) Angiospermae / Anthophyta

- (iv) • Presence of flowers as reproductive axis / highly differentiated reproductive organs present
• Presence of seeds for propagation
• Seed formed inside fruits/ seeds covered by pericarp / ovary developed into fruit /ovules develop within ovary / ovules formed on carpels.
• Double fertilization / resulting in triploid endosperm
• Vassels in xylem

(D) (i) Greenhouse treat is the gradual rise in global/ (atmospheric) temperature

- (ii) • Carbon dioxide
• oxides of nitrogen / NO, NO₂, N₂O
• Methane, Water

- (iii) • Oxides of sulphur / sulphur dioxide
• Oxides of nitrogen/NO₂/ NO

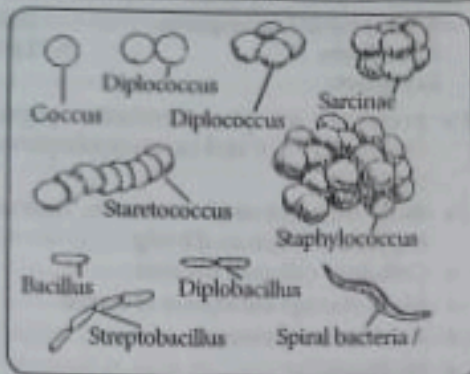
- (iv) • Destroys (specially metallic parts and marble) in monuments and buildings / corrodes parts of buildings and monuments /or examples
• Increases soil acidity /decreases pH of water and hence harmful to aquatic flora and fauna.
• Destroys vegetation / Cultivation forests
• Increases solubility of heavy metals in water

- (v) a - Ramsar convention
b - CITES
c - Montreal((Protocol)
d - Basel Convention
e - Biodiversity convention

02.

- (A) (i) • Organism microscopic/Size minute Hence escapes detection / High surface : volume ratio.
• Able to use a vast number of substrates / metabolic versatility
• Nutritional versatility /modes of nutrition include photo autotrophic, chemosyn thetic, parasitic, saprophytic, symbiotic
• Aerobic or anaerobic / can live with or without oxygen
• Can survive drastic environmental conditions / Can endure very high or Very low conditions of pH, temperature and salinity
• High the of multiplication / high reproductive rate / less generation time / faster

(ii)



(iii) Micrometer / μm
Nanometer / nm

- (B) (i) (a) Nutrient agar
(b) Potato dextrose agar

- (ii) (a) • Heat in an oven (using hot air)
• at 160°C for 1-2 hours.
(b) • Heat in a pressure cooker / autoclave
• at 121°C for 15-20 minutes

- (C) (i) A Primary treatment / Primary sedimentation
B Secondary treatment / Trickling filtration
C Anaerobic (sludge) is removed
D Disinfection / chlorination

- (ii) A • Large particles which float, are removed.
• Sand is also removed
• Oil (grease) is removed
• Solid matter settles out / sediments
• Removes 25-35% organic and fine suspended matter.
B • Waste water is slowly sprinkled over a bed of rocky material,
• Aerobic bacteria / micro organisms grow on the walls
• A large amount of decomposition / microbial (bacterial) oxidation occurs.
• 75-95 % organic material is removed I BOD reduced
C • Organic matter is decomposed anaerobically / by anaerobic bacteria
• Methane and carbon dioxide are produced.
D • Micro organisms destroyed.

- (D) (i) • Since micro organisms are colourless/ transparent
• They cannot be seen clearly with a light microscope/ no contrast

(ii)

Steps	Purpose
Preparation of bacterial smear	To spread the bacterial to get this layer;
Air drying flaming/ heating in the flame	Fixation To prevent the sample from getting washed off during staining

Stain with/ add methylene blue and keep for 30-60 seconds	To stain the bacterial cell (wall)
Wash in running water	To remove excess stain

03.

- (A)(i) • Hormones are (organic) chemical substances / acting as chemical messengers
• Which are produced in one part of the organism, but transported to the place of action / target organ or tissue, situated in another part
• They are secreted/produced in small amounts / concentrations and promote stimulations/bring about a physiological response/ change
• and intermediate filaments (in eukaryotes) and found within the cytoplasm / cell

(ii)

Animal hormone	Plant hormone
Synthesized in ductless endocrine glands	Synthesized in certain tissues. No specific organs or glands involved in synthesis
Transported in blood / blood vessels	Transported through xylem / phloem
Complex organic substances	Simple organic substances

(iii) Homoeostasis

- (B) (i) Endocrine glands do not have ducts (ductless), while exocrine glands have ducts.

(ii) Pancreas.

(iii)

Hormone	Site of production	Site of action
Aldosterone	Adrenal cortex	Distal convoluted tubule
Secretin	Duodenum	Liver/pancreas
Oxytocin	Hypothalamus	Uterus / mammary glands / myometrium of uterus smooth muscle fibres
Growth hormone	Anterior pituitary	All organs / all tissues and cells.
(FSH) Follicle stimulating hormone	Anterior pituitary	Ovarian follicle seminiferous tubules

(iv) Prolactin / Growth hormone

(v) Renin/Erythropoietin

- (C) (i) • In the neck

- On either side of / slightly below the larynx anterior to the trachea

- (ii) • Calcitonin / Thyrocalcitonin
• Thyroxin/T₄
• Tri iodo thyronin / T₃

- (iii) • Cervical
• Lumbar
• Thyroxin (and) triiodo thyronin regulate / increase the basal metabolic rate promotes breakdown of glucose and fats to provide energy / increases cell respiration and cardiac output.)
• Increases / regulates growth / development
• Calcitonin
• decreases the level of calcium in blood
• decreases the level of phosphate in blood

- (iv) • Reduction of blood glucose level, stimulates the islets of Langerhans to increase secretion of glucagons, which act on the liver and stimulate / cause conversion / breakdown of glycogen to glucose also it stimulates conversion of proteins to glucose and lipids to glucose
• This increases glucose level in blood

- (D) (i) • Auxins;
• Gibberellins / gibberellic acid
• Cytokinins
• Abscissic acid;
• Ethylene / ethane

- (ii) • a- gibberellins / gibberellic acid
• b- cytokinins
• c- auxins
• d- ethylene / ethane
• e- cytokinins
• f- cancelled
• g- gibberallins
• h- ethylene / ethane
• i- cytokinins
• j- auxins / gibberallins

04.

- (A) (i) • Deoxyribose sugar
• Phosphate
• Nitrogen base [not A, T, C, G]
(ii) • it has a structure which is simple,
• Stable and universal / common
• It can store information (as the base sequence), this information may be changed.
• Mutations also result in variation of information
• It can self-replicate to produce identical / exact copies of itself

(iii) a) RNA

b)

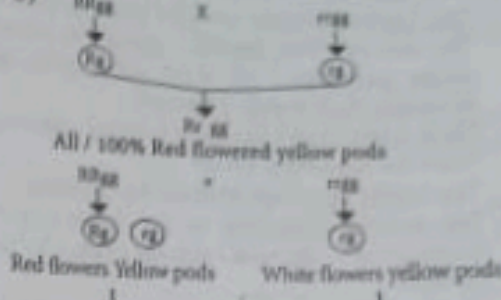
DNA	RNA
Pentose sugar is deoxy ribose / deoxyribose nucleic acid	Pentose sugar is ribose / ribonucleic acid
Thymine present. No uracil	Uracil present. No thymine

- (B) (i) A cross with the totally homozygous (phenotype) recessive individual / a cross carried out with the recessive phenotype for all characters concerned

(ii) To determine the genotype of an organism.

- (iii) a) Red flower - R White flower - r
Green pod - G yellow pod - g
Genotype • RRgg • Rrgg

b)



- (C) • Manufacture of hormones (like insulin or growth hormone)
• Production of vaccines.
• DNA finger printing (to identify people)
• Gene therapy
• Manufacture of enzymes (like protease, amylase etc)
• Production of blood Clotting factor
• Production of varieties of pest-resistant crops
• Production of high yielding crop varieties / livestock / animals / genetically modified food.
• Production of disease - resistant crops - fish varieties, Production of crops with high nutritive value.

(D)

Phenotype	Observed frequency (O)	Expected frequency (E)	$(O - E)$	$(O - E)^2$	$\frac{(O - E)^2}{E}$
A	80	$\frac{160}{16} \times 9 = 90$	-10	100	1.1
B	40	$\frac{160}{16} \times 3 = 30$	10	100	3.3
C	25	$\frac{160}{16} \times 3 = 30$	-5	25	0.8
D	15	$\frac{160}{16} \times 1 = 10$	5	25	2.5

Total no. of frequencies = 80 + 40 + 25 + 15 = 160

$$\chi^2 = \sum \frac{(O - E)^2}{E} = 7.7$$

- Chi square / from the table, for 4 classes is 7.82-
• The calculated value is less than the value from table
• Hence, observed frequencies/values are not significantly different from expected
• /values (at 5% level of significance)
• Hence, at 5% level of significance, A : B : C : D conforms to 9 : 3 : 3 : 1

Part B- Essay

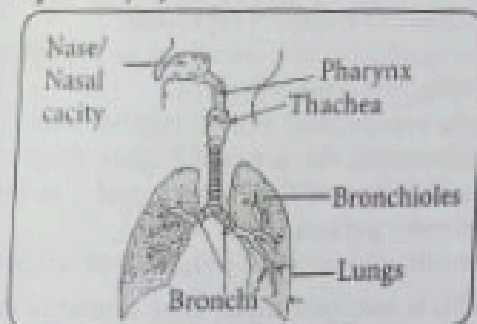
01.

- (i) • Starch, which is the temporary storage product of photosynthesis, is converted to sucrose for transport, in the mesophyll
• This sucrose dissolves in the water in the cells, and in this aqueous condition, it is transported through the phloem sieve tubes.
• These sieve tubes contained in the veins / veinlets leaves
• Receive sucrose by an active process / using energy (ATP) through transfer cells

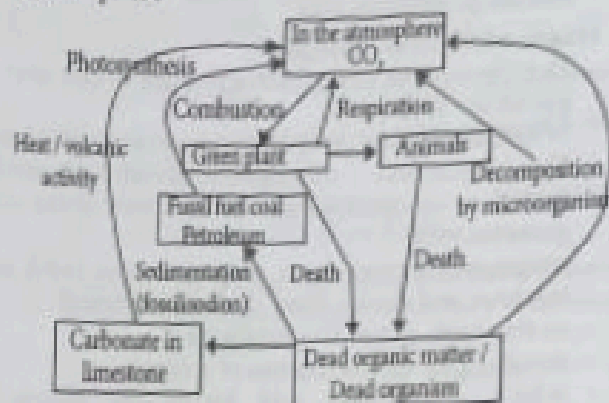
- This (active) process is called phloem loading.
 - The sucrose thus loaded / received, increases the solute potential / of sieve tube cells, and thus decreases their water- potential
 - Then, water enters the sieve tube by osmosis.
 - From the adjoining xylem
 - This builds up a high hydrostatic pressure
 - The sucrose (dissolves in the water), is passively transported to the sink / storage organs by mass flow method
 - At the storage organ / sink, sucrose actively enters the cells of sink through transfer cells,
 - the process being termed phloem unloading.
 - This removal of sucrose from the sieve tube causes an increase in water potential in the sieve tube
 - so that water moves out into the neighbouring xylem tissue.
 - This establishes a concentration gradient / hydrostatic pressure gradient from the source which is the mesophyll to the sink which is storage organ
 - Phloem transport / translocation is known as the pressure flow hypothesis
- (ii) - Phloem tissue consists of Phloem parenchyma
Phloem fibres, companion cells, Sieve tubes / sieve elements, Sieve tubes / elements are living cells with thin cytoplasm but without a nucleus
- The cell walls are of cellulose and not lignified
 - The sieve elements / individual cells of the sieve tube, are connected end to end forming a continuous tube with sieve plates at the cross walls / end walls
 - Each sieve tube cell / sieve tube member is associated with a companion cell which has a distinct nucleus and dense cytoplasm
 - In-growth are present in the companion cells / transfer cells.
- 02.
- i) - Theory of creation life / Living species were creations of God
- Theory of spontaneous generation At any time
 - Life arises from non living material/things
 - Spontaneously
 - Extra terrestrial theory / cosmogony theory Living beings came to earth from outer space.
 - along with meteorites or in an (alien) space craft
 - Biochemical theory-life arose
 - and gradually evolved in accordance with natural physical and chemical laws
 - The earth which is about 4.5 billions of years old, did not have oxygen in its atmosphere. Instead there were plenty of gases like hydrogen, ammonia, methane, hydrogen, sulphide and water vapour
 - Due to the high level of ultra violet radiation (from the sun)
 - Complex organic molecules were formed (from these gases) and (atmospheric) electrical discharges (lightning)
 - The first of life / living beings would have arisen from aggregation of the above organic molecules,
 - which were subjected to a process of natural selection
- (ii) - In a population/ species, individuals can produce a large number of off spring / have a higher reproductive potential
- The number of individuals produced exceeds number that survives. This is over production
 - There are morphological / structural differences amongst individuals (in a species / population)
 - They also differ in their functioning / activities and behavior
 - The above differences are called variations which occur (purely) at random
 - Some variations may be favorable, and some unfavorable
 - (Only) some of the variations are passed on to the, following generation which would contribute towards evolution.
 - Competition amongst individuals exists for limited resources such as habitats / places of shelter, mates / breeding grounds and food.
 - This competition could be between members of the same species or between members of different species.
 - Individuals with favorable characters / variations, have a greater advantage in this struggle of existence
 - They can utilize environmental resources better than others
 - Hence they would survive in that environment.
 - This is known as survival of the fittest [selective advantage]. They reproduce (successfully) and pass the favourable characters / variations, to the off spring / next generation / progeny.
 - Those without favourable characters / variations, would not be able to reproduce,
 - or,
 - would not survive till adulthood / maturity [they die, before reproduction]
 - Thus individuals with favourable variations / characters, having successfully survived natural selection will remain in that environment
 - This natural selection occurs from generation to generation
 - resulting in individuals that are better adapted to survive in that environment.
- 03.
- (i) **Respiratory system of man starts with**
- The nose or nasal cavity which opens to the outside through anterior / external nostrils/ nares
 - Nasal cavity / nose consists of two chambers / parts,
 - separated by a longitudinal septum.
 - Nasal cavity leads to the next part, the pharynx
 - Pharynx leads to the larynx which contains cartilages and vocal chords
 - Trachea is the part leading from the larynx.
 - Trachea containing C - shaped (semi circular) cartilages, it is forked at its free end / distal end / inferior end into (two) bronchi
 - Each bronchus enters a lung
 - Inside each lung, the bronchus divides into bronchioles

- These bronchioles divide into terminal bronchioles and respiratory bronchioles or alveolar duct and alveoli.
- Alveoli are bubble-like
- the lungs of which there are two are cone shaped and sub divided. Right lung contains 3 lobes and the left lung has 2 lobes
- Ventilation consist of a process of inspiration and expiration / it is the process by which air moves in and out of the lungs.
- Contraction of external intercostal muscles cause the ribs to move upwards
- and the sternum to move for wards
- This enlarges the thoracic cavity sideways and anteroposteriorly.
- Diaphragm is depressed / flattens / contracts so that the thoracic cavity enlarge vertically
- As a result of enlargement of the thoracic cavity, pressure inside the plural cavity decreases
- This causes the lung- volume to increase by the expansion / stretching of lungs outwards pleura,
- so that the pressure within the lungs decreases below atmospheric pressure
- This causes an inflow of air to the lungs
- until the pressure within the lungs equals to atmospheric pressure
- The above is called inspiration and is an active process
- Relaxation of external intercostal muscles and diaphragm muscles cause the ribs, sternum and diaphragm to resume their original positions
- causing a reduction in volume of the thoracic cavity
- causing an increase in pressure within the pleural cavity
- The result ant reduction in volume of lungs increases the lung- pressure causing the air within to move / flow out
- This passive process is expiration
- lung ventilation is regulated by the respiratory centre in the brain.

Respiratory system of man



- The carbon thus fixed, is returned to the atmosphere as CO_2 in the following ways
- a) By respiration of plants, animals microbes
- b) By decomposition of dead organisms and faeces
- by heterotrophic/saprophytic microorganisms / bacteria and fungi
- Sedimentations of dead organisms in aquatic environments form deposits of carbonates/ lime stones
- Accumulation over million years, of dead and decaying organic matter
- under anaerobic conditions,
- result in the production of fossil fuel.
- Carbon in the fossil fuels and other organic materials are released to the atmosphere, as CO_2 ,
- by burning/ combustion
- Volcanic activity / eruptions also release CO_2 to the atmosphere



- (ii) - Increase in carbon dioxide in the atmosphere occurs as follows

- Burning of fossil fuels in factories / industries
- and in vehicles / automobiles
- Deforestation / cutting down of trees in large numbers in the forests.
- Forest vegetation absorbs a large amount of CO_2 for photosynthesis.
- Increase in CO_2 in this fashion causes an imbalance of gases [O_2 and CO_2] in the atmosphere
- CO_2 increases, causes global warming / contributes to green house effect
- This results in the melting of glaciers / polar ice caps, and thermal expansion of water,
- causing a rise in sea-level.
- Result would be the inundation / flooding of coastal areas. Thus affecting biodiversity.

05.

- (i) - Life cycle consisting of three phases / stages involved (two hosts)- man and female mosquito - *Anopheles*
- Recessive allele
 - They are a) pre erythrocytic / exoerythrocytic stage
 - b) erythrocytic stage
 - and sexual stage / stage which being in man and occur inside the mosquito

Exoerythrocytic stage

- Sporozoites (in mosquito) enter the blood-stream of man, when an infected female mosquito bites a man.

source / pool of carbon is air/ atmosphere in the form of CO_2 .
In plants/plants with chlorophyll
is carbon CO_2 into glucose / organic compounds
photosynthesis
imals fungi, heterotrophic bacteria / heterotrophic
imals either directly get their carbon from plants
tting them or indirectly, by eating herbivores /
imals

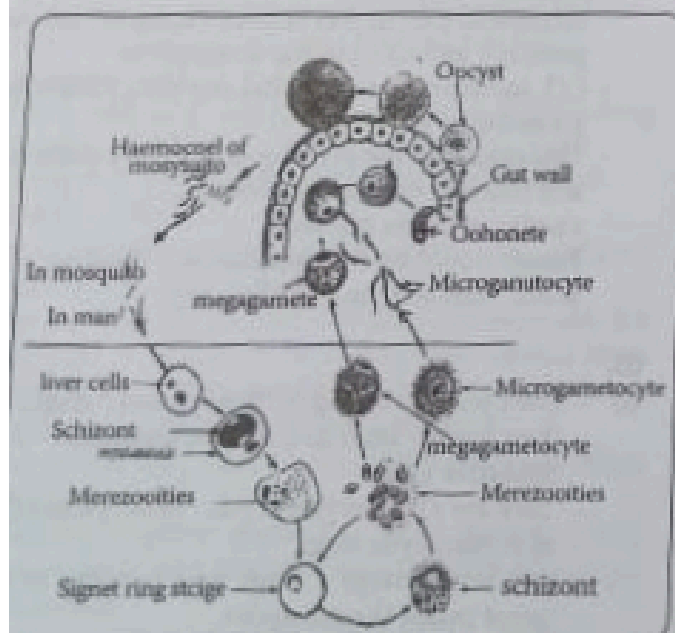
- From the blood, the sporozoites enter the liver cells and grow to become schizonts.
- which multiply asexually / by fission,
- producing merozoites.
- Rupture of the liver cells
- release these merozoites into the blood stream.

Erythrocytic stage.

- Merozoites enter the red blood cells (RBC)
- and assume a signet-ring shape inside it.
- and becomes a schizont.
- Schizont multiplies asexually / mitotically
- and form merozoites
- Merozoites are released into the blood
- when the erythrocytes rupture.
- Some merozoites may attack new erythrocytes
- and start another cycle
- Some of the merozoites form gametocytes / micro and mega gametocytes

Stages within the-mosquito

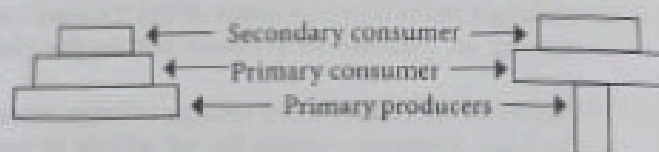
- The (two types of) gametocytes are drawn into the gut of the mosquito
- When the female *Anopheles* mosquito sucks blood.
- The (sperm like) microgametes (with large nucleus and clear cytoplasm) are formed from in the micro gametocytes
- megagametocytes form megagametes (with small nucleus and dense, food-laden cytoplasm)
- in the mid-gut of the mosquito
- resulting in the formation of a zygote
- which (elongates) and forms the (worm-like) ookinete. Ookinete passes through the gut wall
- and forms an oocyst (after enlargement)
- within the gut wall
- sporozoites are haploid are formed within the oocyte.
- Sporozoites enter the haemocoel / fluid filled body cavity of mosquito
- and enter the salivary glands (where they stay till ejected into a man, when the mosquito sucks blood.)



- (ii) - Control of mosquito (population) could control the spread of malaria, since this insect is essential to complete the life-cycle of the malarial parasite
- This can be done by a) destroying (stagnant pools of water which are the breeding grounds of mosquitoes)
- b) using insecticides / [mosquitocides] to kill the adult mosquitoes
- c) using fish which feed on mosquito larvae/ to kill larvae
- Also, malaria can be controlled by preventing mosquito bites / contact between mosquito and man
- by using a) mosquito repellents b) mosquito nets
- Once the parasite enters the human body, it can be controlled by using suitable drugs (eg. Quinine)

06.

- (i) - Prawn farming is usually done by clearing mangrove areas which results in a) loss of / decrease in bio diversity b) loss of habitats / breeding grounds for aquatic fauna / fish / prawns
- erosion. Due to waste water from prawn-farms
- being sent to nearby water ways / flooding the area
- and due to blocking / obstruction of drainage water canals
- quality of water in the nearby rivers and streams, deteriorates
- Grazing area for cattle also would reduce.
- (b) - Ecological pyramids are diagrams which depict / show energy transfers and feeding / nutritional relationships through biotic components / living beings, of an ecosystem



- Generally, the base of the pyramid is represented by primary producers and
- other trophic levels are represented by higher levels
- Biomass pyramid represents
- total dry mass of organisms at each trophic level
- pyramid of numbers represent
- the number of individuals at each trophic level
- Energy pyramid represents
- total energy fixed at each trophic level
- Sometimes, the areas of higher trophic levels may exceed that of the lowest level - in the number / biomass pyramid.
- resulting in inverted pyramids or irregular pyramids
- (iii) - This is non-specific defence system in man
- occurring as a response to an infection
- or damage to tissues.
- It prevents spread of infection from original site /
- Characteristic features of inflammatory response are
- a) swelling (of site of infection) b) reddening of that area c) rise in temperature at the area d) pain in the infected area