P530/2

BIOLOGY

PAPER 2

2½ hours

Apr 2023

Uganda Advanced Certificate of Education

BIOLOGY DEPARTMENT – 2023

SET NINE

PAPER 2

THEORY

2 hours 30 minutes.

INSTRUCTIONS TO CANDIDATES:

- ✓ Answer question one in section **A** plus three others from section **B**.
- ✓ Candidates are advised to read the questions carefully, organize their answers and present them precisely and logically, illustrating with well labeled diagrams where ever necessary.
- ✓ Write on the answer sheet, your name, index number and the questions attempted in their order as shown in the table.

QUESTION	MARKS
TOTAL	

SECTION A: (40 Marks)

Compulsory.

1. The **arctic ground squirrel**, Spermophilus parryii of body mass 850g, has small ears, a cylindrical body and a shorter tail than other species of ground squirrel. The arctic ground squirrel can survive cold winters by hibernating for up to eight months per year. During hibernation, the **core body temperature,** T_b of an arctic ground squirrel can fall from 37°C to -3°C

   The Table 1 below shows the effect of **ambient temperature,** T_a on the **metabolic rate**, oxygen uptake, **core body temperature, Tb** and **respiratory quotient, R.Q** in the arctic ground squirrel.

   Table 1:

Ambient temperature, T_a / °C	Metabolic rate/ cm^3 oxygen g^{-1} $hour^{-1}$	Core body temperature, T_b / °C	Respiratory quotient, RQ.
-16	0.18	0	0.83
-12	0.14	0	0.81
-8	0.08	0	0.79
-4	0.04	0	0.77
0	0.03	1	0.74
4	0.02	5	0.70
8	0.02	8	0.70
12	0.02	12	0.80
16	0.03	17	0.85
20	0.04	21	0.87

a) What is meant by ambient temperature? **(02marks)**

b) Calculate the

   (i) Volume of oxygen consumed and carbon dioxide evolved in one hour at ambient temperature of -12°C. **(03marks)**

   (ii) Change metabolic rate for an artic ground squirrel as ambient temperature increases from -16°C to 4°C. Give your answer in dm^3 oxygen day^{-1}. **(03marks)**

c) Represent the effect of ambient temperature on metabolic rate, core body temperature and RQ on the same axes. **(10marks)**

d) Describe the effect of ambient temperature on the core body temperature. **(05marks)**

e) Explain the relationship between ambient temperature and core body temperature. **(09marks)**

f) Why does arctic ground squirrel hibernate during the winters? **(04marks)**

g) Based on results for RQ, explain the respiratory substrates being utilized during the hibernation process. **(04marks)**

SECTION B: (60 Marks)

Attempt only 3 questions from this section.

2. (a) Describe the process involving absorption of carbohydrate products of digestion in the human gut. **(08marks)**

   (b) Relate the above process to the maintenance of osmotic properties of cells within the human gut. . **(08marks)**

   (c) How does influx of potassium cyanide alter the rate of absorption of products in (a) above? **(06marks)**

3. (a) Distinguish starch from cellulose. **(06marks)**

   (b) Explain why lipids;

   (i) Are better energy storage compounds in animals than carbohydrates? **(06marks)**

   (ii) Have a higher calorific value than carbohydrates? **(06marks)**

4. (a) Describe the structure of a plant cell wall. **(12marks)**

   (b) Compare the structure of the plant cell wall and that of the plasma membrane. **(08marks)**

5. (a) Distinguish between the following as applied to evolution.

   (i) Convergent evolution and divergent evolution. **(05marks)**

   (ii) Analogous structures and homologous structures **(05marks)**

   (b) Account for the different pre-zygotic mechanisms that isolate organisms of different organism. **(10marks)**

6. (a) With suitable examples in each case, describe the photoperiodic categories of flowering plants. **(14marks)**

   (b) Outline the differences in the effects of red light and far-red light plants. **(06marks)**

END