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O' Level Biology Seminar

At Makerere University

On Sunday 24th September, 2023

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Topic 1: Diversity of living things

1. (a) Outline three features common to all insects (03 marks)
(b) Name the other types of arthropods apart from insects (03 marks)
(c) Insects are the most abundant animals on this planet. Suggest reasons for this observation. (09 marks)
2. Figures below are illustrations of different forms of a plant organ



P



Q



R

- (a) (i) Identify the plant organs (01 mark)
(ii) Give two reasons for the identity (02 marks)
(b) Which features does R have in common with a bean seed? (03 marks)
(c) Describe the modes of dispersal for specimens P and Q
(i) P (02 marks)
(ii) Q (02 marks)
(d) What are the different types of placentation in fruits? (10 marks)

GODS WAY HIGH SCHOOL. MAGANJO

3. Below are illustrations of common forms of animals.

U



V



W



X



Y



Z

- (a) State which of the above is/are
(i) Simplest of all the animals? (01 mark)
(ii) Invertebrates? (01 mark)
(iii) An obligatory parasite? (01 mark)
(iv) Chordates? (01 mark)
(b) Outline three characteristics shared both by W and Y (03 marks)
(c) How does W physically differ from Y? (03 marks)

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4. A student was given the following list of specimens during a biology practical exam.

Specimen P – has eight jointed legs, two body divisions, no antennae, and no wings.

Specimen Q – has six jointed legs, three body divisions, one pair of antennae and one pair of wings.

Specimen R – has six jointed legs, three body divisions, one pair of antennae and no wings

Specimen S – has ten jointed legs, two body divisions, two pairs of antennae and no wings.

(a) Put the information above in a suitable table form

(b) Construct a flow chart to represent the organisms

(c) Use the flow chart above to identify the organisms

Topic 2: Soil

5. (a) Define the following terms as applied in soil biology:

(i) Weathering (01 mark)

(ii) Nitrification (01 mark)

(iii) Leaching (01 mark)

(iv) Conservation (01 mark)

(b) (i) Explain how weathering leads to soil formation. (02 marks)

(ii) Describe one other method of soil formation. (03 marks)

(c) Describe how PH of a given soil sample can be determined using universal indicator solution. (06 marks)

6. A class of students carried out an experiment to investigate the percentage of air in three types of soil samples. The results are summarized in the table below. Study the table and answer the questions that follow.

Type of soil	Percentage of air by volume
Sample A	20
Sample B	6
Sample C	13

(a) Identify the soil types above. Giving reasons in each case. (03 marks)

(b) If all the three types were mixed without loss of any contents, what would be the percentage of the air content in the mixture? Show your working. (03 marks)

(c) Of what significance is air in the soil? (05 marks)

(d) Describe how you would obtain the above results in the table. (06 marks)

(e) Explain why some plants in water logged soils, tend to gradually die out. (03 marks)

KAWANDA S.S

7. (a) Explain the role of earthworms in maintaining soil in a condition suitable for crop growth. (06 marks)

(b) How does clay affect soil fertility when added to soils of a given area? (04 marks)

(c) Discuss the human activities that degrade soil. (05 marks)

8. (a) Define the major processes involved in the nitrogen cycle. (06 marks)

(b) State the general names of the bacteria that drive some of the processes above. (04 marks)

(c) Explain why water-logged soils are usually deficient in nitrates. (02 marks)

(d) Explain the effect of denitrification on plant growth. (03 marks)

Topic 3: Nutrition in plants and animals

7. The table below shows the rate of activity of an enzyme at different temperatures

Temperature / °C	Rate/mg of product per minute
0	1.8
5	2.4
10	3.7
15	4.9
20	7.4
25	9.3
30	13.4
35	17.2
40	19.0
45	19.0
50	8.1
55	1.7
60	0

(a) Represent the information in the table above in a suitable graph on the graph paper provided. (06 marks)

(b) (i) State the optimum temperature for this enzyme. (01 mark)

(ii) Explain the rate of activity at 17°C (02 marks)

(iii) Explain the results at temperatures above 45°C. (02 marks)

(c) Name four factors other than temperature which would affect the rate of enzyme activity.

(04 marks)

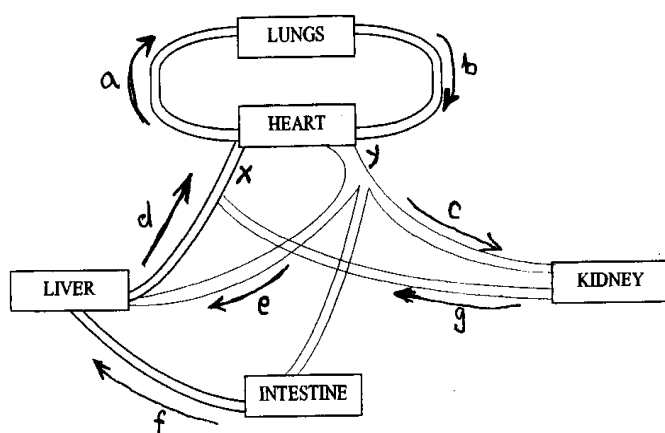
- (d) If the enzyme used in the experiment above was amylase, name the;
 (i) substrate: _____
 (ii) product(s): _____ (01 mark)
 (e) Briefly describe the lock and key hypothesis of enzyme activity (04 marks)

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8. (a) Describe the role of the different digestive enzymes secreted along the alimentary canal. (07 marks)
 (b) Explain the significance of the two non-enzymatic substances secreted into the alimentary canal that are important in digestion (04 marks)
 (c) State the adaptations of the ileum to its functions (04 marks)
9. (a) What is meant by the term photosynthesis? (02 marks)
 (b) What is the role of each of the following during photosynthesis?
 i) Sunlight (01 mark)
 ii) Chlorophyll (01 mark)
 (c) How are plants suited for the following processes?
 i) Absorption of water from the soil (03 marks)
 ii) Uptake of carbon dioxide (03 marks)
 iii) Trapping sunlight energy (04 marks)
 (d) State the final product of photosynthesis. (01 mark)

Topic 4: Transport in plants and animals

10. Figure below shows blood vessels supplying some organs in the human body. Arrows show the direction of blood flow.



(a) Name blood vessels labeled **a** to **f**.
(marks)

(03

(b) State the differences in composition of blood in vessel:

(i) **a** and **b**

(02 marks)

(ii) **c** and **g**

(02 marks)

(iii) **d** and **f**

(02 marks)

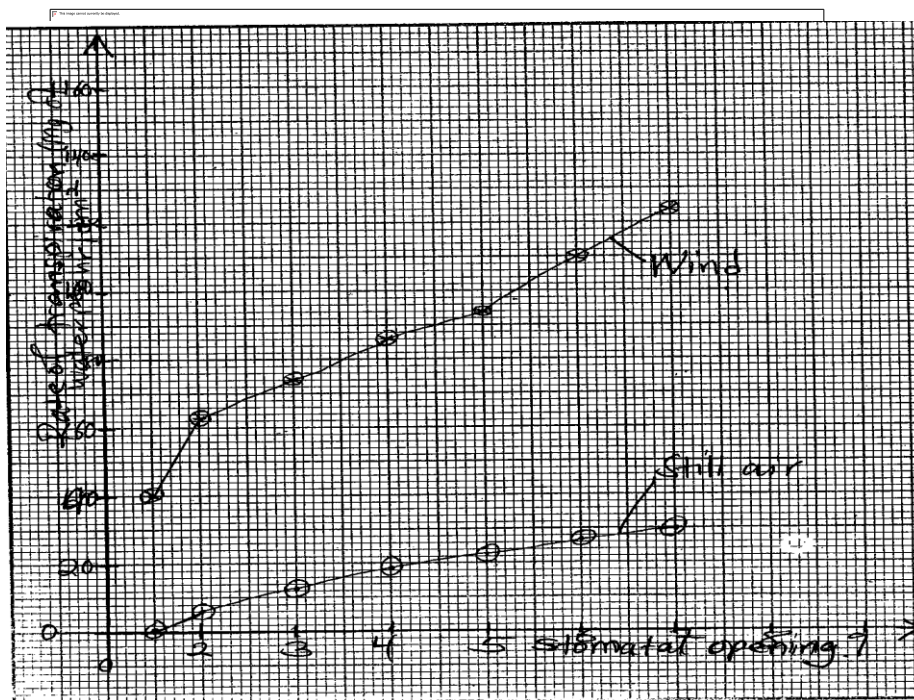
(c) Stat four structural differences between blood **vessels x** and **y**

(04 marks)

(d) Briefly describe how blood circulates through the heart

(02 marks)

11. The graph below shows the effect of wind, still air and stomata opening on the rate of transpiration of a plant in milligrams of water lost per hour per dm². Study the table and answer the following questions.



(a) (i) Compare the rates of transpiration in windy and still air. (08 marks)
(ii) Explain your observations. (04 marks)

(b) How does stomatal opening affect transpiration rate. (02marks)

(c) Explain three other factors that affect the rate of transpiration. (03 marks)

(d) State three functions of transpiration to plants. (03 marks)

- 12 . a) Distinguish between diffusion and osmosis. (02 marks)
- b) Describe an experiment to demonstrate osmosis, using a named plant material. (08 Marks)
- c) How is a plant leaf adapted to its functions? (05 marks)

Topic 5: Gaseous exchange and Respiration

13. An experiment was carried out to show how breathing rate for trained and untrained athletes changes during the course of the vigorous exercise. **Two individuals A and B** were subjected to vigorous exercise for five minutes and the results are shown in the table below.

Time (minutes)	Breathing rate (cm ³ per minute)	
	A	B
0	20	20
1	30	28
2	40	38
3	50	43
4	58	44
5	58	44

- (a) Plot on the same axes graphs to show how the breathing rate of each individual varies with time of exercise. (06 marks)
- (b) Giving a reason for your answer, identify the individual who was
- (i) **A trained athlete** (02 marks)
- (ii) **An untrained athlete** (02 marks)
- (c) Explain the changes in the rate of breathing for individuals between
- (i) 0 and 4 minutes (04 marks)
- (ii) 4 and 5 minutes (02 marks)
- (d) After the exercise, individuals were allowed to rest for 1 minute. The breathing rate of **individuals A and B** were 38 and 40 cm³ per minute respectively. Explain why the breathing rate of individual **B** after one minute at rest was higher than that of individual **A**. (03 marks)
- (e) State one difference between the composition of expired air at rest and that of expired air after 5 minutes of exercise. (01 mark)

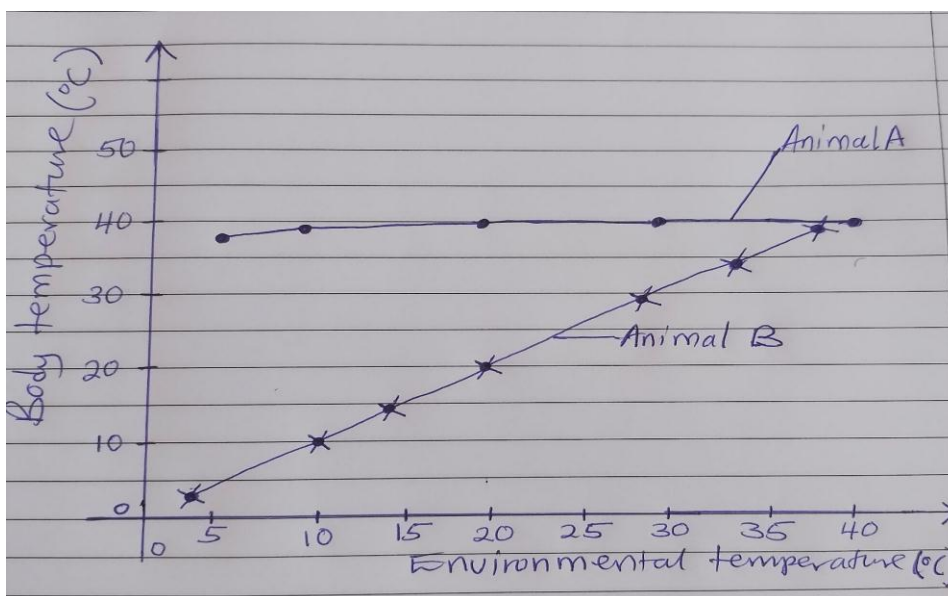
ST. JOHNS S, MUKONO

- 14.(a) what features of a respiratory surface make it efficient for gaseous exchange in living organisms (04 marks)
- (b) Describe how
- (i) Inhalation in a bony fish (04 marks)
 - (ii) Exhalation in man; occur (04 marks)
- (c) Suggest reasons why plants do not need a special breathing system. (03 marks)
15. (a) What is anaerobic respiration? (02 marks)
- (b) How does respiration in plants differ from photosynthesis? (04 marks)
- (c) With aid of a diagram, explain how oxygen from the alveolar air reaches a muscle cell. (04 marks)

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Topic 6: Excretion, Homeostasis and Osmoregulation

16. (a) Distinguish between Homeostasis and osmoregulation (02 marks)
- (b) Describe how the human body responds to the following
- (i) High blood glucose levels (03 marks)
 - (ii) Cold weather conditions (03 marks)
- (c) Explain the role of the hormone produced from the renal cortex in homeostasis. (03 marks)
- (d) How is the human skin adapted to its functions? (04 marks)
17. The figure below shows variation of body temperature of **animals A and B** With environmental temperature.



- (a) Describe the variation of body temperature of the animals with environmental temperature:
- (i) **Animal A** (01 mark)
- (ii) **Animal B** (01 mark)
- (b) Explain the relationship between the body temperature of each animal and environmental temperature.
- (i) **Animal A** (02 marks)
- (ii) **Animal B** (02 marks)
- (c) State and explain the expected difference in food consumption per day for the two animals. (04 marks)
- (d) What are the advantages of **animal A** over **B**? (03 marks)
- (e) What are the **long-term** adaptations of mammals surviving in cold areas? (05 marks)

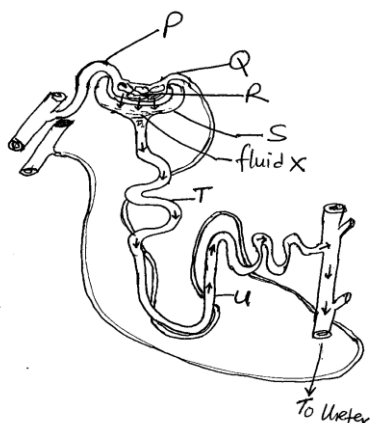
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18. Doctors wanted to investigate the effect of exercise on the excretion of salts. They collected urine from people before and after running a long distance on a hot day. The results of their investigation are shown in table below.

Volume of urine/sodium concentration	Before running	After running
Average volume of urine /cm ³	1156.0	569.0
Average concentration of sodium in urine/mmol per dm ³	85.6	78.2

- (a) State the difference in the results obtained. (02marks)
- (b) Suggest explanations for the difference in the obtained results. (03marks)
- (c) Calculate the percentage change in the average sodium concentration after running compared with before running. (02marks)
- (d) Describe how the kidney tubules enable the excretion of salts. (03marks)

19. The figure below shows a human kidney nephron.



- (a) Identify parts labelled **P** to **U** (03 marks)
- (b) How are parts **R** and **T** adapted to their functions
 - (i) Part **R** (03 marks)
 - (ii) Part **T** (02 marks)
- (c) (i) Name the process that leads to formation of liquid **X** (01 mark)
- (iii) How does composition of **X** differ from that of blood in **P** (03 marks)
- (d) Explain why urine production almost ceases after a fatal accident. (03 marks)

MBOGO HIGH SCHOOL KAWEMPE

Topic 7: Coordination in plants and animals

- 20.** (a) Distinguish between tropism and nastic response. (02 marks)
- (b) What is meant by

Phototropism? (02 marks)

- (c) Describe an experiment to show phototropism in a named plant part. (06 marks)
- (d) Explain the significance of tropisms in plant growth. (05 marks)

- 21.** (a) Distinguish between voluntary actions and reflex actions. (02 marks)
- (b) Explain the sequence of events that occur in the ear, until a sound of a bullet fired from a pistol is heard. (05 marks)

(c) Kajubi was collecting rubbish and suddenly his foot was pricked by a thorn, his response was quick as was seen by fast withdrawal of his leg. Describe the process that led to the quick withdrawal of his leg after it was pricked by a thorn. (05 marks)

- (d). State three advantages of reflex actions to animals. (03 marks)

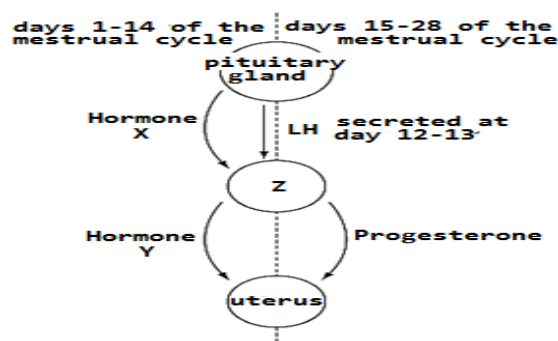
22. In an experiment, a student looked at the light source of varying intensities. The diameter of the pupil was measured at each intensity. The data below shows how the diameter varied with light intensity.

Light intensity (Arbitrary units)	0	2	4	6	8	10
Diameter of the pupil (mm)	8.4	7.2	4.2	2.9	1.8	1.4

- (a) On the graph paper provided, draw a graph to show how the pupil diameter varied with light intensity. (06 marks)
- b) (i) Describe how pupil diameter varied with light intensity from the graph. (03 marks)
- (ii) From the graph, state the relationship between light intensity and pupil diameter. (02 marks)
- c) Using the structures of the mammalian eye, explain how the pupil is able to adjust its diameter at various light intensities. (05 marks)
- d) State two common eye defects in humans and state how they are corrected. (04 marks)

Topic 8: Reproduction in plants and animals

23. Study the figure below showing different hormones affecting the human menstrual cycle with the target organs involved.



- (a) (i) Name hormones X and Y. (01mark)
(ii) Name organ Z. (01mark)
- (b) Describe the role of progesterone during the menstrual cycle and during pregnancy. (02marks)
- (c) Describe the role of hormone X in the menstrual cycle. (02marks)
- (d) Menstruation only occurs in case of no fertilization of the ovulated ovum in the fallopian tube. Describe the hormonal changes that occur in the female reproductive system in order to sustain the pregnancy. (03 marks)
- (e) Other than those in the diagram, state the role of any other two hormones secreted by the pituitary gland. (02marks)

AMITY S.S, NANSANA

24. (a) Describe how insect pollinated flowers are adapted to pollination. (05 marks)
(b) Describe the events that occur in a flower from pollination to fruit formation. (07 marks)
(c) Explain any three forms of asexual reproduction in plants. (03 marks)
25. (a) What is family planning? (01 mark)
(b) Describe the barrier methods of birth control. (05 marks)
(c) Discuss the changes in the female reproductive system from the time of fertilization to birth. (09 marks)

Topic 9: Genetics, cell division and Evolution

26. (a)(i) Define the terms mitosis and meiosis, stating where each of them occurs in plants and animals. (03 marks)
(ii) Discuss the stages of mitosis. (05 marks)
- (b) (i) Give the differences and similarities between mitosis and meiosis. (05 marks)
(ii) What is the relevance of meiosis in reproduction? (02 marks)

27. (a) In a breeding experiment, plants which were homozygous for white flowers were crossed with those homozygous for red flowers. The resultant F1 generation all had red flowers.

- (i) Explain the absence of white flowers in the F1 generation. (01 mark)
- (ii) Using genetic symbols, show the results in the F2 after selfing the F1 generation. (05 marks)
- (b) (i) What are mutations? (01 mark)
- (ii) Outline the causes of mutations. (03 marks)
- (c) (i) What role does mutation play in the process of evolution. (03 marks)
- (iii). Briefly explain how mutation is applied in agriculture. (02 marks)
28. (a) (i) What are homologous structures? (01 mark)
- (ii) In what ways do homologous structures provide evidence for evolution? (03 marks)
- (b) An albino person has no pigment in the skin and is often pale. This condition is caused by a recessive gene. If an albino man marries a phenotypically normal woman whose father was an albino and the mother was normal. (06 marks)
- (i) How likely is it that their first child will be an albino? Show your working. (04 marks)
- (ii) Which individuals in this family are carriers? (01 mark)

MITA COLLEGE KAWEMPE

29. Colour blindness is a recessive sex-linked trait. A colour-blind man married a carrier woman.

(a) Explain the meaning of:

- (i) Colour blindness. (02 marks)
- (ii) Recessive gene. (02 marks)
- (iii) Sex-linked gene. (02 marks)

(b) Use suitable symbols to work out the probability of producing a colour-blind daughter.

(06 marks)

(b) Give three practical applications of genetics.

(03 marks)

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Topic 10: Locomotion and support

30. (a) Describe the structure of the different types of skeletons in animals, giving an example to each. (09 marks)

b(i) With the help of a well labelled drawing, explain how the lumbar vertebra in mammals is adapted to its functions. (03 marks)

(ii) How does the human body deal with accumulated lactic acid in the body? (03 marks)

31. (a) Explain how bending and straightening of the arm occurs in humans. (04 marks)

(b) (i) State the adaptations of the vertebrae of the abdominal region in the human body, to their functions. (03 marks)

(ii) Compare cartilage and bone, in terms of their structure and function. (08 marks)

32. A bird is one of the animals adapted for flight.

(a) Explain how action of muscles bring about flight in birds. (05 marks)

(b) Outline adaptations of birds for locomotion in air. (07 marks)

(c). Explain why a skeleton is necessary in a mammalian body. (03 marks)

Topic 11: Growth and Development

33. (a) What is seed germination? (01 mark)

(b) With the aid of well labeled diagrams explain type of germination where epicotyl elongates faster than hypocotyl. (05 marks)

(c) Describe an experiment you would carry out to show that heat is liberated by germinating seeds. (06 marks)

(d) Explain the conditions necessary for germination to take place in seeds. (03 marks)

MATUGGA MIXED S.S

34. (a) Define the term metamorphosis. (01 mark)

(b) Briefly describe the life cycle of a housefly. (06 marks)

(c) State four roles played by larval stages in the life cycle of animals. (04 marks)

(d) What Changes occur from tadpole to adult stage of amphibians. (04 marks)

Topic 12: Ecology

35 (a). Define the following terms;

(i) Population size. (01 mark)

(ii) Community. (01 mark)

(c) List down four factors that limit population size of fish organisms in their natural habitat. (04 marks)

(c)(i) Describe how you would best estimate the population of fish in a water pond. (06 marks)

(ii) State three precautions taken when using the above method of population estimation.

(03 marks)

36 (a) What is pollution? (01 mark)

(b) Name **any four** water pollutants and how they affect aquatic life. (04 marks)

(c) Give **five** ways in which water pollution can be controlled. (05 marks)

(d) How can levels of pollution of a water body be determined? (05 marks)

37. The table below shows the relationship between two organisms; **A** and **B** in area. Study it and answer the questions that follow.

Time(days)	5	15	20	30	35	45	50
Number of organism A	25	50	40	70	30	50	20
Number of organism B	90	120	80	145	100	75	95

- (a) Draw a graph to represent the data above. (05 marks)
- (b) Which of the organism above is a;
 - (i) Prey? (01 mark)
 - (ii) Predator? (01 mark)
- (c) Explain your answer in (b) above. (02 marks)
- (d) State the number of each organism on the 25th day. (01 mark)
- (e) Explain the fluctuation shown by each organism. (03 marks)
- (f) State any other **two** external factors that can affect the population of the organisms in the ecosystem. (02 marks)

38. Study the feeding relationship below and answer questions that follow:

Grass → Sheep → Tiger → Bacteria

- (a) Giving a reason, state the type of feeding relationship represented in the figure above. (02 marks)
- (b) Identify organisms which are:
 - (i) Producers (01 mark)
 - (ii) Primary consumers (01 mark)
 - (ii) Decomposers (01 mark)
- (d) State what would happen in the above ecosystem if all sheep were killed. (02 marks)
- (e) (i) Construct a pyramid of energy for the above relationship. (02 marks)
- (ii) Account for the energy changes that along the trophic levels. (05 marks)
- (f) Why is energy flow in an ecosystem unidirectional? (01 mark)

JANAN SS BOMBO

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