**MARKING SCHEME**

1. a.) D – A – B – C – E (1mark)  
     
   1. i.) (2marks)

**D—1000**

**A—10**

**B—0.10**

**C—0.01**

**E—0.0.01**

ii. **E** and **C** because they have the same biomass (2marks)

iii. Pyramid of numbers does not reflect the actual energy in trophic level that can sustain the subsequent trophic levels.(2mark)

iv. Interspecific competition.(1mark)

2a.) i Plant tissue

ii. It has got no centrioles

iii R – anaphase  
 T– Telophase  
b.) – Retention of chromosome number  
 - give rise to new cells  
 - Brings about growth in multicellular organisms  
c.) Root tip, Shoot tip, Cambium, Flower, Bud, Young leaf  
d.) Chromatids reach the poles and become densely packed.  
 - A cell plate grows across the equatorial plane.  
 - Nuclear membrane forms.

**3** a.) **E** – Guard  **F** – Stoma/ Stomatal **G –** Epidermal cell  
b.)- Thick inelastic inner walls;

-thin elastic outer walls.  
c.)PH is raised: high PH activates enzymes that convert starch to glucose: osmotic pressure is raised: cells draws water from neighboring epidermal cells leading to turgidity: stomata opens.

**4**a.) **Aim** – To demonstrate osmosis in red blood cell in hypertonic solution.  
  **Requirements** – Hypertonic solution (water, salt/ sugar) whose concentration is higher than   
 that of the red blood cell.  
 **Procedure** – red blood cell is placed in hypertonic solution and left for some time.  
 **Observation** – After sometime the red blood cell shrinks/ crenate.   
 **Explanation** – By osmosis water moved out of the red blood cell because it was hypotonic to the solution. The red blood cell became crenated.   
  
  
 b.) - Reabsorption of water from the kidney tubules into the bloodstream.  
 - feeding insectivorous plants.

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 b.) i. Downs syndrome – extra somatic chromosome  
 ii. Klinefelter’s syndrome – extra sex chromosome  
 iii. Turners syndrome – only one sex chromosome  
 iv. Polyploidy – number of chromosomes in plants may double or triple up.

Parental genotypes

xnY X xNxn

xn

Y

xN

xn

xNxn xn xn xNY xnY

Long wing vestigial wing long wing vestigial wing

Genotypic ratio: 1 xNxn : 1 xn xn : 1xNY : 1 xnY

Phenotypic ratio: 1 female carrier: 1 female vestigial wing: 1 male long wing: 1 male vestigial wing

(Long wing)

6 (b) 38.5 mg (Accept a range of 0.5 above and below the given value)

C (i) Hydrolysis of starch into simple sugars which is translocated to the embryo: and oxidized in

respiration to release energy for germination: heat and gaseous products.

(ii) New materials are synthesized (from proteins), bringing about growth of embryo.

(iii) The rate of respiration is faster than that of synthesis of materials for growth.

(v) presence of germination inhibitors (abscisic acid)

Absence or inactivity of germination hormones or enzymes (accept gibberellins and cytokinins)

Impermeable testa (seed coat)

(ii) Unsuitable temperatures (unfavorable temperatures): absence of light: absence of

Moisture/ water and lack of oxygen.

7. (a) water exists as a film in the soil/ soil particles: the concentration of the cell sap of the root hair cell is greater than hypertonic to the surrounding solution in the soil: the osmotic pressure of the hair cell sap overcomes the water retention capacity of the soil: causing root hair cell to draw water by osmosis: through cell wall and cell membrane: water drawn into the root hair cell dilutes the concentration of the root Hair cell: making root hair cell hypotonic/ less concentrated than the adjacent cortical cells of the root: due to osmotic gradient, water moves from the root hair cells into the adjacent cortical cells by osmosis: until the endodermis where it passes through by active transport: then into the xylem of the root.

7. (b) **structure and functions of the blood (12 marks)**

* Red blood cells – transport oxygen in the form of oxyhaemoglobin from the lungs to the rest of the body: transport carbon (IV) oxide in the form of carbamino-haemoglobin and weak carbonic acid from the tissues to the lungs.
* The plasma- transport carbon (IV) oxide as bicarbonate from tissues to lungs from exhalation: Transports waste materials from body tissues to excretory organs e.g. Urea from liver to kidneys: - Transports hormones from endocrine glands to the tissues where they act.

-Transports heat from the liver and muscles to all parts of the body. - Transports ions and water to maintain osmotic balance of body fluids. -Transport white blood cells and antibodies to sites that are infected by pathogens.

-Transport of enzymes from sites of secretion to areas where they are required.

-Transports antibodies and phagocytes to sites of infection.

* White blood cells – lymphocytes secrete various antibodies which cause agglutination/ clumping

together of micro-organisms for easy ingestion by phagocytes.

* Phagocytes engulf pathogens then secrete enzymes that digest and destroy them.
* Platelets initiate blood clotting of injured blood vessels.

8. (a) **Fossils** - this are remains of ancestral forms of organisms that were accidentally preserved in sedimentary rocks, resins: the study of fossils records is called **paleontology.** It provides direct evidence of gradual changes from one type of organism to another. Fossils are prepared in sedimentary rocks which are layered: lowest layers of rocks contain the oldest fossils whereas the uppermost contain the most recent forms of fossils. This points to the fact that organisms evolve with time and hence more complex structures are found in most recent fossils in the upper sedimentary layers.

(b) **Geographical distribution of organisms**- millions of years ago the world was one land mass called Pangea surrounded by a huge ocean. - Water on the land mass split and the continents drifted apart to their present locations & continental drifts.

- It is believed that before the continental drift areas with similar climates were inhabited by similar species of organisms. After the split members of the same species became isolated by barriers such as deserts, oceans, mountains etc.

-though mountains and natural selection each isolated group evolved independently adapting to different environmental conditions: eventually each group became a different species although they were in climatically similar but geographically different regions, e.g. puma in south America is related to the African lion; Llamas of south America are related to the African camel.

(c) **Comparative Serology ­**– serology is the study of blood of (serum) proteins. The blood proteins antigen/ antibody and their reactions in different animals show **phylogenic relationship.**

- An animal may produce antibodies to serum proteins of an animal from a different species. This point out a common ancestry from which they diverged to differ. The antigen-antibody reaction is an immunological reaction leading to the formation of a precipitate. The greater the amount of precipitate in the immunological reaction between blood samples from the different animals the closer the phylogenetic relationship e.g. human has constituents and antigen- antibody reactions similar to that of apes e.g. ABO and rhesus factor system. This confirms their close common ancestry.

(d) **Comparative Embryology** – this is the study of development of embryos of related animals.

- Embryos of different vertebrate species have many common features suggesting a common ancestry.

- At the early stages of development the embryos of many vertebrate species resemble one another so closely that it is most almost impossible to tell them apart.

- All vertebrates Embryos have tails which in man degenerates while in most other vertebrates it remains/ persists. The similarity suggests a common ancestry, the closer the resemblance between early stage embryo the closer their evolutionary relationship.

(e) **Comparative Anatomy** – members of phylum or group shows similarities; organisms have similar structures or organs performing similar functions e.g. digestive system, urinary system etc. such structures are categorized into three

1. **Homologous structures –** these are structures having common embryonic origin but may be modified to perform different functions hence they differ structurally. The presence of homologous structures implies same ancestry at some time during evolutionary history, hence one form could give rise to various forms and this is called *divergent evolution*. E.g. pentadactyl limb plan in vertebrates: beak structures of birds: feet structures of birds, vertebrate hearts.
2. **Analogous structures** - these are those having different embryonic but have evolved to perform similar functions due to exploitation of same kind of environment. Evolution of analogous structures is called *convergent evolution*. E.g. wings of birds and insect used for flight: eye structures for humans and octopus: thorns in sisal and cactus.
3. **Vestigial structures -**  these are structures which have ceased/ stopped to be functional and hence are greatly reduced to be functional and hence are greatly reduced in size (rudimentary) in the course of evolution: it is believed that these organs were present and functional in the ancestral organisms but were selected against as the animals/ organisms became adapted to different modes of life e.g caecum and appendix in man, ear muscles in man, body hair in man, coccygeal/ coccyx in man, nictitating membrane, reduced wings beneath the body plumage of kiwi (Australian flightless bird).