Grade 12 Biology Model Paper 3

MODEL PAPER

Full marks 75 · 3 hours

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 75

Answer every question; where a question has an OR question, answer either one. Time: 3 hours.

A practice paper by Science Playground, made to CDC's Specification Grid 2078, Grade 12 Biology (Bio. 202); not an official CDC or NEB paper. Mark it yourself online: the QR code below opens the paper with its answers.

A full practice run of the NEB Grade 12 Biology paper (Bio. 202): 75 marks in 3 hours, in two parts, Botany (37 marks) and Zoology (38 marks). Each part has three groups: group A is one question of multiple-choice items (5 in Botany, 6 in Zoology), and groups B and C have short-answer questions of 4 marks and long-answer questions of 8 marks, of two to four parts each, with each part's marks shown. Allow about 25 minutes for all the multiple-choice items and 155 minutes for the rest. CDC's paper numbers the questions of each part from 1; here they run straight through, Questions 1–7 in Botany and 8–14 in Zoology, so that every question has its own number. Questions 4 and 11 in group B and Questions 6 and 14 in group C each have an OR question: answer either the question or its OR question, every part from the same one, and mark only the one you answered. Write on paper first, then tap your choice in group A and open each other part's answer to give yourself the marks its scheme allows.

Botany, Group A Multiple choice (Botany) 5 marks

Question 1 5 × 1 = 5

Choose the correct option for each of the following questions.

a. A lawn of dubo grass is mown every week, yet the grass keeps growing back taller from the cut stems. Which tissue makes this possible?

(i) the apical meristem at the tip of each shoot
(ii) the intercalary meristem at the bases of the internodes and leaves
(iii) the cork cambium under the epidermis
(iv) the sclerenchyma of the vascular bundles

b. Which plant hormone is called the stress hormone, because it closes the stomata when a plant is short of water?

(i) auxin (ii) gibberellin (iii) cytokinin (iv) abscisic acid

c. In alcoholic fermentation, yeast turns each glucose into two molecules of ethanol and two of carbon dioxide. How many molecules of carbon dioxide are given off when the yeast in a batch of dough ferments 15 molecules of glucose?

(i) 15 (ii) 30 (iii) 45 (iv) 90

d. A short-day plant is kept on short days with long nights, but in the middle of each night a light is switched on for a few minutes. It does not flower. What does this show?

(i) The plant needs more hours of light in the day.
(ii) What the plant measures is an unbroken dark period, and a flash of light breaks it.
(iii) Short-day plants never flower in a greenhouse.
(iv) Light at night makes the plant photosynthesize too much.

e. Through which opening does the pollen tube usually enter the ovule?

(i) the chalaza (ii) the micropyle (iii) the hilum (iv) the funicle

Botany, Group B Short answers (Botany), each on one content area — 16 marks

Question 2 — 4 marks

Under the microscope, Swastika compares vertical sections of two leaves. Leaf P: a row of tall, closely packed cells under the upper epidermis and loosely packed, rounded cells with large air spaces above the lower epidermis; most stomata in the lower epidermis. Leaf Q: the mesophyll all of one kind; stomata in both epidermises; groups of very large, thin-walled cells in grooves of the upper epidermis.

a. What are bulliform cells? **[1]**

b. Why does leaf P have most of its stomata on the lower surface? **[1]**

c. Identify each leaf as a dicot or a monocot leaf, giving one reason each. **[2]**

Question 3 — 4 marks

A seed company in Banke produces hybrid maize seed. In its field, rows of the female parent alternate with rows of the male parent, and workers pull the tassels (the male flowers) off every plant of the female rows before they shed pollen.

a. Define pollination, and name any two devices in flowers that favor cross-pollination. **[2]**

b. Why are the tassels removed from the female rows only, and what would happen to the seed if the workers missed some plants? **[2]**

Question 4 — 4 marks

In the gene for the β chain of hemoglobin, the sixth codon of the coding strand is GAG, which means glutamic acid. In the sickle-cell allele it is GTG, which means valine. A survey in Dang found that 9.3% of the Tharu people screened carried sickle hemoglobin.

a. How can a change of one base in DNA change a whole protein's working? **[1]**

b. Name the kind of mutation in the sickle-cell allele. If instead one base were deleted from the first codon of the gene, how would the effect on the protein differ? **[2]**

c. The sickle-cell allele harms people with two copies, yet it is common among the Tharu of the western Terai. Suggest why. **[1]**

OR

A part of the template strand of a gene reads, from left to right: TAC GGA TTC.

a. What is meant by saying that the genetic code is degenerate? **[1]**

b. Write the mRNA made from this part of the gene, and the anticodon of the tRNA that reads its first codon. **[2]**

c. Why must the genetic code use three bases for each amino acid, and not two? **[1]**

Question 5 — 4 marks

Ankit grows cabbage and rice in Kavrepalanchok. He sprays a chemical insecticide on his cabbage every week against caterpillars, and adds urea to his rice field.

a. What is a biofertilizer? **[1]**

b. Suggest a biofertilizer Ankit could use in his flooded rice field in place of some of the urea, and say how it helps. **[1]**

c. Ankit's neighbor advises him to use a spray of *Bacillus thuringiensis* (Bt) on the cabbage instead of the chemical insecticide. Give two reasons why this is the better choice. **[2]**

Botany, Group C Long answers (Botany), each on one content area — 16 marks

Question 6 — 8 marks

Rabina covers four similar leaves of a potted plant: leaf A with petroleum jelly on both surfaces, leaf B on the upper surface only, leaf C on the lower surface only, and leaf D not at all. She weighs the whole plant and its pot at the start and the next day, and compares the leaves' condition.

a. Define transpiration. **[1]**

b. Explain how a stoma of a dicot leaf opens and closes. **[3]**

c. The next day, leaves A and C lost almost no water, while leaves B and D lost a lot. What does this show about the stomata of this plant's leaves? **[2]**

d. Rabina says a plant would be better off without stomata, since it loses so much water through them. Do you agree? Explain both sides. **[2]**

OR

Wheat of a winter variety is usually sown in the autumn in Mustang, lives under the cold through the winter and flowers in the spring.

a. Define vernalization. **[1]**

b. Explain epigeal and hypogeal germination with an example of each, and say what vivipary is. **[3]**

c. Name the kind of movement in each case: (i) the leaflets of *Mimosa pudica* (lajjawati) fold when touched; (ii) the tendril of a pea plant coils round a support it touches. **[2]**

d. A farmer in Mustang lost his autumn sowing and sowed the same winter wheat in the spring. It grew leaves all summer but flowered late or not at all. Explain why, and suggest how he could have had it flower in the same year. **[2]**

Question 7 — 8 marks

In maize, a plant with colored, full seeds (both alleles dominant, from one parent) is test crossed with a plant with colorless, shrunken seeds (both recessive). Among 1,000 seeds of the cross are 480 colored full, 470 colorless shrunken, 26 colored shrunken and 24 colorless full.

a. Explain how crossing over takes place, and why it matters. **[2]**

b. Which seeds are parental and which recombinant? Calculate the recombination frequency and the distance between the two genes. **[3]**

c. In another plant, the recombination frequencies between three linked genes are: A and B 12%, B and C 4%, A and C 16%. Work out the order of the genes on the chromosome, and explain why the frequencies tell us this. **[3]**

Zoology, Group A Multiple choice (Zoology) — 6 marks

Question 8 — 6 × 1 = 6

Choose the correct option for each of the following questions.

a. Which of these diseases of poultry is caused by a virus?

(i) Ranikhet (Newcastle) disease
(ii) fowl cholera
(iii) coccidiosis
(iv) aspergillosis

b. Why is blood counted as a connective tissue?

(i) It connects the heart to every organ.

(ii) Like other connective tissues it has cells scattered in a matrix, here the fluid plasma, and it develops from mesoderm.

(iii) Its cells are joined by tight junctions.

(iv) It contains collagen fibers.

c. Which hormone, released from the posterior pituitary, makes the uterus contract in childbirth and milk flow from the breasts?

(i) prolactin

(ii) oxytocin

(iii) ADH (vasopressin)

(iv) FSH

d. A dog suddenly runs at Sushant. His heart pounds, his pupils widen and his breathing quickens. Which nerves bring this about?

(i) the sympathetic nerves

(ii) the parasympathetic nerves

(iii) the cranial nerves to the eye muscles

(iv) the sensory nerves of the skin

e. A man has had a vasectomy, in which each vas deferens is cut and tied. Which is true afterwards?

(i) His testes stop making sperms and testosterone.

(ii) He still ejaculates semen, but it contains no sperms.

(iii) He can no longer ejaculate.

(iv) His sperms can still reach the urethra through the seminal vesicles.

f. After her gall bladder was removed, Pratiksha finds that heavy, fatty meals upset her, though she digests rice and dal well. Which is the best explanation?

(i) She no longer makes bile, so she can't digest proteins.

(ii) Bile is no longer stored and released in large amounts after a meal, so big amounts of fat are not well emulsified for lipase.

(iii) The gall bladder made the lipase that digests fat.

(iv) Without the gall bladder the liver stops working.

Zoology, Group B Short answers (Zoology), each on one content area — 16 marks

Question 9 — 4 marks

Tenzing looks at a stained smear of nerve tissue from a spinal cord. He sees large cells, each with many branched short processes and one long process, and many smaller cells among them that don't carry impulses.

a. What are the gaps in the myelin sheath of an axon called? **[1]**

b. What are the smaller cells he sees? Explain any two of their functions. **[2]**

c. Classify the large cells by the number of their processes. **[1]**

Question 10 — 4 marks

In a frog's blastula, the cells are already destined for particular fates: a fate map shows which part of the tadpole each patch of the blastula will become. Then, in gastrulation, the cells move to their places.

a. Why is gastrulation an important stage of development? **[1]**

b. From which germ layer does each of these develop: the brain and spinal cord; the lining of the gut; the notochord and the muscles? **[2]**

c. In 1924, Hilde Mangold grafted the dorsal lip of the blastopore from one newt gastrula into the ventral side of another, and the host grew a second body axis. What does this show about the dorsal lip? **[1]**

Question 11 — 4 marks

As her plane comes down into Tribhuvan airport, Sneha's ears feel blocked and dull; when she swallows they "pop" and she hears clearly again. Afterwards, at a fair, she spins on a ride and feels the world still turning after she gets off.

a. Name the three ear ossicles in order from the eardrum. **[1]**

b. Explain why Sneha's ears felt blocked during the descent, and why swallowing cleared them. **[2]**

c. Why does Sneha feel she is still turning after the ride stops? **[1]**

OR

A blood bank in Biratnagar tests the blood of two donors by mixing drops with anti-A and anti-B sera. Donor X's blood clumps with anti-B only; donor Y's clumps with neither.

a. Which blood group is called the universal donor? **[1]**

b. Find the blood group of each donor, and give a reason. **[2]**

c. An Rh-negative mother's first Rh-positive baby is healthy, but her second Rh-positive baby is born seriously ill. Why is the first baby safe? **[1]**

Question 12 — 4 marks

In 1798 Thomas Malthus wrote that people, unchecked, double every 25 years, while food rises only by a fixed step in the same time. Nepal's population grew by about 2.66% a year from 1971 to 1981 and about 0.96% a year from 2011 to 2021.

a. Explain Malthus's idea of how population and food grow. **[1]**

b. Using the rule that the doubling time is about 70 divided by the yearly growth rate in percent, find how long Nepal's population would take to double at each rate. **[1]**

c. Has Malthus's prediction come true? Argue your answer, using the demographic transition. **[2]**

Zoology, Group C — Long answers (Zoology), each on one content area — 16 marks

Question 13 — 8 marks

A town in Bhaktapur district plans a sewage treatment plant, because its sewage now runs straight into a stream. A test shows that the raw sewage has a biochemical oxygen demand (BOD) of 300 mg per liter.

a. What is meant by the biochemical oxygen demand (BOD) of water? **[1]**

b. Explain how the activated sludge process cleans sewage in secondary treatment. **[3]**

c. In the planned plant, primary treatment would remove 30% of the BOD, and secondary treatment 90% of the BOD left after it. What would the BOD of the water be after each step? **[2]**

d. Explain why, while the raw sewage still runs into the stream, its fish die and its water turns black and smelly, worst in the dry season. **[2]**

Question 14 — 8 marks

Two patients at a hospital in Butwal both pass very large volumes of urine and are always thirsty. Patient X's urine contains glucose; patient Y's is very dilute and has none. Tests show that Y's pituitary gland was damaged in an accident.

a. Explain how the anterior lobe of the pituitary controls other endocrine glands, and how the hypothalamus in turn controls the anterior lobe. **[2]**

b. Identify the disorder of each patient. **[2]**

c. Explain why each patient passes so much urine, though the two causes are quite different. **[4]**

OR

Organophosphate pesticides, sprayed on vegetables, are a common cause of poisoning in Nepal. They block the enzyme acetylcholinesterase at synapses. A nerve cell's membrane at rest has a potential of about −70 mV.

a. Explain why the inside of a resting nerve fiber is negative compared with the outside. **[2]**

b. The absolute refractory period of a nerve fiber is about 2 ms. What is the greatest number of impulses it could carry in a second? A stronger stimulus does not make an impulse bigger: what does it change instead? **[2]**

c. Explain what happens at a synapse and at the muscles when acetylcholinesterase is blocked, and why a person poisoned by an organophosphate may die. **[4]**