Enrolment No. _____

AHMEDABAD UNIVERSITY

SCHOOL OF ARTS AND SCIENCES

UNDERGRADUATE / GRADUATE PROGRAMMES

2025-2026 MONSOON SEMESTER

END SEMESTER EXAMINATION

BIO600 EVOLUTIONARY BIOLOGY

Date: 03-12-2025 Total Marks: 30

Time: 02.00 pm – 04.00 pm No. of printed pages: 9

General Instructions:

1. Students must carry their identity card during the examination.
2. No break is allowed during the examination under any circumstances. In case of an emergency, with prior permission of the invigilator and an escort, a break of maximum five minutes is allowed.
3. No unauthorized devices, such as mobile phones, any kind of watches, other gadgets, or any kind of material is allowed on person.
4. Any violation of examination rules and an intent of malpractice will lead to strict disciplinary action, including a possible expulsion from the university.

Course Specific Instructions:

1. Please use the space given under each question for your responses.
2. Anything written outside the given space will not be examined.

Please give page numbers in the footer, aligned with right hand side margin.
Please do not change the fonts and spacing of the header.
Student Name:_____

Q1-5; each question carries one mark

Q1. The phrase "correlation does not imply causation" said by Karl Pearson means we should not a cause-and-effect relationship between two variables just because they are correlated. Give a theoretical or real example where two variables may be correlated, but one is not the cause of the other.

Q2. Explain how phylogenetics has supported evidence from the fossil record for evolution.

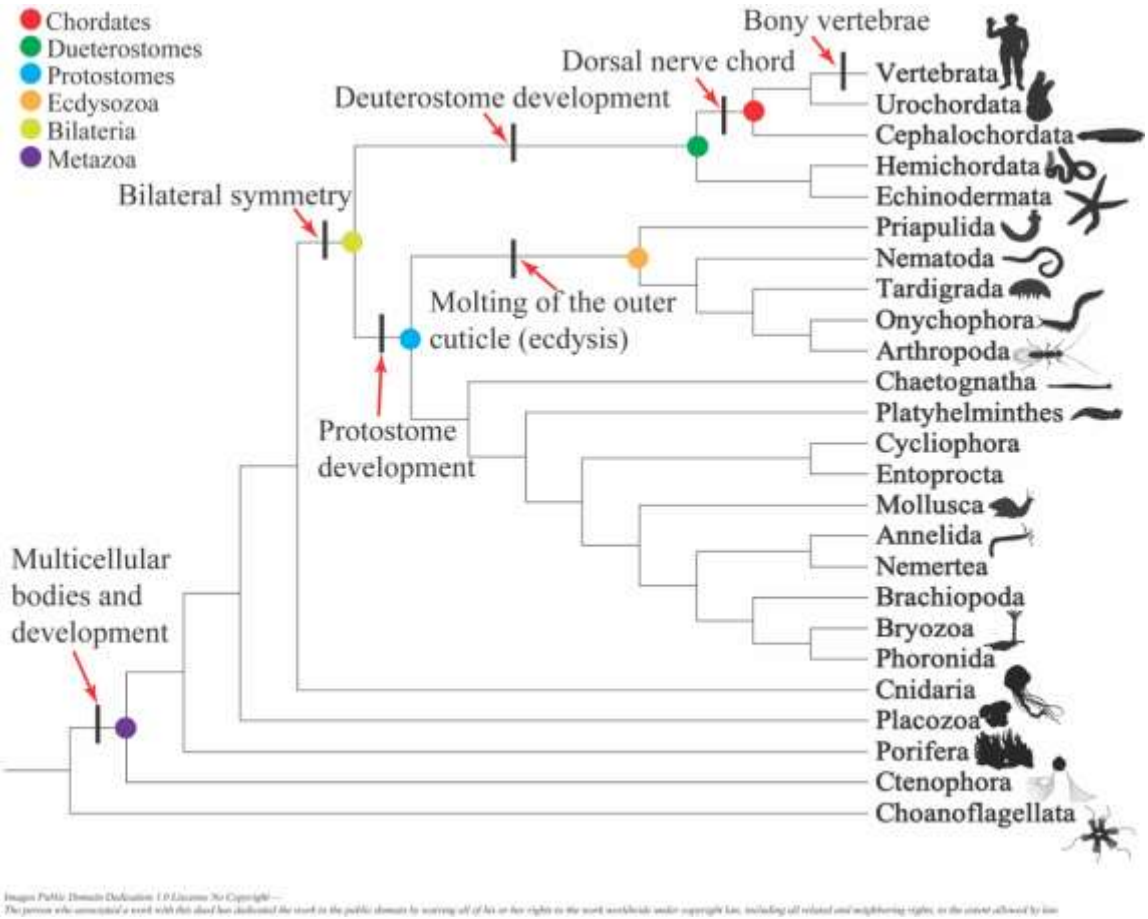
Q3. How many times did modern humans leave Africa?

Q4. Why is evolution unpredictable?

Q5. List the major evolutionary events in the history of life on earth.

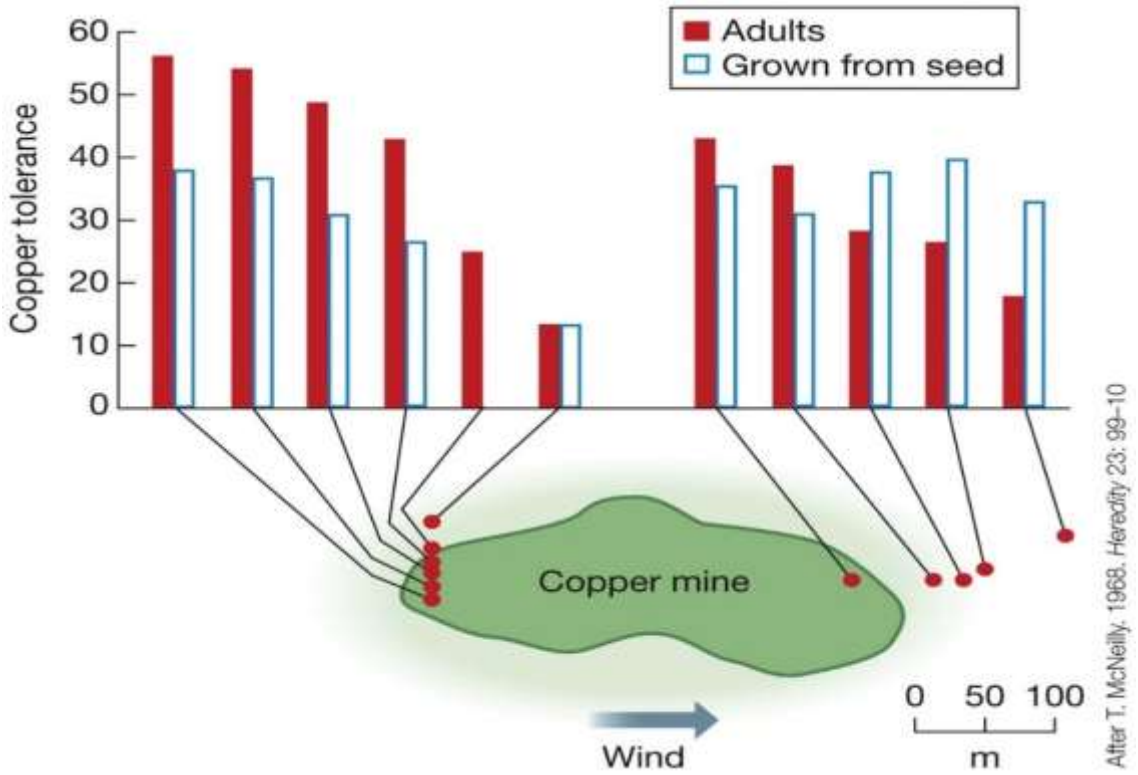
Q6-10; each question carries two marks

Q6. Refer to the figure.



Above is a phylogeny showing the evolutionary relationships of the living animal phyla. You believe you have discovered a new animal species that may belong among the chordates. What character state would you look for that would be most useful in placing this new taxon among the chordates?

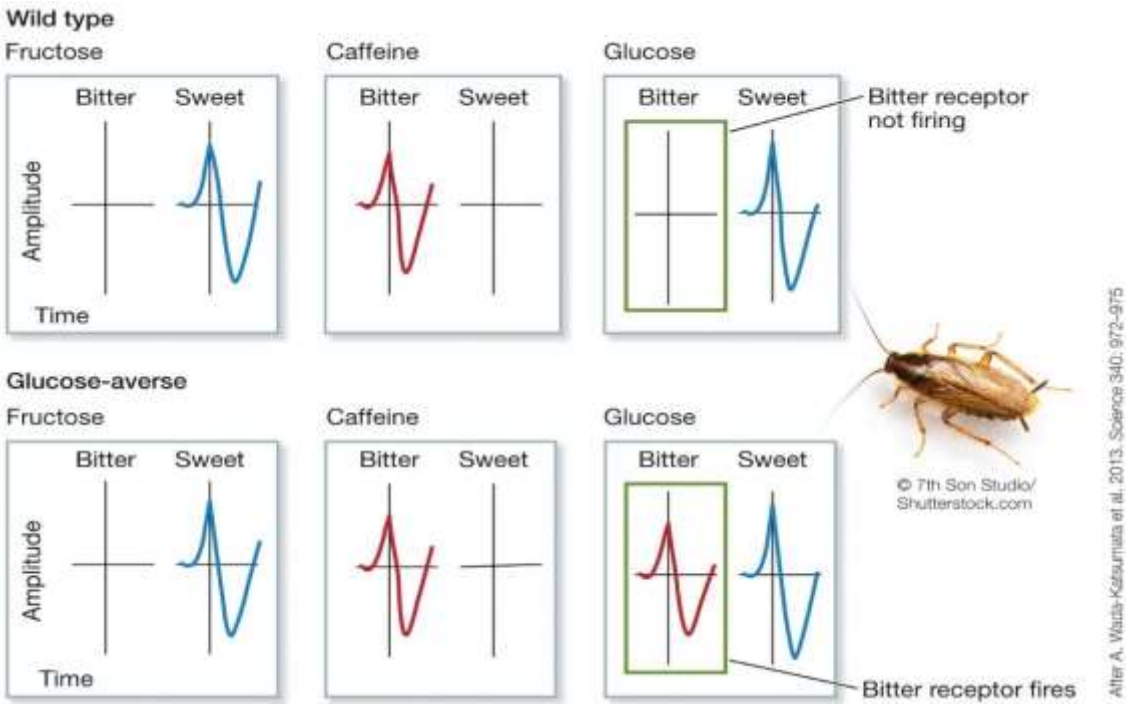
Q7. Refer to the figure.



In the figure above what affect was wind having on gene flow?

Q8. Describe when selection will be a much stronger force than drift, and vice versa.

Q9. Refer to the figure.



As shown in the figure above German cockroaches have evolved an aversion to glucose after exposure to poisoned glucose baits. This demonstrates _____.

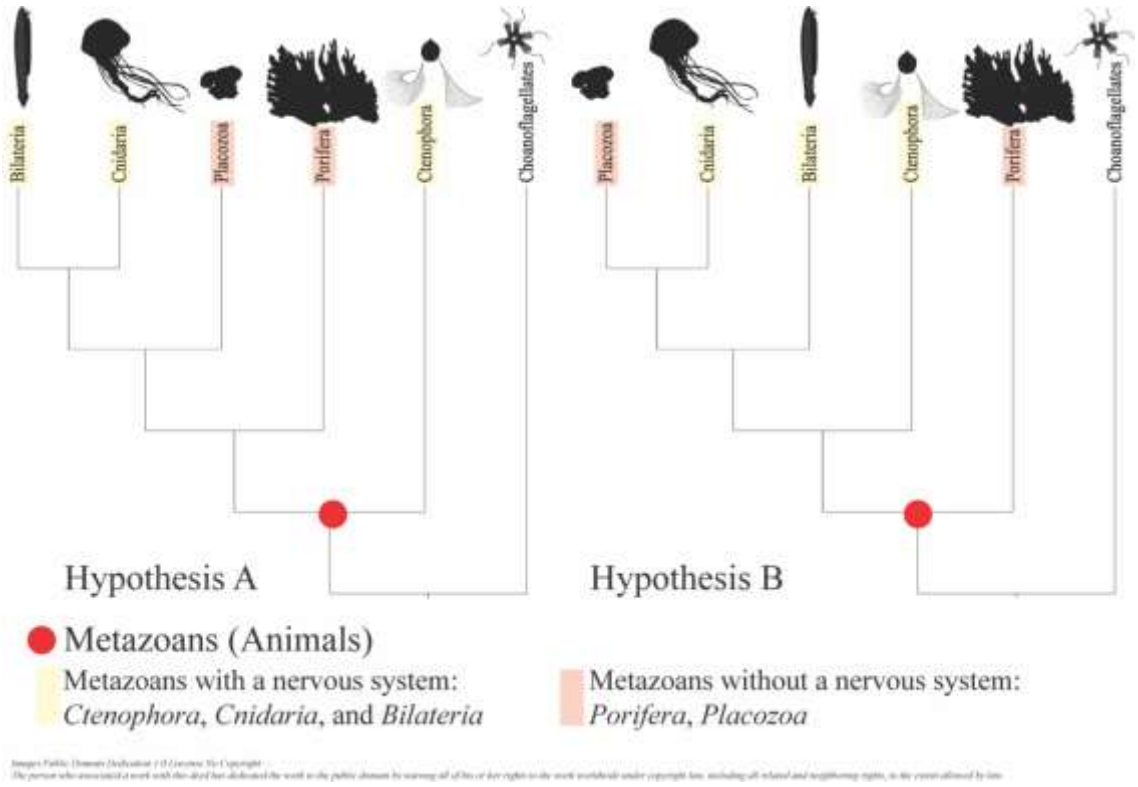
Q10. Over evolutionary time, many cave-dwelling organisms have lost their eyes. Tapeworms have lost their digestive systems. Whales have lost their hind limbs. How can natural selection account for these losses?

Q11-13; each question carries 3 marks

Q11. The distinction between r- and K-selected species represents a continuum, yet it is also well known for its failure to capture the rich diversity of life history strategies, most notably the life history of plants. Oak species (*Quercus* sp.) themselves have a rich diversity of life history strategies, but consider a generic oak tree. It lives to be a few hundred years, starts producing acorns around 40-60 years of age, produces thousands of acorns each season, millions over its lifetime, and reaches peak production around 100-120 years old. Yet of the acorns produced, perhaps one out of several thousand ever survive to adulthood. Summarize the r- and K-strategy distinction and describe how this oak tree fails to fit neatly into the r- and K-continuum.

Q12. What is the distinction between prezygotic and postzygotic isolation? Why is it important?

Q13. Refer to the figure.



The metazoans are multicellular eukaryotes we typically refer to as animals. A key evolutionary innovation that arose within the animals is the nervous system, however, both the porifera (sponges) and the placozoans lack a nervous system. Challenges related to understanding the early branches on the animal family tree have complicated our understanding of the evolution of this unique adaptation. For example, the position of the ctenophores (comb

jellies) has long been a puzzle for evolutionary biologists. Below are two phylogenetic hypotheses showing relationships among the major animal groups and a close eukaryotic relative to the animals, choanoflagellates (which lack a nervous system). Map the evolution of the nervous system on each tree based on the information you are provided. Which tree is most parsimonious with respect to this trait and implications would each tree, if true, have for the evolution of the nervous system.

Q14-25; each question carries 0.5 mark

Q14. **Which of the following could be a suitable example of 'gene–culture coevolution'?**
A. Human language diversity
B. Reading ability
C. Adult lactase persistence in dairying populations
D. Clothing styles in ancient societies

Q15. Which of the following statement could precisely explain spread of the maladaptive cultural behaviour?
A. Humans always imitate high-status individuals
B. Individuals copy others when uncertain, even if doing so is not adaptive
C. Genetic evolution always overrides cultural evolution
D. Cultural traits spread only through conformity bias

Q16. Which traits possibly would have been under higher selection pressure in woolly mammoth genomes?
A. High-altitude respiration
B. Hair, skin, fat metabolism, and immune function
C. Aquatic locomotion
D. Desert heat tolerance

Q17. If you were asked to study woolly mammoth genome which other species genome would you possibly like to use for a comparative genomics angle?
A. Rhinos
B. Horses
C. African and Asian elephants
D. Camels

Q18. Which of the following genes was found associated with beak shape variation in Darwin's finches?
a) BMP4
b) FOXC1
c) CALM
d) ALX1

Q19. By which evolutionary process Darwin's finches could be explained best?
a) Genome duplication
b) **Interspecies gene flow (introgressive hybridization)**
c) Lateral gene transfer
d) Polyploidy

Q20. Which chromosome shows the highest rate of rearrangement in Anopheles mosquitoes?
A. Chromosome 2L
B. Chromosome 3R
C. Chromosome X
D. Mitochondrial chromosome

Q21. Which life stage of a mosquito is aquatic?
A. Adult
B. Pupa
C. Egg
D. Both larva and pupa

Q22. Museum specimens revealed that UK great tits, compared to mainland Europe birds, had:
A. Shorter bills
B. Similar bill lengths
C. Longer bills
D. No consistent difference

Q23. Which classic example demonstrates rapid beak evolution in response to environmental change?
A. Penguins in Antarctica
B. Flamingos in lakes
C. Darwin's finches in the Galápagos
D. Parrots in Australia

Q24. A **classic hard sweep** typically arises from:
A. Selection on multiple pre-existing common alleles
B. Selection on introgressed haplotypes

C. Selection on a single novel beneficial mutation
D. Genetic drift in small populations

Q25. Which of the following best describes a human tongue?
A. A rigid cartilaginous rod
B. A muscular hydrostat that maintains volume during shape change
C. A bone-supported muscular lever
D. A keratinized conveyor belt

‘END’