

SET B 2016

Name

Signature

P530/1

BIOLOGY

Paper 1

JUNE 2016

2½ hours

Uganda Advanced Certificate of Education

Facilitation Exams 2016

**BIOLOGY
(THEORY)**

Paper 1

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of sections A and B.

*Answer **all** questions in both sections.*

SECTION A:

Answers to this section must be written in boxes provided.

SECTION B.

Answers to this section should be written in the spaces provided and not anywhere else. No additional sheets of paper should be inserted in this booklet.

For Examiner's use only	
Section	Marks
A: 1-40	
B: 41	
42	
43	
44	
45	
46	
Total	

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SECTION A (40 MARKS)

1. Eukaryotic cells differ from prokaryotic cells in that only eukaryotic cells
- A. Contain DNA
 - B. Have a plasma membrane
 - C. Are considered to be alive
 - D. Have a nucleus

2. Which of the following lists the chemical bonds from the strongest to the weakest
- A. Covalent –ionic –hydrogen
 - B. Ionic-covalent-hydrogen
 - C. Covalent –hydrogen -ionic
 - D. Hydrogen-ionic-covalent

3. Which of these is **not** consistent with evolutionary theory?
- A. All living organisms share a common ancestor
 - B. The environment affects which organisms survive to reproduce
 - C. Natural selection always favors the same traits regardless of the environment
 - D. Species change overtime

4. Carbon dioxide functions as a greenhouse gas by
- A. Interfering with water's ability to absorb heat
 - B. Increasing the random molecular motion of oxygen
 - C. Allowing radiation from the sun to reach the earth and absorbing the reradiated heat
 - D. Splitting into carbon and oxygen and increasing the rate of cellular respiration

5. When individuals are evenly placed throughout the habitat their dispersion is termed as
- A. Clumped
 - B. Uniform
 - C. Random
 - D. excessive

6. Which of the following does **not** occur during the light reactions of photosynthesis
- A. Oxygen is split releasing water
 - B. Electrons from chlorophyll are added to the electron transport chain
 - C. An electron transport chain drives the synthesis of ATP for use by the Calvin cycle
 - D. Oxygen is produced when water is split
7. After telophase 1 of meiosis each daughter cell is
- A. Diploid and the chromosomes are composed of one double stranded molecule
 - B. Diploid and the chromosomes are composed of two sister chromatids
 - C. Haploid and the chromosomes are composed of one double stranded DNA molecule
 - D. Haploid and the chromosomes are composed of two sister chromatids
8. A substance moving across a membrane against a concentration gradient is moving by
- A. Passive transport
 - B. Osmosis
 - C. Active transport
 - D. Diffusion
9. Neurons maintain a negative charge in their cytoplasm relative to the outside of the cell via the
- A. Krebs cycle
 - B. Electron transport chain
 - C. Hydrogen carrier system
 - D. Sodium-potassium pump
10. The path of a sperm during fertilization is
- A. Follicle cells, egg plasma membrane, zona pellucida
 - B. Egg plasma membrane, zonapellucida, follicle cells
 - C. Zona pellucida, folliclecells, egg plasma membrane
 - D. Follicle cells, zonapellucida, eggplasma membrane

11. The release of the oocyte from the follicle is caused by

- A. A decrease in oestrogen
- B. An increase in follicle stimulating hormone
- C. An increase in the luteinizing hormone
- D. An increase in progesterone

12. The antagonistic pairs of arm and leg muscles

- A. Allow healthy muscles to compensate for injured ones
- B. Allows muscles to produce opposing movements
- C. Allow different types of rotations of joints
- D. Allows myofibrils to fire impulses in response to different stresses

13. Which cause of extinction results from humans direct use of species?

- A. Over exploitation
- B. Habitat fragmentation
- C. Pollution
- D. Introduction of computers

14. When a woman is breast feeding, the more her infant drinks the more milk she produces. This is an example of

- A. Negative feedback
- B. Positive feedback
- C. Thermoregulation
- D. Independent regulation

15. Autoimmune disorders result when

- A. A person's endocrine system malfunctions
- B. Liver enzymes malfunction
- C. **B** cells attack **T** cells
- D. The immune system fails to differentiate between self and non self

16. A researcher captures 50 penguins, marks them with a spot of paint on their bills, and releases them. One month later the researcher returns, captures another 50 penguins, and notes that only 1 has a previous mark.

What is the likely size of the total penguin population in the researcher's study area?

- A. 50
- B. 100
- C. 2500
- D. 150

17. The % differences in amino acid sequence between humans and other organisms can be summarized as follows:

Cytochrome C sequence	% difference from sequence of human
Chimpanzee	0.0
Mouse	8.7
Donkey	10.6
Carp	21.4
Corn	33.3
Green alga	43.4

Which of these is most closely related to humans?

- A. Green alga
- B. Donkey
- C. Chimpanzee
- D. Corn

18. A species of crayfish that lives in caves produces eyestalks like its above-ground relatives but no eyes. Eyestalks in cave-dwelling crayfish are thus

- A. An evolutionary error
- B. A dominant mutation
- C. Biogeographical evidence of evolution
- D. A vestigial mutation

19. Today's male elephants have significantly shorter tusks at full adulthood than male elephants in the early 1900's. This is an example of

- A. Disruptive selection
- B. Stabilizing selection
- C. Directional selection
- D. Evolutionary regression

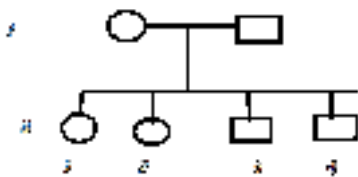
20. Which of the following taxonomic levels contains organisms that share the most recent common ancestor

- A. Family
- B. Order
- C. Phylum
- D. Genus

21. What is the probability that a family with two children will have one boy and one girl

- A. 100%
- B. 75%
- C. 50%
- D. 25%

22. The pedigree in figure 1 illustrates the inheritance of hemophilia. What is the genotype of individual II-4?



- A. $X^H X^H$
- B. $X^H X^h$
- C. $X^H Y$
- D. $X^h Y$

23. Enzymes speed up chemical reactions by
- A. Heating cells
 - B. Binding to substrates and stressing their bonds
 - C. Changing the shape of the cell
 - D. Supplying energy to the substrate
24. A short day plant can be prevented from flowering by
- A. Keeping it constantly in light
 - B. Preventing phytochrome from converting into the active form
 - C. Ensuring that day length does not exceed the plant's critical length
 - D. Growing in the same environment as a long day plant
25. Plant hormones are unlike animal hormones because they
- A. Are produced in small amounts
 - B. Have different effects in different organs
 - C. Are not produced in specialized glands
 - D. are mobile and can move throughout the plant body
26. Which of the following adaptations provide an advantage to plants in warm, moist environments
- A. Closing stomata in response to decreased water availability
 - B. Large diameter xylem vessels, permitting rapid water uptake
 - C. Deciduousness, reducing water loss during dry periods
 - D. Small leaf size, reducing sun exposure
27. Menstruation is regulated such that
- A. Increasing oestrogen levels have a positive feedback effect on FSH and LH level
 - B. Increasing FSH levels leads to ovulation
 - C. As progesterone level increase, so do FSH and LH levels
 - D. Ovulation occurs on the 5th day of the cycle
28. Leaf cutter ants keep fungal gardens while the ants provide food for the fungus on which they feed. This is an example of
- A. Competition
 - B. Predation
 - C. Commensalism
 - D. Mutualism

29. Six species of monkeys are found in a tropical forest .Most likely they

- A. Occupy the same niche
- B. Eat same foods and occupy the same range
- C. Eat different foods and occupy different ranges
- D. Spend a lot of time fighting each other

30. Increasing solute concentration affects water potential by making it

- A. more positive
- B. more negative
- C. positive in certain conditions and more negative in others
- D. it less positive in certain conditions and more negative in others

31. An embryo sac contains

- A. 7 cells and 8 nuclei
- B. 7 cells and 7 nuclei
- C. 8 cells and 7 nuclei
- D. 8 cells and 8 nuclei

32. The female gametophyte is the

- A. Embryo sac
- B. Ovule
- C. Ovary
- D. Egg cell

33. A couple are normal but each has an albino parent. What is the probability that the next child will be an albino male

- A. $\frac{1}{8}$
- B. $\frac{1}{4}$
- C. $\frac{1}{2}$
- D. $\frac{3}{4}$

34. During the formation of a blood clot, coagulation is initiated by

- A. Secretion of nitric oxide by the capillary endothelial cells
- B. Exposure of blood to collagen fibers
- C. Blood escaping from the vessels at the site of the wound
- D. Arise in the level of heparin in the plasma

35. When the demand for oxygen temporarily exceeds the rate of supply

- A. Tissue respiration slows down
- B. Lactic acid fermentation occurs
- C. The oxygen of oxymyoglobin is released
- D. Anaerobic respiration commences

36. Figure 2 shows the stages of a biological process



Which of the following identifies in the correct order the stages involved

- A. Replication,transcription,translation
- B. Transcription,translation,replication
- C. Replication,translation,transcription
- D. Translation,replication,transcription

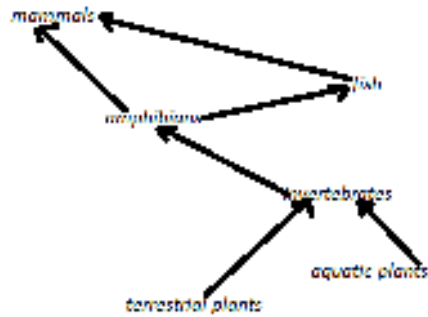
37. The plant life cycle involves a diploid sporophyte stage that produces haploid spores. Which of the following statements is true?

- A. Haploid spores are produced through meiosis
- B. Haploid spores are produced through mitosis
- C. Diploid spores are produced through meiosis
- D. Diploid spores are produced through mitosis

38. High concentration of sediment in the water can block out sunlight needed by aquatic plants for photosynthesis. This condition will most likely result in

- A. Increased concentration of nitrogen
- B. Decreased concentration of nitrogen
- C. Increased concentration of oxygen
- D. Decreased concentration of oxygen

39. Figure 3 shows a feeding relationship in nature



In a polluted river at what level in the food web above would pollution concentration be the highest

- A. Aquatic plants
- B. Fish
- C. Invertebrates
- D. Mammals

40. After many generations, an insect species evolved resistance to a particular pesticide. This occurred because spraying pesticide

- A. Killed most of the insects pests
- B. Caused mutations in the insects species gene pool
- C. Caused another insect species to go into extinction
- D. Selected for insects that were able to survive and reproduce

SECTION B :(60 MARKS)

41.a)In snapdragon flower colour is determined by two alleles of **R for** red and **W**for white which are incompletely dominant.

A population has the following individuals distributed as follows

Flower colour	Number of individuals
Red	450
Pink	500
White	50

b) Using the information provided determine the

i) total number of the **R** and **W** alleles in the population (*03 marks*)

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ii) Genotype frequency for each genotype(*03 marks*)

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iii) Allele frequencies of each allele(02 marks)

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c) State **two** causes of change in the allele frequencies and genotype frequencies in populations (02 marks)

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42. The endosperm of seeds of a species of a plant is a storage tissue containing lipids which are metabolized during germination. The main products, fatty acids are broken down in a process which yields two carbon fragments. These fragments may enter one of two different biochemical pathways, the Krebs cycle or the glyoxylate cycle

A typical equation for the metabolism of the fatty acids via the Krebs cycle is as follows



A typical equation for the metabolism of the fatty acids via the glyoxylate pathway is as follows



a) Calculate the RQ (respiratory quotient) for the oxidation of the fatty acid via the

(i) Krebs cycle

(01 mark)

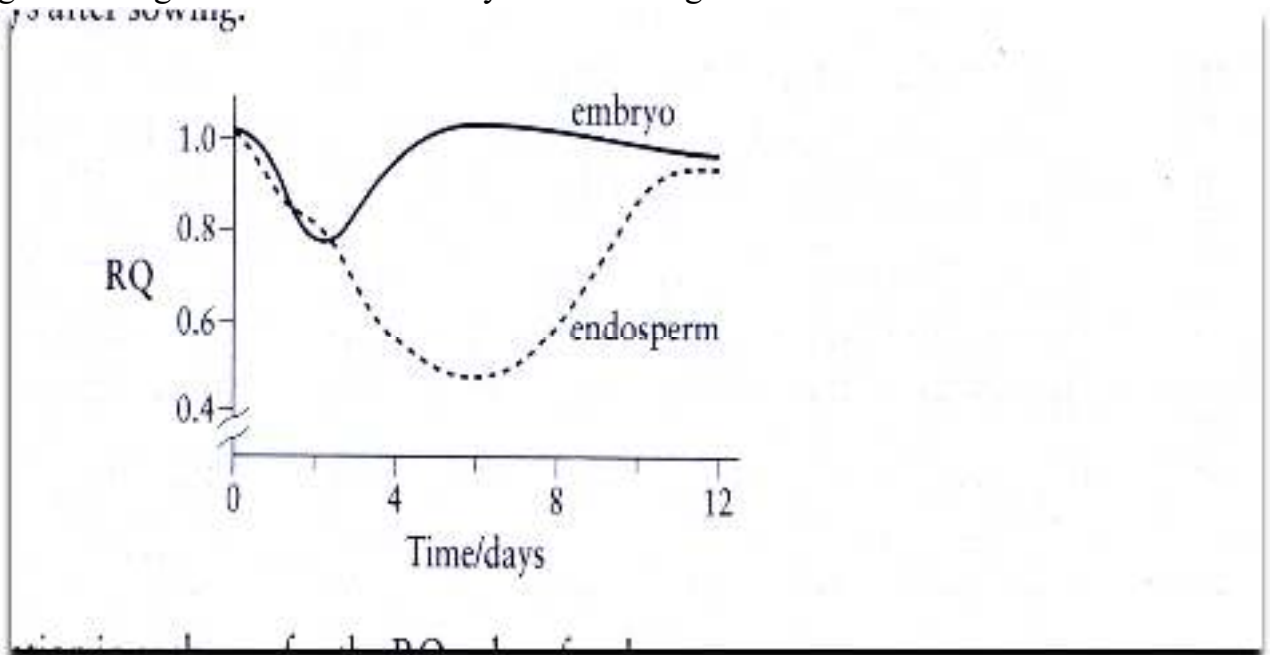
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(ii) glyoxylate

($\frac{1}{2}$ mark)

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b) Figure 4 shows the RQs of the embryo and endosperm components of seeds germinating in the dark for 12 days after sowing



c) Suggest an explanation in each case for the changes in the RQ values for the
i) embryo and endosperm from 0-2 days (01 ½ marks)

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ii) endosperm from 2-12 days (02 marks)

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iii) embryo from 2-12 days (02 marks)

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The table 1 gives results selected from analysis of germination seedlings

	Dry mass/mg per seedling		
	Lipid	Carbohydrate	Total
Day 4	250	51	390
Day 6	108	182	451

d) Explain what the changes in dry mass of lipids and carbohydrates suggest about the pathways of lipid metabolism in use at this time. (03 marks)

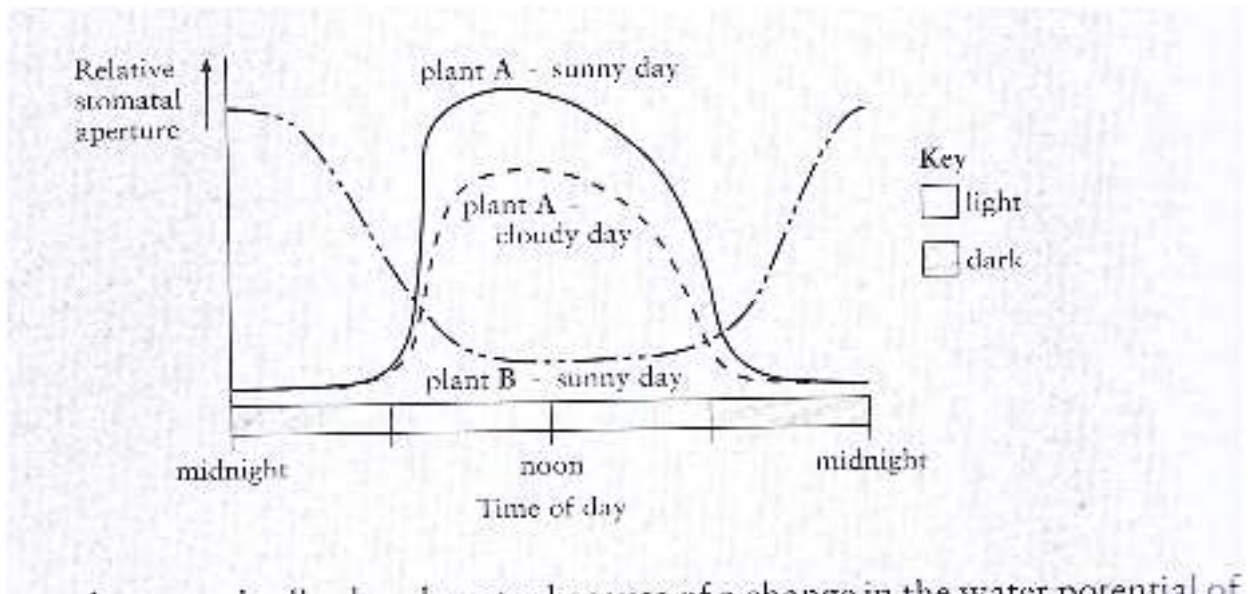
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43. Figure 5 shows the stomatal aperture changes in two plants, A and B in different conditions



- a) stomata open when guard cells absorb water because of a change in the
Water potential of their cell contents

Give **one** explanation for the mechanism that results in

- i) a change in water potential of the guard cells in plant **A** between 06.00 and noon *(03 marks)*

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- ii) the stomata of plant **A** not operating as widely on the cloudy day as on the sunny day *(03 marks)*

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b) Plant **B** is a succulent plant that lives in dry conditions

- i) Give **one** advantage to plant **B** of the different behavior of its stomata

(03 marks)

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ii) Give **one** disadvantage to plant **B** of the different behavior of its stomata
(02 marks)

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44. The table shows how the concentration of insulin and glucose in the plasma vary at different times

When measurement taken	Plasma insulin/units per cm³	Plasma glucose concentration/mg per 100cm³
During overnight fast	10	60-100
During a meal	70	110-180
After a meal	10	60-100
During prolonged fasting	5	50-70

a) Describe the relationship between glucose concentration and insulin concentration in the plasma(01 mark)

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b) Explain the rise in plasma glucose and insulin levels that occurs during the meal (05 marks)

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c) Use information from the table to explain how the control of insulin production is an example of negative feedback(02 marks)

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d) The plasma glucose level is maintained at a minimum of 50mg per 100 cm³during prolonged fasting
Suggest how this might be achieved (03 marks)

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45.a) What fundamental physical constraints necessitate a circulatory system in large organisms? *(02 marks)*

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iii) State **one** advantage and **one** disadvantage of a closed circulatory systems *(02 marks)*

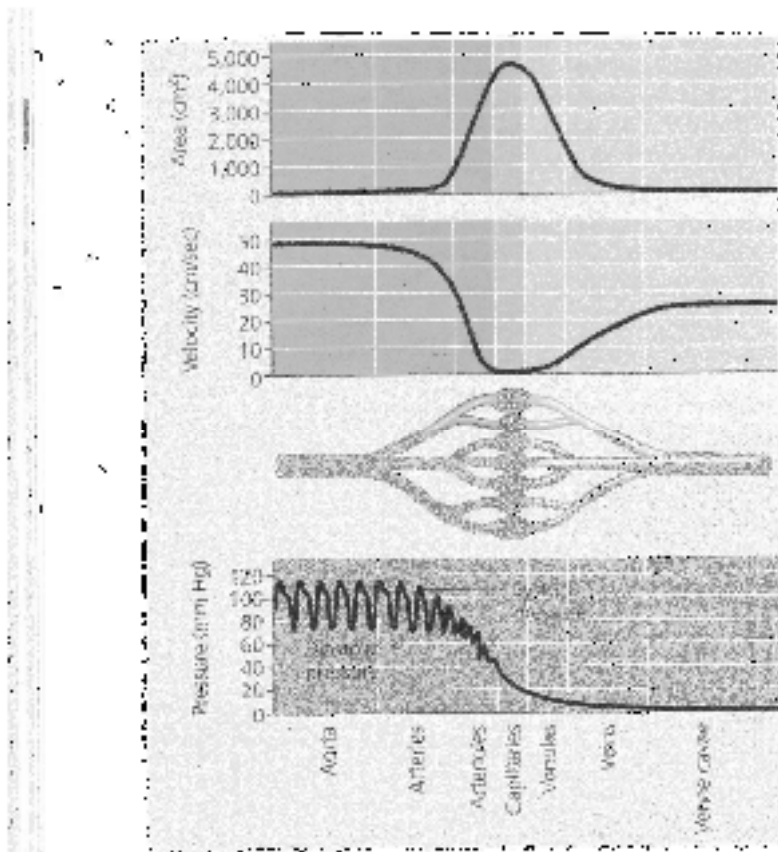
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c) State **two** physiological advantages of separate pulmonary and systemic circuits in a mammalian circulatory system *(02 marks)*

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d) Figure 6 shows the interrelationship of blood flow velocity, cross sectional area of blood vessels and blood pressure



Explain the relationship between **area** and **velocity** in the arteries
(04 marks)

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46. a) State how the structure of a sperm is adapted to its function (04 marks)

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b) Explain the following observations

i) Most animals that rely on external fertilization live in aquatic environments (01 mark)

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ii) Species with external fertilization tend to produce exceptionally large numbers of gametes (02 marks)

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c) Given that sperms and eggs from different individuals must be released into the environment synchronously for external fertilization to work, explain how gamete release is coordinated? (03 marks)

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