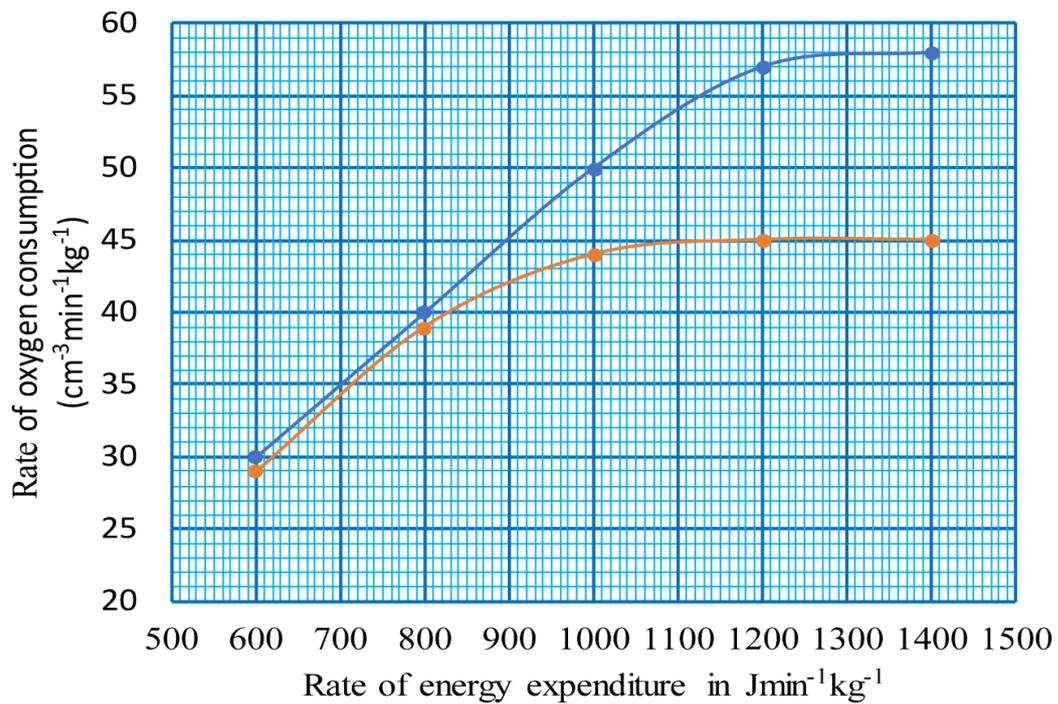


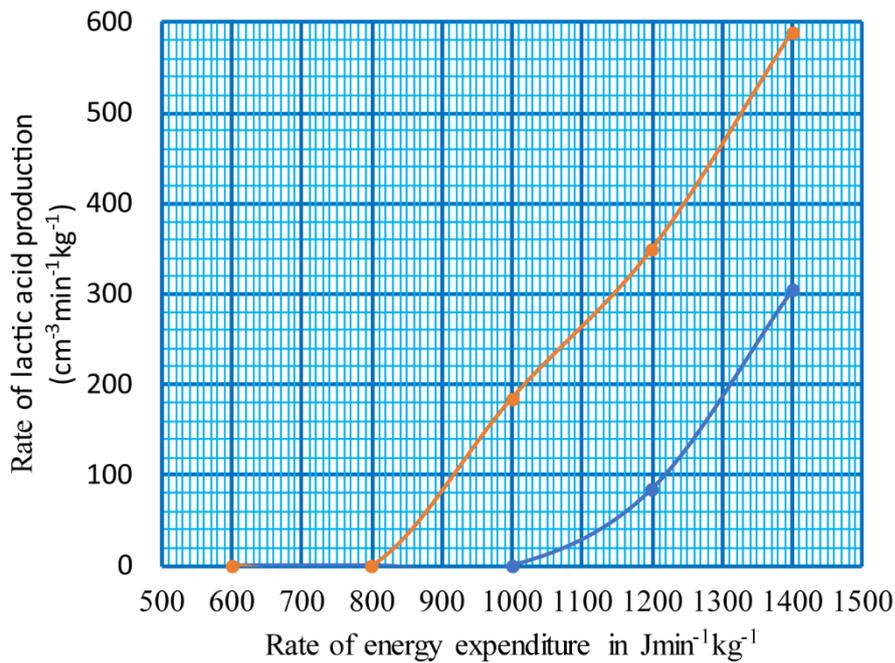
A-level

Marking guide biology paper 2 2000

A graph showing relationship between the rate of oxygen consumption and rate of energy expenditure



A graph showing relationship between the rate of lactic acid production and rate of energy expenditure



(b)(i) Athlete

- An increase in the level of activity leads to steady /gradual/uniform rise in the rate of oxygen consumption up to 1000Jmin⁻¹kg⁻¹ after which the rate of increase is decrease to zero.
- There is no lactic acid accumulation up to the rate of energy expenditure of 1200Jmin⁻¹kg⁻¹ after which lactic acid accumulated exponentially.

(ii) Non-athletes

- An increase in the level of activity leads to a steady/gradual increase in the rate of oxygen consumption up to 1000Jmin⁻¹kg⁻¹. Thereafter, the rise is slower and levels off.
- No lactic acid is produced up to the rate of energy expenditure of 1000Jmin⁻¹kg⁻¹, after which lactic acid accumulated exponentially.

(c)

- Athletes consume oxygen at a higher rate than non-athletes
- Non-athletes produce more lactic acid than athletes do
- In both groups, lactic acid accumulates more rapidly at very high level of energy consumption.

(d)

- athletes take in more oxygen that allows tissue respiration, liberating more energy for the same amount of food.

- Complete oxidation does not allow lactic acid to accumulate.

2. Describe what would happen in an individual who develops a malfunctioning liver.

Solution

The liver is the largest organ and center of metabolic activity in the body. Its failure to function properly it fails the following functions

- (i) A person will have abnormal sugar levels due to failure of synthesis and breakdown of glycogen
- (ii) Regulation of lipids may fail leading to high concentration of lipids in blood causing heart diseases and gall stone
- (iii) Detoxification of poisonous substance may fail leading to death due to accumulation of poisons in the body
- (iv) Production of bile may fail leading impaired digestion of fats
- (v) Synthesis of plasma proteins may fail leading to accumulation fluid in he tissue swelling of feet
- (vi) Storage of minerals such as iron may reduce causing deficiency diseases
- (vii) Synthesis of vitamin K may be impaired leading to inability of blood to clot
- (viii) Reduced storage of blood
- (ix) Reduced production of heat and hemostasis of body temperature
- (x) Failure to remove old worn out red blood cells from the body.

3. Some viable seeds are not able to germinate immediately dispersed from their parent even when the minimum conditions for germination are provided. Discuss

Failure of viable seeds to germinate immediately they are disposed from their parents is term seed dormancy.

Cause of seed dormancy

- (i) Premature embryo; time must be provided for the embryo to mature before germination
- (ii) Presence of germination inhibitors such as abscisic acid.
- (iii) Presence of hard/impermeable testa that needs to be broken to allow water and air to reach the seed embryo
- (iv) Some seed require a particular day length of light in order to germinate. These seed can only germinate when such conditions are available
- (v) Some seed require a period of cold treatment/stratification.

Advantages of seed dormancy

- Allows time for seed dispersal
- It prevents seed from germinating in ponds
- Seeds are able to survive unfavorable condition like drought.
- Allow the seed to stay viable longer

Disadvantage of seed dormancy

- Prolonged dormancy reduces food reserves
- Increases chances of seed destruction
- Delay seed germination and growth of seeds.

4. Describe how new species of organism may arise

The process by which new species arise is known as speciation. Speciation occurs through genetic isolation of a population for enough time to allow the new species to arise. Mutation and natural selection take place in independently isolated populations and each may lead to formation of new distinct species.

Population and genetic isolation may be achieved in the following ways

- Geographical/ecological isolation**
This is when a physical barrier such as a mountain, river or other water bodies prevents the population from mixing.
- Reproductive isolation**
Populations that may not be ecologically separate, are not able to interbreed. This can be due to a lack of attraction between individuals in a population, non-corresponding genitalia, development of immune destruction of sperms. Inability of the zygote to develop.
- Behavioral isolation**
This may be due to failure of courtship behavior to stimulate sexual activity in another.
- Genetic isolation**
Even though mating is possible, fundamental differences in genetic constitution may prevent reproduction being successful. For instance, pollen grains of one plant may fail to germinate on the stigma of another. Sometimes offspring are produced but the hybrid may be sterile and fail to reproduce.

5. The use of seeds and other planting materials are common methods in plant propagation. Using named examples, give advantages and disadvantages of each method

(i) Use of seeds.

Gene mixing during gamete formation and fertilization creates gene variation in offspring. Variation of offspring allows adaptation of the organisms in changing environmental conditions.

Seed dormancy allows time for seed dispersal and increases the chances of survival of organisms.

Seeds are light and can easily be dispersed and can easily colonize new locations.

In seeds the embryo is protected and can remain viable for a long period of time.

Seeds are easy to store

Seeds tolerate adverse conditions such as drought.

Cheap to transport

- Seeds are the source used most widely

- New cultivars and varieties can be created through sexual propagation
- It tends to be cheaper to propagate from seed
- The majority of seeds are readily available
- Sexual propagation seldom requires expensive propagation structures
- Large numbers of plants can be produced in minimal space
- Sexual propagation can be used to create rootstocks for budding and grafting
- Sexual propagation promotes genetic variability which helps plants evolve against pathogens and fluctuating environmental conditions
- Many seeds allow for the possibility to be stored.
- Trees grown from seed tend to live longer, bear more fruit and are hardier.
- Propagating from seed generally carries a lower risk of transferring diseases from the parent plant. (Provided adequate sanitation practices are followed)
- Certain plants can only be raised from seed

Disadvantage

It requires skilled knowledge to select and plant

Food reserves are limited

Suitable characteristic may be lost during hybridization.

Seeds are easily destroyed by pests and diseases

Seedlings take long to mature

Plants propagated from seed risk not being true to type (flowers, growth habit etc. won't be the same as the mother plant) due to cross pollination.

In some cases Sexual propagation can be slower than asexual.

Some plants produce non-viable seeds.

Some seeds are very difficult to germinate.

The seed of certain plants need require to be treated chemically or mechanically to stimulate germination.

Certain plants don't produce seed at all.

In most cases seedlings have to go through an immature phase before maturing and fruiting.

Seed collection can be difficult, in some cases hazardous and timing must be right to ensure the seed will be viable.

Pollination is required to ensure seed is viable.

(ii) Vegetative propagation

Involve use of plant materials other than seeds such as cutting (sweet potatoes, cassava) suckers (pineapple, banana), stem tubers (iris)

Advantages

- Take short time to grow
- Good qualities are easily retained
- Easy to propagate
- High rate of multiplication
- Asexual propagation can be used for plants with low seed production.
- Propagating asexually allows for clones.
- Uniform and true to type offspring can be ensured through asexual propagation.
- Can often be easier and more economically viable.
- Undesirable features such as excessive thorns can be minimized by selecting propagation material from less thorny plant parts. The same method can be used to cultivate desirable qualities such as interesting variegated growth.
- Mature plants are produced more rapidly resulting in faster flower and fruit production.

Disadvantages

- No genetic mixing
- Difficult to improve on their characteristic
- Overcrowding leads to competition for resources
- Bulky to transport
- Easily spread diseases.
- his method often requires expensive equipment and structures.
- Certain plants can only be propagated from a specific cutting type, in many cases the plant material required is only obtainable during a specific season or certain time of the year.
- Cuttings require more space than the equivalent in seed.
- Cutting propagation poses the risk of cloning unfavourable genetics. E.g. if the parent plant is susceptible to disease all other clones grown from cuttings will be equally vulnerable.
- Though possible, the storage of cutting material is considerably harder and less effective than storing seeds.
- Smaller plants only allow for a few cuttings to be made per plant.
- Propagating by cuttings tends to be more labour intensive.
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6. (a) (i) Describe how plants absorb nitrate from the soil.

(ii) Give three ways in which plants use the nitrates they have absorbed.

(b) Describe ecological effects of drainage of nitrate fertilizers into rivers and streams.

(a)(i)

- Plants absorb nitrates through root hairs using passive and active mechanism.

- The nitrates cross the cortex of the root through the apoplast, symplast and vacuolar pathways into the xylem vessel of the root.
- Transpiration pull translocate the nitrates up the plant in solution with water.
- From the xylem vessels, the nitrates are conveyed to cells of the plant by passive and active mechanisms.

(ii)

- Synthesis of chlorophyll
- Synthesis of enzymes, and hormones
- Synthesis of nucleic acids
- They are determinant of osmotic pressure of the cell sap
- They are determinant of osmotic pressure of the cell sap.

(b)

- Accumulation of nitrates in the streams (eutrophication) encourages proliferation of protists and algae on the surface of water.
- When the algae die, bacterial decomposers use up a lot of oxygen for decomposition and reduce amount of dissolved oxygen in water
- Reduction in amount of oxygen in water leads to death of fish and animals
- Light penetration reduces and this lead to death of aquatic plants.
- Bad odor and taste of water

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