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A2 Biology

LATEST SYLLABUS

Unit 4: 2019 – 2025 Classified Past PAPERS

SCAN ME

4 Photosynthesis involves the fixation of carbon dioxide in chloroplasts.

(a) Place a cross ☒ in the box next to the region of the chloroplast that would be involved in the fixation of carbon dioxide.

(1)

Calvin cycle

- ☒ **A** crista
- ☒ **B** granum
- ☒ **C** matrix
- ☑ **D** stroma

(b) An investigation was carried out into the effect of reducing the carbon dioxide available for photosynthesis. Cells of a unicellular alga were suspended in a solution containing 1.0% carbon dioxide. After 250 seconds, the carbon dioxide in the solution was reduced to 0.003%.

The cells were illuminated with a bright light and some were removed at regular time intervals for 500 seconds. The concentrations of ribulose bisphosphate (RuBP) and glycerate 3-phosphate (GP) in the cells were measured.

(i) Suggest **two** reasons why a suspension of cells of a unicellular alga, in a solution, is more suitable for this investigation than using leaves.

(2)

All cells are identical this way, so fair comparison

Cells are identical in their surface area, mass and genotype

It is much easier to to control the supply of carbon dioxide, GP and RuBP this way

(ii) Suggest why it would be advisable to illuminate the cells at a high light intensity during this investigation.

(3)

Light is needed for light-dependent reaction which produce ATP and reduced NADP

Both products are required for the light-independent reactions

Light is a limiting factor for photosynthesis so it shouldn't be supplied in short amounts

This ensures that carbon dioxide is the only limiting factor

PHOTOSYNTHESIS II

(iii) Place a cross ☒ in the box next to the metabolic process that best describes the process that accounts for most of the difference between GPP and NPP in plants.

(1)

- ☒ **A** Chemosynthesis
- ☒ **B** Respiration
- ☒ **C** Photosynthesis
- ☒ **D** Protein synthesis

*(c) With reference to the structures in a chloroplast, explain how the energy from light is made available in ATP molecules for the synthesis of organic materials.

(6)

Light raises the energy levels of electrons in chlorophyll

Chlorophyll is found in photosystems located in the thylakoid membranes

Electrons are then carried through the thylakoid membranes via special carriers

Photolysis of water provides electrons replace those lost by chlorophyll

As the electrons move across the carriers, their energy decreases

Meanwhile protons are pumped from the stroma into the thylakoid space

Protons flow though ATP synthase which helps to make ATP from ADP + Pi

(Total for Question 5 = 12 marks)

The three statements below show the conclusions recorded by different students following the seashore study of periwinkles.
Place a cross ☒ in the box next to one statement that could form a valid conclusion using the information shown in the graph opposite.

(1)

☒ **A** All periwinkles are affected by the height above sea level

☒ **B** The height above sea level influences the distribution of different species of periwinkle

☒ **C** Neither of the species of periwinkle is affected by the height above sea level

(v) With reference to the data in the graph, discuss the validity of statements **A**, **B** and **C**.

(4)

Statement A is not valid because the graph only provides information about two species

Statement B is valid because density of both species changes as height changes
As height increases L. littorea tends to increase, while L. obtusa tends to decrease
Competition not a (significant) factor as both species can be found at same height

Statement C is not valid because density of species changes as height changes
No information is mentioned about other factors that influence distribution

(Total for Question 3 = 12 marks)

*(b) Large areas of land may need to be cleared in order to produce biofuels. This might involve deforestation.

Discuss why the production of biofuels may not be carbon neutral.

(5)

- Biofuel production may overall result in more atmospheric carbon dioxide
- Carbon neutrality means that carbon dioxide produced during combustion equals that used during production of the biofuel (photosynthesis)
- Deforestation results in a net increase in carbon dioxide as there are less
- Burning of trees while clearing the land produces CO2
- Decomposition of dead trees may also release methane
- Trees absorb carbon dioxide by photosynthesis
- Transportation and production of biofuels might also involve the use of fossil fuel which leads to the production of more CO2

(c) Explain how the combustion products, from the burning of fuels, may lead to global warming.

(4)

- Greenhouse gases such as CO2 and CH4 build up a layer in the upper atmosphere
- This layer absorbs IR that is reflected from the surface of Earth
- The higher the level of the greenhouse gases causes an enhanced greenhouse effect
- which leads to a higher temperature of our planet

(Total for Question 3 = 10 marks)

(i) Enzymes can be used to produce protein fragments from the isolated protein.

Put a cross ☒ in the box next to the description that completes the following statement.

Enzymes are

(1)

☐ **A** fibrous proteins that decrease activation energy

☐ **B** fibrous proteins that increase activation energy

☒ **C** globular proteins that decrease activation energy

☐ **D** globular proteins that increase activation energy

(ii) Put a cross ☒ in the box next to the term that completes the following statement.

Enzymes digest proteins into fragments using

(1)

☐ **A** condensation reactions

☐ **B** esterification reactions

☒ **C** hydrolysis reactions

☐ **D** polymerisation reactions

(iii) Using your knowledge of gel electrophoresis in the analysis of DNA, suggest how gel electrophoresis could be used to analyse the protein.

(3)

Protein fragments are loaded on the gel

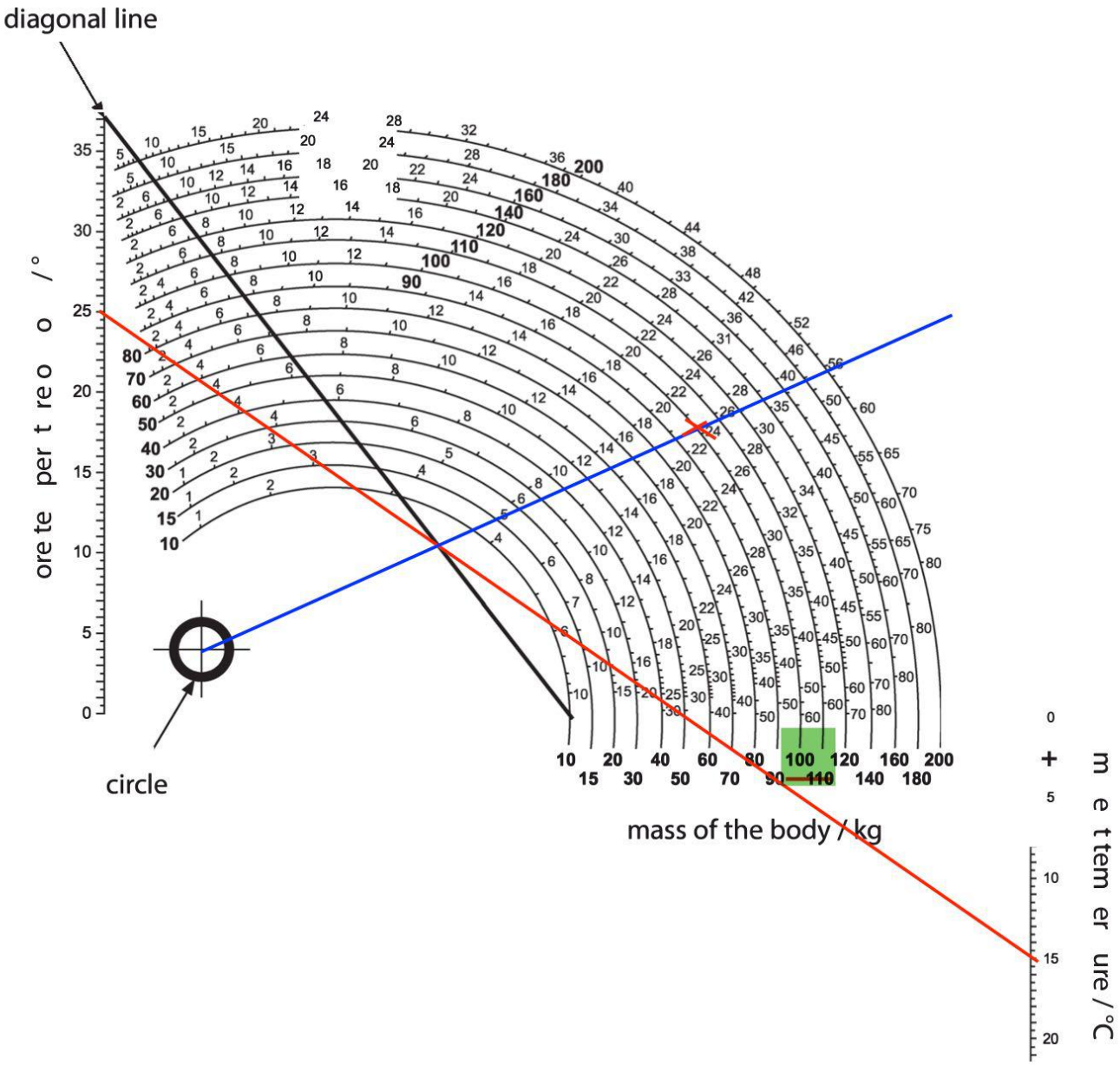
An electric current is then applied

Gel electrophoresis separates the protein fragments

Proteins can then be identified by the number and size of protein bands

Proteins can then be identified by the position of protein bands

Henssge nomogram



(i) A body was found. The mass of the body was 100 kg and the core temperature of the body was 25 °C. The ambient temperature was 15 °C.

Use the Henssge nomogram to estimate the time of death.

(3)

time of death = 23 – 24 hours ago

(b) The flow diagram below shows the main stages in the life cycle of blowflies and beetles.

EGG → LARVA → PUPA → ADULT

(i) Place a cross ☒ in the box next to the factor that would have the most effect on the rate of development of each stage of the life cycle of insects on this dead body.

(1)

☒ **A** interspecific competition

☒ **B** light

☒ **C** predation by birds

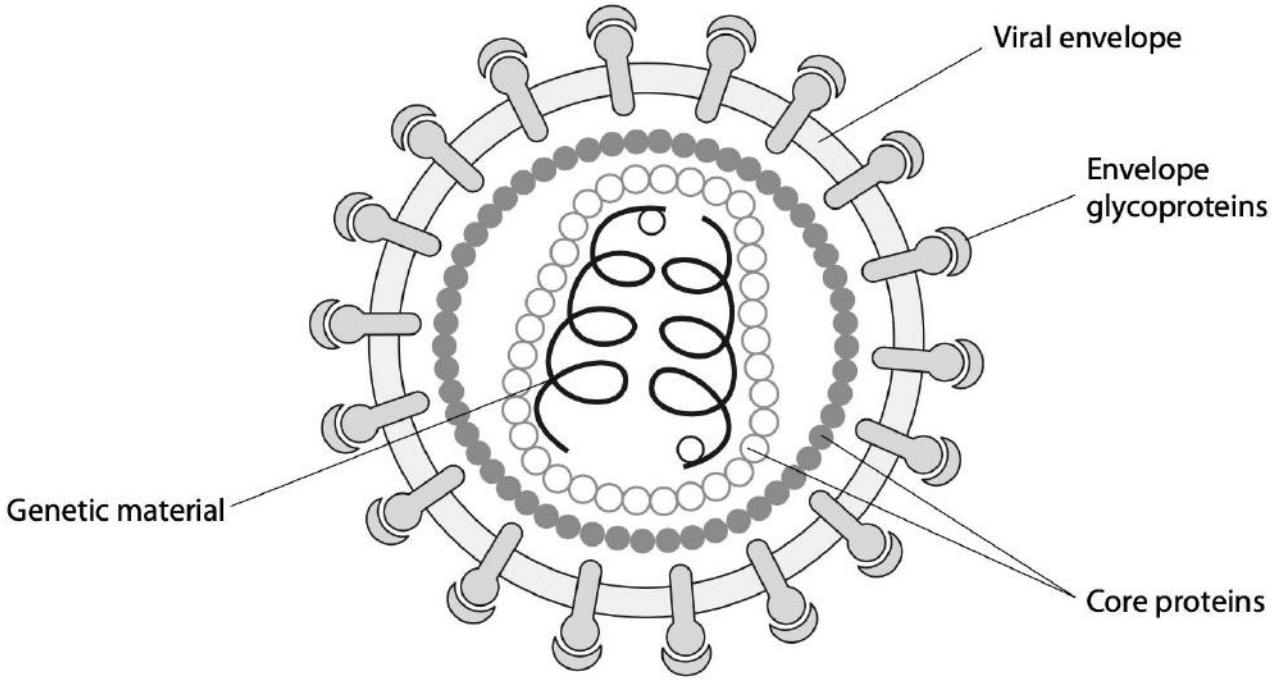
☑ **D** temperature

(ii) Suggest how the pathologist might use the information in the table and the flow diagram to estimate the time of death of the young man.

(3)

The body has been dead for a while
As more than one species of insect are present
Every species of insects makes conditions suitable enough for the
next species to inhabit the dead body. This is known as succession
TOD can be estimated with knowledge about the life cycle of the insects
For instance, blowfly have completed their life cycle which indicates
that the TOD has happened long time ago
However, factors such as temperature could influence the development of insects

3 The diagram below shows the structure of Human Immunodeficiency Virus (HIV).



(a) State how the genetic material in HIV differs from the genetic material in the bacterium *Mycobacterium tuberculosis* that causes TB.

(2)

RNA in HIV and DNA in bacterium

Circular in bacterium and linear in HIV

Plasmids in bacterium only

(b) One of the ways in which HIV may enter the blood is through the use of infected needles. Explain why unbroken skin is an effective barrier against HIV infection.

(2)

Keratin in the skin surface

which is hard and impermeable

which creates a physical barrier

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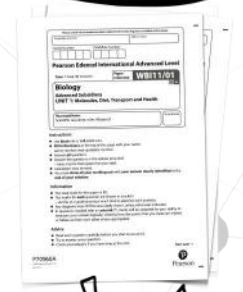

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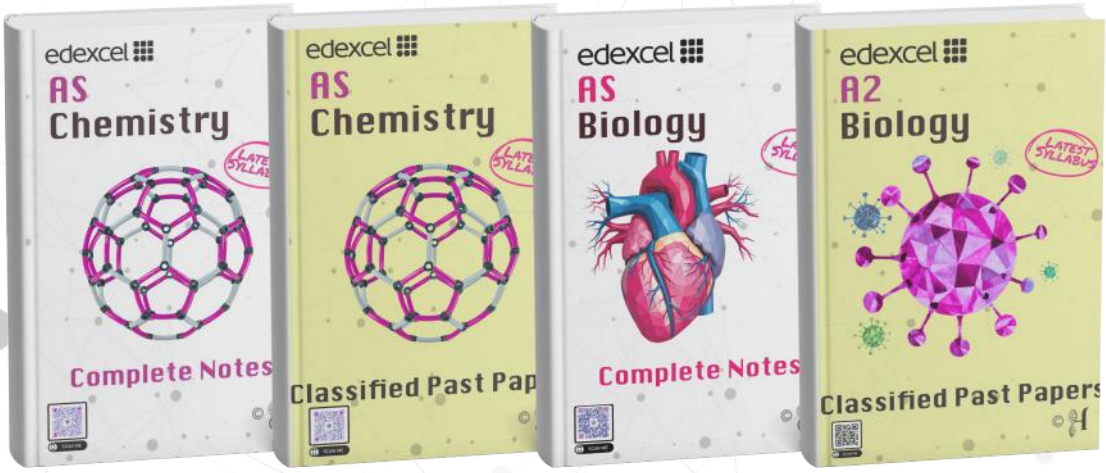

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