2024 YEAR 4 EXPRESS BIOLOGY PRELIMINARY EXAMINATION

PAPER 2 MARK SCHEME

Section A

1a) right ventricle;

1b) increases when heart / ventricle + contracts/systole;
decreases when heart / ventricle + relaxes/diastole;

1ci) lung;

1cii) Oxygen diffuse from the air spaces in the alveoli/lung to the blood capillaries;
Carbon dioxide diffuse from the blood into the air spaces in the alveoli/lung;

1d) clusters of alveoli -> increase SA:V
single cell epithelium/ thin wall -> reduce distance travelled
constant blood flow -> maintain concentration gradient (any 2 pairs)
Reject: Moist surface-> allow gases to dissolve (does not increase efficiency)

2a) Percentage difference in mean fresh mass = (98.0-86.5/86.5)x100%=13(whole number)

2b) **Increase in height →**
more sunlight can be absorbed;
allow more room for corn to form/grow;
Increased number of leaves →
increases the surface area exposed to sunlight;
increases the amount of gaseous exchange;
increases amount of chloroplast/chlorophyll; (any 3)

leading to increases the yield of corn;

2c) Reject: Light intensity/Temperature/Carbon dioxide concentration/humidity (all these factors will change in the glass house)
Accept: amount of water, type of corn seeds, space between corn plant, type of soil, nutrients/fertilizer level, number of plants for experiment

2d) Light intensity: lights can be installed to provide light to the plants under low light conditions (e.g. at night, early morning);

Temperature: heater may be installed to provide sufficient heat for enzymes to function close to their optimum temperature for photosynthesis;

Carbon dioxide: Any valid method to increase carbon dioxide levels. E.g. burning of candles, rearing of pets / livestock in glasshouse;

3a) correct label on the diagram

3b) hotter/warmer/higher temperature;

3c) Sweat glands more active/more sweat secreted;
More latent heat (of vapourisation) removed from body due to evaporation of water in the sweat;

Skin arteriole dilated;
more blood reaches the skin arterioles, resulting in more heat lost through the surface of the skin via through convection, radiation and conduction;

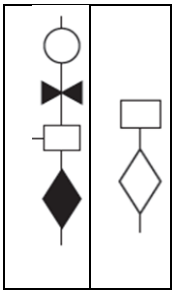
3di) ADH increased

3dii) Walls of the collecting duct more permeable to water, more water selectively reabsorbed via osmosis from the lumen of the collecting duct back into blood;
Lesser volume and more concentrated urine produced;

4ai) aa;

4aii) A and a OR A and a.
Reject a and a, AA, Aa

4b)



*Correct shading required

4c) *State one type of*
chemical, e.g. tar;
radiation, e.g. ultraviolet radiation

4d) closely related people possess similar genotype
Higher chance of homozygous genotype
Recessive condition will be expressed

5a) the process involving the fusion of nuclei of male and female gametes to form a zygote; and the production of genetically dissimilar/ different/ non-identical offspring;

5bi) menstruation

5bii) pregnancy

5c) large surface area to volume ratio for exchange of substances;
thin walls/ membranes leading to shorter diffusion distance;
richly supplied with blood capillaries / highly vascularised to maintain a steep concentration gradient;

5d) Functions like 'lungs':
- Allow oxygen to diffuse from maternal blood into fetal blood;
- Helps to remove carbon dioxide which diffuse from the fetal blood into the maternal blood;

Functions like 'kidneys'
- helps to remove removes excretory products such as urea which diffuses from the fetal blood into the maternal blood for removal;

6a) S: Scale of both graphs are more than >50% of the size of the grids
L1: Best-fit line for enzyme A
L2: Best-fit line for enzyme B
A: Axes labelled with units correctly for x and y axes + graphs are labelled A and B.
P1: Points plotted correctly for enzyme A.
P2: Points plotted correctly for enzyme B.

6b) Enzyme B is obtained from a human;
as its optimum temperature is close to that of human blood temperature of 37 °C;

6c) Enzyme molecules begin to denature;
Active sites unfold/ deformed / lost their shapes and are no longer complementary to the shape of the substrate molecules, leading to lower frequency of effective collisions and less enzyme-substrate complexes formed.

7a) Any 2:

bacterial cell	**animal cell**
cell wall present	cell wall absent
nucleus / nuclear envelope absent	nucleus / nuclear envelope present
membrane bound organelle absent e.g. RER, SER, Golgi body, vacuole	membrane bound organelle present e.g. RER, SER, Golgi body, vacuole

Reject: animal cells have no flagellum (sperm cells exist).

(b) Insulin gene is isolated by cutting with restriction enzyme to produce sticky ends and plasmid is cut with the same restriction enzymes;
To generate complementary sticky ends;
DNA ligase is used to repair the sugar-phosphate backbone / seal the recombinant plasmid
Transformation via heat shock or electric shock / Bacterial ribosomes synthesise insulin protein;
Reject: bacteria cells produce insulin (as this is repeating the question), recombinant plasmid is inserted into bacterial cell (this is repeating the words in the Fig.)

7c)

Vaccines	**Antibiotics**
used to prevent infectious diseases	used to treat **bacterial** diseases
effective against bacterial and viral diseases	effective only against bacterial diseases
stimulates white blood cells to produce <u>antibodies</u>	chemical that disrupts bacterial cell structure (cell wall, cell membrane, ribosomes, enzymes) to kill cell

Section B

8a) Burning/combustion of fossil fuels;
Deforestation/ cutting down trees in forests;
other valid answer but **process** must be clearly stated

8b) The oceans function as a carbon sink (or) The land contains forests, which can function as a carbon sink.

A carbon sink is an area that functions as a reservoir that accumulates and stores more carbon (compounds) than it releases.

The waters of the oceans can function as a solvent and dissolve carbon dioxide.

Large amounts of phytoplankton (producers) in the ocean can carry out photosynthesis (or) Trees in forests can carry out photosynthesis, which is a process that removes carbon dioxide from the atmosphere to form glucose.

The oceans and seas consist of coral reefs / bodies of marine organisms can store carbon compounds. The calcium carbonate skeleton of corals can help store carbon thus removing it from the environment. (or) The bodies of trees can store carbon compounds.

The dead bodies of aquatic organisms can sink to the bottom of the sea and become fossilised, where they are converted into fossil fuels. Fossil fuels found at the bottom of oceans and seas also store (sequester) carbon from the environment. / The dead bodies of trees can be buried and converted into fossil fuels (charcoal). [max: 5]

8c) Cycle, walk, take public transport (instead of driving);
Use fans instead of aircon;
Eat more fruits and vegetables (instead of meat);
other valid answer [max:3]

9ai) relate long daylight (June – Sep) to decreasing concentrations of carbon dioxide;
Rate of photosynthesis higher than respiration, more carbon dioxide used up
Data cited from graph;

9aii) peak between Jun – Aug
Trough between Dec – Feb
Smooth line for entire graph otherwise max: 1

9b) more food produced ;
comparative data manipulation ;
fewer levels in food chain AW ;
correct reference to herbivore / carnivore + human ;
correct reference to primary / secondary + consumer ;
less energy lost / more efficient ;
example of energy not lost (e.g. through movement); [max: 5]