1. **a ) i) rate of water absorption/uptake by the leafy shoot;**

**ii) rate of transpiration;**

**b)(i)**

***Cut shoot under water;***

***Apply petroleum jelly to cork, glass/ bung glass***

***Open reservoir:***

**(ii)**

***To ensure no air enters leafy shoot xylem;***

***To ensure the apparatus is airtight;***

***To remove air bubbles from tube***

**(c)**

***Stomata size and number; Hairy leaf; Leaf size and shape***

***Leaf fall; Cuticle;***

***Population size = First capture X Second capture***

***Marked recaptured***

***= 70 X 40***

***27***

***= 104 garsshoppers***

***Large samples are more representative of the population***

***Sweep nets***

* ***No organisms moved into or out of the study area during the investigation***
* ***The grasshoppers mixed randomly and completely in the population***
* ***Markings do not wear off***
* ***No new hatchings / metamorphosis***
* ***The markings do not alter the grasshoppers behaviour***

1. **AA ; aa;**
2. **150 x 4 = 600;**

**¾ x 600 = 450 or 600 – 150 = 450 fruit flies ;**

1. **Aa ;**
2. ***Test cross /back cross to determine an unknown genotype ;***

***Short life cycle***

***Produce many offsprings***

***Has clear contrasting characteristics / exist in many mutant forms***

***Large chromosomes***

***Few chromosomes***

***Wide spread throughout the world***

***Not known to be a vector of human diseases***

1. **a)  *A natural unit in which abiotic and biotic factors interact freely / naturally leading to a self sustaining system***

**b) *S - Emergent type ;P - Submerged type; Q – Floating type ;***

**c)**

***- Have numerous chloroplasts to absorb light for photosynthesis***

***- Chloroplast are sensitive to low light intensities, thus photosynthesise under low light***

***Intensities***

***- The leaves are deeply dissected into thread like straws to increase the surface area for absorption of light***

* ***Have a large air spaces/aerenchyma tissues for storage of air required for gaseous exchange/provide buoyancy.***
* ***The leaf lack cuticle to facilitate exchange of gases through epidermis***
* ***They have poorly developed roots that lack root hairs to reduce absorption***

***of water***

**5.** **(a) To destarch;**

**(b)**

**(i) To absorb carbon (iv) oxide gas;**

**(ii) To increase the concentration of carbon (iv) xide gas;**

**(c)**

**(i) M : brown colour of iodine solution is retained ;photosynthesis did not take place due to absence of carbon (iv) oxide gas hence no starch thus negative results;**

**(ii) N : blue-black colour was observed; all conditions necessary for photosynthesis were available hence accumulation of starch thus positive results;**

**(d) light duration; light wavelength;**

6a)

1. Flask X [4marks]

Steady increase in temperature reading followed by a steady decline; the starch in soaked seeds was hydrolysed by water to reducing sugars; which was oxidized to produce energy needed for germination of seeds ;after all the stored food had been used up ,the decline in energy production led to decline in temperature reading;

1. Flask Y [3marks]

Steady /continuous rise in temperature reading; boiling denatured the respiratory enzymes, bacteria(decomposers) respired as they fed on boiled seeds to bring about decomposition; due to their increasing number following steady reproduction ,the heat energy produced increased exponentially;

1. Explain the results obtained in flask Z [2marks]

Constant temperature reading ;Methylated spirit disinfected the seeds hence no bacteria that would have respired to release heat energy;

1. Explain why :
2. Vacuum flask were used in this experiment [1mark]

To conserve the heat energy produced during respiration

1. Cotton wool and not rubber bungs were used to hold the thermometer in place

To allow free circulation of air in and out of the flask;. (Bacteria need oxygen gas for respiration)

1. State the aim of the above investigation [1mark]

To show that germinating seeds produce energy during respiration;

To show that decomposers produce heat energy during respiration;

1. Evolution of an organism is towards better adaptation and survival to its habitat.
2. Explain how this is achieved to members of Class Insecta towards locomotion and protection [7mks]

***Locomotion***

***Wings for flight***

***Legs for walking***

***Segmentation to allow movement***

***Moulting /ecdysis to permit locomotion***

***Protection***

***Hard cuticle for protection against mechanical injury/ infestation***

***Polymorphic forms / colour for camouflage against predators***

***Cuticle is waterproof /chitinous to prevent water loss***

1. Suggest how the modern long necked giraffes may have evolved from short necked stock [13mks]

***Short necked stock over produced resulting to competition for food ; variation occurred in population ; long necked giraffes resulted among short necked ; both stock struggled for existence ; long necked giraffes were better adapted than short necked /fittest for survival; long necked giraffes reached reproductive age and passed on desirable trait to offspring while short necked giraffes failed to do so / were eliminated, long neck was naturally selected ; gradual changes accumulated in new stock forming a population of long necked giraffes ;***

1. A) ***process of fertilization***

Fertilization is the fusion of the male and female nuclei in the embryo sac; after pollination the pollen grains absorbs nutrients from the stigma; and develops an outgrowth called the pollen tube; the pollen tube grows down the style ,to the embryo sac taking along the male gametes with it; the pollen grains usually adhere to the sigma as a result of the stigma cells secreting a sticky substance; which also stimulates the pollen grain to germinate sending down its pollen tube; the growth of the pollen tube into the stigma ,through the style to the ovary is by pushing its way between the cells where it gets nourishment from the surrounding tissues; this process is quite rapid and takes place in a matter of minutes; as the pollen grain germinates ,the tube nucleus occupies a position at the tip of the growing pollen tube; the generative nucleus divides by mitosis into two male gamete nuclei, which follow behind the tube nucleus as the pollen grows down the style; the pollen tube enters an ovule through the micropyle and when it reaches the centre of the ovule it penetrates the wall of the embryo sac and burst open; meanwhile the tube nucleus disintegrates leaving a clear way for the entry of the male nuclei; one of the male nuclei fuses with the egg cell nucleus to form a diploid zygote; which develops in to the embryo;while the other male nucleus fuses with the polar nucleus to form a triploid primary endosperm;