Candidate's Name:……..……

Signature: ……..PERSONAL NO…….

P530/1
BIOLOGY
Paper 1
SEP. 2019
2 ½ hours

DEPARTMENT OF BIOLOGY

RESOURCEFUL POST MOCK EXAMINATIONS, 2019

Uganda Advanced Certificate of Education

BIOLOGY

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**: Write answers to this section in the boxes provided.*

***SECTION B**: Answers to this section must 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: No. 41	
42	
43	
44	
45	
46	
Total	

SECTION A (40 MARKS)

Write letter corresponding to best choice in the box provided for each question. *Each question in this section carries* ***one*** *mark.*

1. Compared with a smaller cell, a larger cell of the same shape has

   A. less surface area.
   B. less surface area per unit of volume.
   C. the same surface-to-volume ratio.
   D. a smaller cytoplasm-to-nucleus ratio.

2. The epithelium best adapted for a body surface subject to abrasion is
   A. simple squamous.
   B. simple columnar.
   C. stratified columnar.
   D. stratified squamous,

3. Which of the following is not an adaptation for reducing the rate of heat exchange between an animal and its environment?
   A. Vasoconstriction
   B. shivering
   C. countercurrent heat exchanger
   D. blubber or fat layer

4. Which of the following animals uses the highest percent of its energy budget for homeostatic regulation?
   A. a hydra
   B. a desert insect
   C. a desert bird
   D. a snake in a temperate forest

5. An animal's inputs of energy and materials would exceed its outputs
   A. if the animal is an endotherm.
   B. if it is actively foraging for food.
   C. if it is hibernating.
   D. if it is growing and increasing its mass.

6. After surgical removal of an infected gallbladder, a person must be especially careful to restrict dietary intake of
   A. starch.
   B. protein.
   C. fat.
   D. sugar.

7. The main target organs for tropic hormones are
   A. muscles.
   B. kidneys.
   C. blood vessels.
   D. endocrine glands.

8. Which of the following results in long-term immunity?
   A. the passage of maternal antibodies to a developing fetus
   B. the injection of serum from people immune to rabies
   C. the administration of the chicken pox vaccine
   D. the passage of maternal antibodies to a nursing infant

9. Which of the following is *not* a correct statement concerning hormones?
   A. Hormones are chemical messengers that travel to target cells through the circulatory system.
   B. Hormones of the same chemical class usually have the same function.
   C. Hormones are secreted by specialized cells usually located in endocrine glands.
   D. Hormones are often regulated through feedback loops.

10. The sympathetic division of the autonomic portion of the peripheral nervous system does all of the following ***except***
   A. relaxing bronchi in lungs.
   B. inhibiting bladder emptying.
   C. stimulating glucose release.
   D. stimulating the salivary glands.

11. Which of the following is true of innate behaviors?
   A. Genes have very little influence on the expression of innate behaviors.
   B. Innate behaviors tend to vary considerably among members of a population.
   C. Innate behaviors are limited to invertebrate animals.
   D. Innate behaviors are expressed in most individuals in a population across a wide range of environmental conditions.

12. Which of the following is true with respect to eutrophic lakes?
   A. The lakes are less subject to oxygen depletion.
   B. Rates of photosynthesis are lower in eutrophic lakes.
   C. Eutrophic lake water contains lower concentrations of nutrients.
   D. Eutrophic lakes are richer in nutrients.

13. The observation that members of a population are uniformly distributed suggests that
   A. the size of the area occupied by the population is increasing.
   B. resources are distributed unevenly.
   C. the members of the population are competing for access to a resource.
   D. the density of the population is low.

14. Which of the following is *not* required for a behavioral trait to evolve by natural selection?
   A. In each individual, the form of the behavior is determined entirely by genes.
   B. The behavior varies among individuals.
   C. An individual's reproductive success depends in part on how the behavior is performed.
   D. Some component of the behavior is genetically inherited.

15. A distinctive feature of the mechanism of action of thyroid hormones and steroid hormones is that
A. target cells react more rapidly to these hormones than to local regulators.
B. these hormones bind with specific receptor proteins on the plasma membrane of target cells.
C. these hormones bind to receptors inside cells.
D. these hormones affect metabolism.

16. The principle of competitive exclusion states that
A. two species cannot coexist in the same habitat.
B. competition between two species always causes extinction or emigration of one species.
C. competition in a population promotes survival of the best adapted individuals.
D. two species that have exactly the same niche cannot coexist in a community

17. Which structure is *incorrectly* paired with its tissue system?
A. palisade mesophyll-ground tissue
B. guard cell-dermal tissue
C. companion cell-ground tissue
D. tracheid-vascular tissue

18. Heartwood and sapwood consist of
A. bark.
B. secondary phloem.
C. secondary xylem.
D. periderm.

19. What would enhance water uptake by a plant cell?
A. decreased Ψ of the surrounding solution
B. an increase in pressure exerted by the cell wall
C. the loss of solutes from the cell
D. positive pressure on the surrounding solution

20. Which of the following would be considered an example of bioremediation?
A. adding nitrogen-fixing microorganisms to a degraded ecosystem to increase nitrogen availability
B. using a bulldozer to re-grade a strip mine
C. reconfiguring the channel of a river
D. adding seeds of a chromium-accumulating plant to soil contaminated by chromium

21. Photosynthesis ceases when leaves wilt, mainly because
A. the chlorophyll of wilting leaves breaks down.
B. flaccid mesophyll cells are incapable of photosynthesis.
C. stomata close, preventing carbon dioxide from entering the leaf.
D. photolysis cannot occur when there is a water deficiency.

22. A plant cell with Ψ_s of - 650kPa maintains a constant volume when bathed in a solution that has a Ψ_s of -300kPa and is in an open container. The cell has a
A. Ψ_p of +650kPa.
B. Ψ of -650kPa.
C. Ψ_p of +350 kPa.
D. Ψ_p of +300kPa.

23. Food chains are sometimes short because
A. only a single species of herbivore feeds on each plant species.
B. most of the energy in a trophic level is lost as it passes to the next higher level.
C. predator species tend to be less diverse and less abundant than prey species.
D. most producers are inedible.

24. Which of the following is the most likely explanation for hypothyroidism in a patient whose iodine level is normal?
A. a disproportionate production of T3 to T4
B. undersecretion of TSH
C. Oversecretion of TSH
D. a decrease in the thyroid secretion of calcitonin

25. lf a long-day plant has a critical night length of 9 hours, which 24-hour cycle would prevent flowering in such a plant?
A. 16 hours light/8 hours dark
B. 14 hours light/ l0 hours dark
C. 15.5 hours light/8.5 hours dark
D. 8 hours light/8 hours dark/light flash/8 hours dark

26. The table below shows the rate of breathing and volume of air exchanged with each breath for a person at rest and during exercise.

State of individual	Breaths per minute	Volume of each breath (cm^3)
At rest	12	500
During exercise	24	1000

The increase in volume of air exchanged per minute when an individual does exercise from rest is

A. 500 cm^3
B. 600 cm^3
C. 15000 cm^3
D. 18000 cm^3

27. In the fruit fly, *Drosophila melanogaster,* the gene for eye colour is sex- linked. The allele for red eye (R) is dominant to the allele for white eye (r).
A cross between two flies produced the offspring shown in the table below.

Sex of offspring	*Number with white eyes*	*Number with red eyes*
Female	*23*	*22*
Male	*21*	*22*

What were the genotypes of the parents in the above cross?
A**.** $\mathbf{X^r X^r}$ and $\mathbf{X^R Y}$
B**.** $\mathbf{X^R X^r}$ and $\mathbf{X^r Y}$
C**.** $\mathbf{X^R X^r}$ and $\mathbf{X^R Y}$
D**.** $\mathbf{X^R X^R}$ and $\mathbf{X^r Y.}$

28. A biochemical analysis of a DNA sample showed that 32% of the bases were adenine. The percentage of guanine bases in the sample is

A. 32
B. 36
C. 18
D. 16

29. Which one of the following cell organelles is associated with final stage of most cell secretions?

A. Smooth endoplasmic reticulum
B. Rough endoplasmic reticulum
C. Ribosome
D. Golgi apparatus

30. A property of water that makes it a suitable component of a hydrostatic skeleton is its

A. incompressibility
B. high density
C. low viscosity
D. high surface tension

31. Which of the following is the correct way of classifying a tick?

A. Kingdom: Animalia; phylum: Arthropoda, class; Insecta
B. Kingdom: Animalia, phylum Nematoda; class Diplopoda
C. Kingdom: Animalia, phylum; Nematoda; class; Arachnida
D. Kingdom: Animalia, phylum Arthropoda, class Arachnida

32. The signaling molecule for flowering might be released earlier than normal in a long-day plant exposed to flashes of
A. far-red light during the night.
B. red light during the night.
C. red light followed by far-red light during the night.
D. far-red light during the day.

33. A desert mammal's lower lethal temperature is higher than that of a mammal living in a cold region because a desert mammal has
A. small body extremities
B. poor insulation mechanisms
C. metabolic water
D. a small surface area to volume ratio

34. Which one of the following cells is the most vulnerable to HIV?
A. T-killer cells
B. T-helper cells
C. T-suppressor cells
D. B-memory cells

35. Following depolarization, repolarization of the membrane begins by
A. diffusion of potassium out of the cell
B. diffusion of sodium ions out of the cell
C. entry of potassium ions into the cell
D. entry of sodium ions into the cell

36. In the alternation of generations in the life cycles of plants,
A. the sporophyte is always dominant
B. gametophyte is always short lived
C. gametes are produced by meiosis
D. spores are always haploid

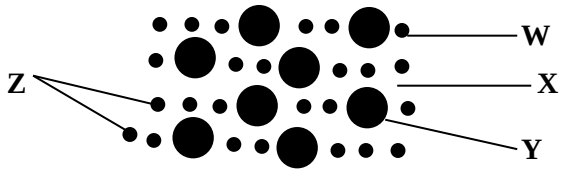
37. Which one of the following phyla has acoelomate organisms?
A. Platyhelminthes
B. Nematoda
C. Annelida
D. Mollusca

38. Which of the following sets of parts constitutes the Organ of Corti?
A. tectorial membrane, basilar membrane, auditory nerve
B. tectorial membrane, endolymph, Reissner's membrane
C. tectorial membrane, basilar membrane, sensory hair cells
D. tectorial membrane, median canal, basilar membrane

39. The gene that causes albinism in humans is also associated with loss of melanin pigment in the skin. This gene is therefore said to be

A. polygenic
B. epistatic
C. codominant
D. pleiotropic

40. The figure below shows part of a cross-section of a fibril of a skeletal muscle.



Which of the parts labelled contains myosin?

A. **W**
B. **X**
C. **Y**
D. **Z**

SECTION B (60 MARKS)

Write answers in the spaces provided.

41. In cats, males are XY and females are XX. A gene on the X chromosome controls fur colour in cats. The allele **G** codes for ginger fur and the allele **B** codes for black fur. These alleles are codominant. Heterozygous females have ginger and black patches of fur and their phenotype is described as tortoiseshell.

(a) Explain what is meant by **codominant** alleles. *(01 mark)*

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(b) (i) Explain why male cats with a tortoiseshell phenotype do **not** usually occur? *(02 marks)*

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(ii) A tortoiseshell female was crossed with a black male. Use a genetic diagram to show all the possible genotypes and the ratio of phenotypes expected in the offspring of this cross. *(03 marks)*

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(c) Polydactyly in cats is an inherited condition in which cats have extra toes. The allele for polydactyly is dominant.

(i) In a population, 19% of cats had extra toes. Calculate the frequency of the recessive allele for this gene in this population. Show your working. *(02 marks)*

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(ii) Some cat breeders select for polydactyly. Describe how this would affect the frequencies of the homozygous genotypes for this gene in their breeding populations over time. *(02 marks)*

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42. Farmland previously used for growing crops was left for 30 years and developed into woodland. During this period, ecologists recorded an increase in the diversity of birds in the area.

(a) (i) Name the process that resulted in the development of woodland from farmland. *(01 mark)*

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(ii) Explain the increase in the diversity of birds as the woodland developed. *(03 marks)*

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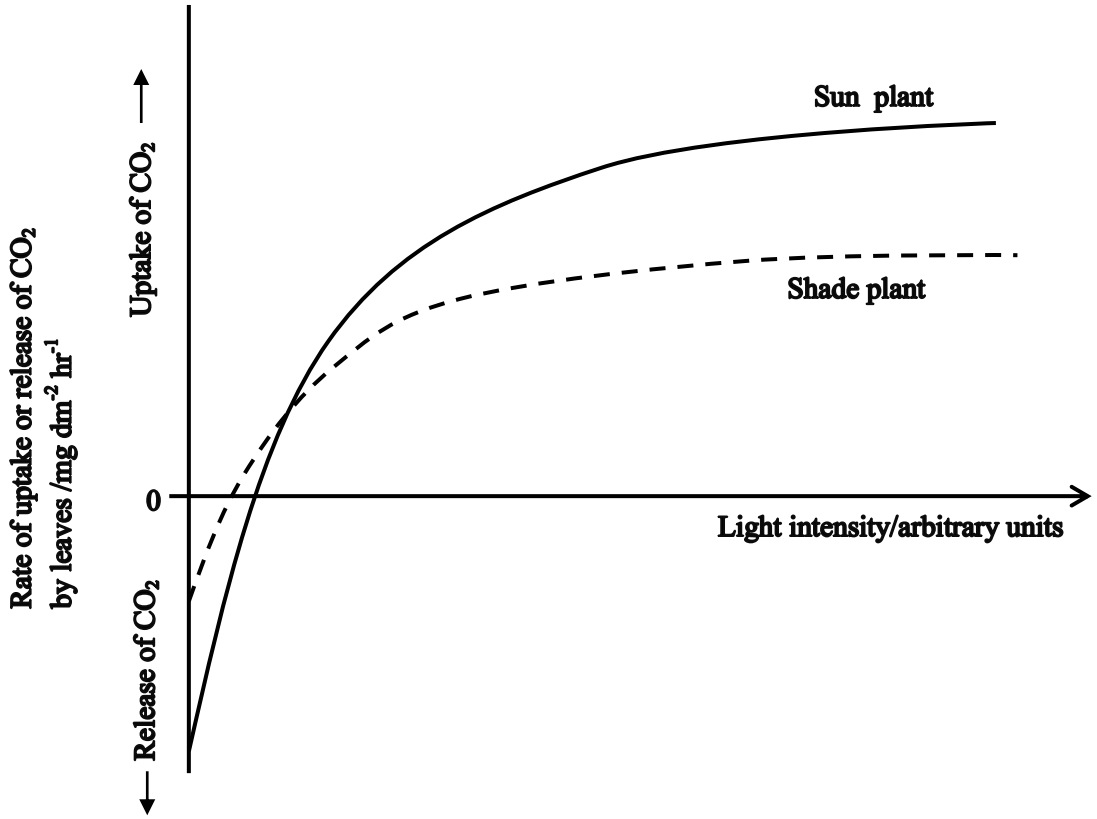
(b) The ecologists also investigated photosynthesis in two species of plant found in the woodland. One of the species was adapted to growing in bright sunlight (sun plant) and the other was adapted to growing in the shade (shade plant). The ecologists' results are shown in **Figure** below.



(i) Compare the rate of CO_2 uptake and release in the shade plant and sun plant. *(04 marks)*

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(ii) Use the information in the **Figure** to explain how the shade plant is better adapted than the sun plant to growing at low light intensities. *(03 marks)*

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43. (a) Describe the physiological mechanisms of maintaining body temperature in a mammal within the efficiency range during hot weather. *(04 marks)*

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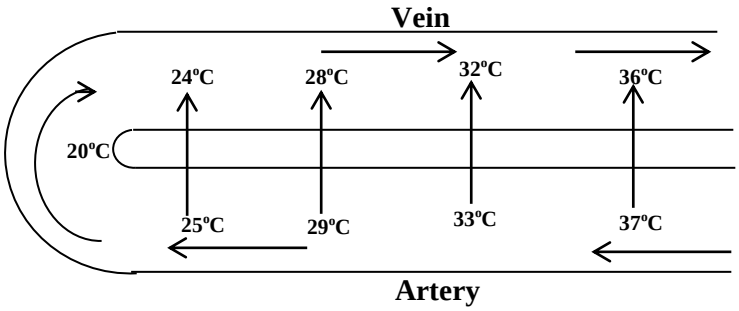
(b) The figure below shows an important mechanism of maintaining body temperature in the limb of a mammal during cold weather.



(i) State the name given to such a mechanism. *(01 mark)*

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(ii) Explain how the mechanism works. *(05 marks)*

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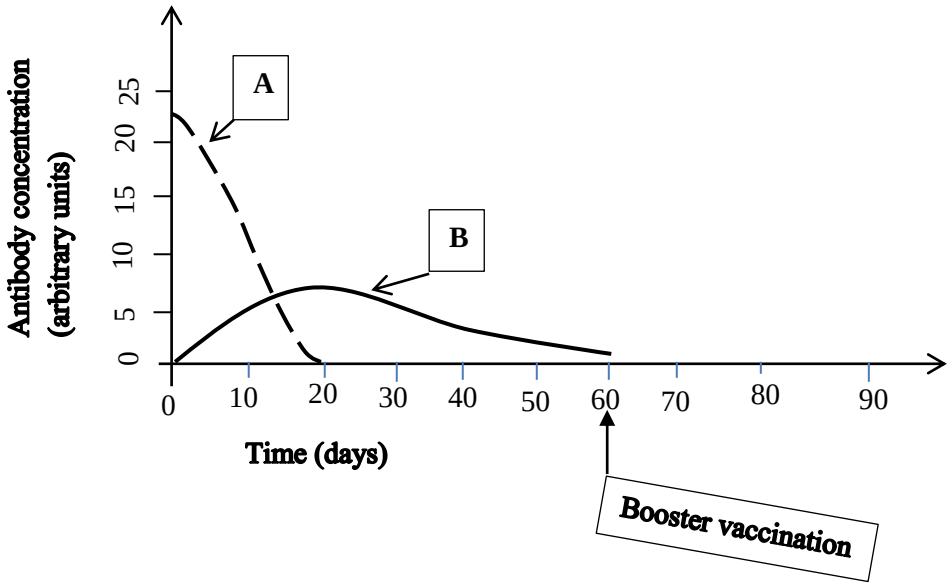
44. Two people took part in a study to find out the effectiveness of two types of immunization. Person **A** received an injection of antibodies against tetanus and person **B** received a tetanus vaccination. Over the next few weeks, the blood from these two people was analyzed for the presence of antibodies to tetanus. The results are shown in the figure below.



(a) Identify the types of immunity exhibited in graphs **A** and **B** respectively. *(02 marks)*

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(b) Explain why the antibody concentration in person **A**,

(i) decreased during the study period *(01 mark)*

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(ii) did not increase. *(02 marks)*

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(c) (i) Sketch on curve **B** what you would expect to happen to the antibody concentration if person **B** received a booster vaccination at day 60. *(01 mark)*

(ii) Explain why, in this investigation, the experimenters had to measure the concentration of antibodies to tetanus rather than the concentration of all antibodies in the blood of **A** and **B**. *(02 marks)*

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(d) State **two** differences between **T** cells and **B** cells. *(02 marks)*

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45. (a) Explain briefly some of the problems which may arise from excessive use of chemicals to control pests of crop plants. *(04 marks)*

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(b) Biological pest control avoids some of the problems of chemical control.

(i) Explain what is meant by the term **biological pest control**. *(01 mark)*

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(ii) Suggest one of the possible risks of biological pest control. *(01 mark)*

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(c) (i) Explain how the release of **chlorofluorocarbons** (CFCs) into the atmosphere can damage ecosystems. *(02 marks)*

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(ii) Explain the effect of **thermal pollution** on life in a water body? *(02 marks)*

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46. (a) (i) Describe how a mature sperm cell is produced from a primary spermatocyte. *(04 marks)*

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(ii) Describe the role of a sperm cell's **acrosome** in the process of fertilization. *(02 marks)*

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(b) Describe the role of the following hormones during pregnancy.

(i) **human chorionic gonadotrophin**, **HCG** *(02 marks)*

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(ii) **Progesterone**. *(02 marks)*

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END