SCORING SCHEME

S.6 BIO2 INTERNAL MOCK-2023

SECTION A (40 MARKS)

1.

(a) Germination for both seed samples begins at the second day; percentage germination of long day illuminated seed samples is higher at any given time than that of short day illumination seed samples; The germination of both seed samples follows the same trend;

OR

Similarities

- From 2nd to 4th day; both increased slowly;
- From 13th to the end of experiment; both remained constant;
- On day 2; both are the same/equal;

Differences

Long day	Short day
• From 4th to 8.5th day; percentage germination increased rapidly; • Percentage germination attained a maximum earlier; • Percentage germination attained a higher maximum; • On any day percentage germination is higher;	• From 4th to 8.5th day; percentage germination increased gradually; • Percentage germination attained a maximum later; • Percentage germination attained a lower maximum; • On any day percentage germination is lower;

03MAX

(b)

(i) The plant will not flower/flowering will be delayed; as the short light period/flash of light caused the conversion of phytochrome 660; to phytochrome 730; which inhibits flowering of a short day plant;

@01MKS; 04MKS

OR

The flash of light separated the long dark period into two short dark periods; and each was short/there was no single long dark period; to allow flowering of a short day plant;

(ii) Long periods of light/ illumination with light increases seed germination; and the short periods of light reduce the seed germination; Light induces the production of plant hormone/germination promoters; gibberellic acid/gibberellins; which stimulates germination; This is done through interaction of two phytochromes; phytochrome red(P660) and

phytochrome far red(P730). During periods of long hours of illumination, P660 is converted to P730; which induces the production of plant hormones including gibberellic acid; thus, germination of seeds is increased; During periods of short hours of illumination P730 is converted to P660; which inhibits the production of gibberellic acid; thus, germination of seeds is reduced**.** **@01MK**, **11MKS**

(c)

(i) When subjected to a short day illumination, the plant did not flower; when exposed to a flash of light the plant flowered; **02MKS**

(ii) The plant will not flower when subjected to a short day illumination/exposed to a flash of light; **01MK**

(d) Long period of dry seed storage increases the germination of seeds; and short period of dry seed storage decreases the germination of seeds; Long period of dry seed storage decreases the germination of seeds; Long period of dry seed storage increases the growth of immature embryo(after ripening period); and decreases the germination inhibitors/abscisic acid; but increases the accumulation of germination promoters/gibberellic acid/gibberellins; which mobilizes food reserves during germination; and germination of seeds increases.

@1MK, 07MKS

(e) .

(i) Increasing exposure of seeds/embryo to air and oxygen; induced more rapid seed germination; and when air was substituted by oxygen; most rapid seed germination was induced; **@01MK,04MKS**

(ii) Germination involves growth which requires energy released by respiration; which occurs in the presence of oxygen; thus increasing exposure of seeds to air and oxygen produced more energy (ATP) required for germination; and the rate of germination increases;

@01MK,04MKS

(f) The spores have less food stores; thus light; and can be dispersed to longer distances; away from the parent plant; reducing on the overcrowding; and the risk of the attack by the diseases of the parent plant;
The spores are resistant to adverse environmental conditions; so can survive and germinate when the conditions are favourable;
The less food reduces chances of being fed on; by animals/pests; thus, remaining viable for longer periods of time;
Spores are mitotically produced and generally identical to the parents thus conserving the traits; from generation to generation; **@0.5MK, 06MAX**

T/L=40MARKS

SECTION B (40 MARKS)

2. (a) This is the change of the three dimensional shape of the protein molecule; due to the breaking/breakage of weak ionic and hydrogen bonds; **@01MK, 02MKS**

(b)

- **Heat**; increases the kinetic energy; causing the atoms of protein to vibrate more significantly thus breaking of the ionic and hydrogen bonds;
- **Acids**; hydrogen ions/protons from acids combine with carboxyl groups/COO^-groups on amino acids and form $COOH$ thus breaking ionic bonds;
- **Inorganic chemicals**; highly electropositive ions like mercury (I) ions, silver ions and highly electronegative ions like cyanide ions combine with amino group/$\overline{N}H_3$groups and disrupt ionic bonds.
- **Organic chemicals**; organic solvents like detergents alter hydrogen bonds in proteins;
- **Vigorous agitation/mechanical force**; physical movements tend to break hydrogen bonds.
- **Alkalis**; cause amino groups/$\overline{N}H_3$groups to lose hydrogen ions and form NH_2 thus breaking ionic bonds. **06 marks 05 MAX**

(c) **Support and movement**

- Actin/myosin; for muscle contraction; ossein; for structural support in bone; collagen; for strength and flexibility in tendon and cartilage; elastin; for strength and elasticity/flexibility to ligaments; keratin; it is tough for protection like in nails, skin, hooves and scales;
- Sclerotin/chitin; for strength in insects' exoskeleton; lipoprotein; for structural composition of cell membrane; mucin; for lubrication;

08 marks

Respiration and transport

- Haemoglobin/haemoerythrin/haemocyanin/ chlorocruorin; for transport of respiratory gases/oxygen;
  Myoglobin; for storage of oxygen in muscles; prothrombin/fibrinogen; for blood clotting; mucin; for keeping respiratory surfaces moist; antibodies; for defense of the body against infections; **04 MAX**

3.

(a) This is a plant in which the immediate product of carbon dioxide fixation; is a four-carbon compound oxaloacetic acid/oxaloacetate; **@01MK, 02MKS**

(b)

(i)

- Photosynthesis can proceed at very low carbon dioxide concentration; due to high affinity of PEP carboxylase for carbon dioxide;
- C_4 plants can efficiently photosynthesize at high temperatures; as PEP carboxylase is not inhibited by temperature;
- Carbon dioxide can be temporarily stored for later use since the four-carbon compound oxaloacetate; can be converted to malate and stored; then later it is broken down to pyruvate; which release carbon dioxide for use in C_3 pathway.
- Photorespiration is avoided; since it reduces photosynthesis efficiently; this is because PEP carboxylase is not inhibited by oxygen in C_4 plants.

@01MK. 07MKS, 06MAX

(ii) Carbon dioxide diffuses from atmosphere into palisade mesophyll cells' cytoplasm via stomatal pore; accepted/fixed by phosphoenol pyruvate (PEP); a four-carbon compound a reaction catalysed by PEP carboxylase; to form oxaloacetate; which is reduced by NADP/$NADPH_2$; to form malate; shunted into bundle sheath chloroplasts; of bundle sheath cells; via plasmodesmata; malate undergoes decarboxylation; to form pyruvate; and carbon dioxide; which enters into the Calvin cycle; and pyruvate passes into mesophyll cells; where it is converted into PEP.

@0.5MK,07MKS,06MAX

(c)

- Palisade mesophyll cells are well placed on/around the vascular bundles and bundle sheath cells; for absorbing carbon dioxide from adjacent air spaces;
- Bundle sheath cells have chloroplasts for trapping light;
- Phloem is ideally situated for carrying away the abundant products of photosynthesis;
- Mesophyll cells are tightly packed around bundle sheath cells; to prevent carbon dioxide loss;
- Bundle sheath chloroplasts have no/little grana; to minimize oxygen production from photolysis thus photorespiration avoided;

@01MK,08MKS,06MAX

4. (a) Endangered species are species that are likely to become extinct; if the factors causing their numbers to decline continue to operate;

OR

These are species with low population numbers; that are in considerable danger of becoming extinct;

@01MK,02MKS

(b) Organisms become endangered because;

- Natural selection; organisms which are genetically better adapted; replace the ones less well adapted;
- Destruction by humans as being health risks; like mosquitoes; which are massively sprayed because they transmit the parasite, causing malaria/plasmodium;
- Competition from humans and their animals; man destroys habitats to create space for shelter, agriculture; ranching schemes which endanger animals living in these habitats;
- Habitat destruction; for timber, it destroys habitats endangering species like monkeys; Draining wetlands endangers species like crested cranes; Removal of hedge row endangers hedgehogs; [**Any 2 expls given**]
- Pollution; oil pollution threatens aquatic organisms like sea birds; pollution by pesticides like DDT threatens many organisms like fish, eagles, due to biological accumulation of DDT along the food chains; **[Any 2 forms of pollution, @0.5MK]**
- Poaching/hunting and collecting; tigers are hunted for sport; crocodiles for their skins; elephants for ivory/tusks; whales for oil; rhinoceros for their horns; toads/rats collected for research making all these species endangered; **[Any 4 expls, @0.5MK]**

@0.5MK,11.5MKS, 09MAX

(c) Conservation measures/remedies

- Establishing sperm banks and seed stores; to maintain the full range of genetic diversity of species;
- Control of introduced species; not to outcompete indigenous species;
- Breeding in zoos and botanical gardens; and when number have increased, they are released in the wilds;
- Commercial farming should be intensified; to provide enough meat for humans not to hunt wild animals;
- Removal of animals from threatened areas; such as those likely to get floods, landslides and volcanic eruptions;

- Education/sensitization; teaching people on ways of preventing habitat destruction/conservation of organisms.
- Pollution control; reduced release of pollutants in air and water bodies; **Accept:** sewage treatment;
- Development of national parks, game parks and natural reserves; where endangered species are kept;
- Strict laws; be put in place and implemented against destruction of some species/habitat destruction and poaching; **@0.5MK,10MKS,09MAX**

5.

(a) Increase in carbon dioxide partial pressure/tension; lowers heamoglobin's affinity for oxygen; **@01MK, 02MKS**

(b) It enables oxygen release to respiring tissues; & combination of carbon dioxide with haemoglobin to be carried away from respiring tissues; where carbon dioxide partial pressure/tension is high; and carbon dioxide to be released in lungs; where carbon dioxide partial pressure/tension is low; so that oxygen combines with haemoglobin to be carried to respiring tissues; **@01MK, 06MKS**

(c) In lungs oxygen diffuses into cytoplasm of red blood cells; due to high concentration gradient ; oxygen combines with haemoglobin from dissociation of haemoglobonic acid; releasing hydroen ions; chloride ion move out cells; hydrogencharbonate/bicarbonate ions enter into the cells; hydrogen ions reacts with hydrogen carbonate/bicarbonate ions , forming weak carbonic acid; weak carbonic acid dissociates into carbon dioxide and water under the catalysis of carbonic acid; Also carboaminohaemoglobin dissociates; to release carbon dioxide and haemoglobin; carbon dioxide diffuses; out of red blood cells' cytoplasm into blood plasma; and later into the alveolar space; via the alveolar membrane; from where it's expelled out as gaseous carbon dioxide during expiration/exhalation; **@01MK,14MKS,09MAX**

(d)

- Lack nucleus; more space for more oxygen carriage;
- Lack mitochondria; more space for oxygen & carbon dioxide carriage; respire anaerobically, thus don't utilize oxygen being carried;
- Contain enzyme carbonic anhydrase; efficiency in transport of oxygen & carbon dioxide.
- Biconcave disc-shaped; thus, large surface area to volume ratio; increasing area for diffusion of respiratory gases;
- Thin membrane; providing shorter distance over which gases diffuse;
- Small in size; thus, easily squeeze through narrow lumens of capillaries to exchange with tissues;
- Flexible; able to bend to fit in small diameter of capillaries; assuming umbrella-like shape; increasing surface for exchange of gases with tissues;

- High percentage /numerous in blood; more haemoglobin thus, carry large amount of oxygen/ respiratory gases;
- Have haemoglobin pigment with higher affinity for oxygen; for efficient transportation of oxygen; **@0.5MK,04MAX**

ACC: Any 4 well explained; @1MK, O4MAX

6.

(a) Plants contain higher proportion of complex and indigestible materials like cellulose, hemicellulose, pectin, lignin and dietary fibres; which are difficult to digest due to lack of appropriate enzymes like cellulase; thus a few are digested by human digestive enzymes; also tough cell walls make nutrients inside plant cells difficult to be accessed by digestive enzyme; unlike animals with higher proportion of less complex and digestible proteins and fats; which are easily accessed and digested by human digestive enzymes due to lack cell walls and appropriate digestive enzymes; proteases and lipases; **@01MK, 05MAX**

(b) Because herbivores mainly feed on plant materials with lower energy content and difficult to digest; thus, have larger and complicated gut to allow more time for efficient digestion and absorption of nutrients; and harbor/inhabit symbiotic microbes/cellulase-secreting bacteria; that enhance digestion of plant materials for maximum nutrient derivation; unlike carnivores which feed on animal materials with high energy content and are easy to digest; due to presence of appropriate enzymes and lack of cell walls; **@01MK, 05MAX**

(c) Ploughing brings buried weed seeds near the surface; getting exposed to favourable conditions of moisture, light and oxygen and reduces competition; of dominant weed seeds in soil with established plants; for sunlight, water and oxygen/nutrients. Thus, dominant weed seeds start to germinate taking advantage of abundant resources; **@01MK, 05MAX**

(d) Flooding makes soil waterlogged; which cuts off oxygen supply to roots; leading to root suffocation and root rot; due to anaerobic respiration; and attack by pathogens; thriving in water; thus, impaired/reduced water and nutrient uptake and transport by plant roots; leading to water stress; hence wilting and withering; **@01MK, 08MKS, 05MAX**

END