



**Test Papers
Hub.**

HSC Biology Practice Paper 1

Year 12 · Modules 5–8 — Practice Examination

**Reading time 5 minutes · Working time 3 hours · Section I: 20 multiple-choice ·
Section II: 80 marks · 100 marks in all**

How to use this booklet

- Reading time – 5 minutes. Working time – 3 hours. Write using black pen. Draw diagrams using pencil.
- NESA-approved calculators may be used. A data sheet (genetic code and useful relationships) is provided at the back of the question paper.
- Section I: 20 multiple-choice questions (1 mark each). Section II: 19 written-response questions (80 marks).
- Worked solutions follow the paper: every question has step-by-step working, a key takeaway and (for multiple choice) a note on why each wrong option is wrong.

SECTION I

20 marks · Attempt Questions 1 – 20 · Allow about 35 minutes

Select the alternative A, B, C or D that best answers the question. Each question is worth 1 mark.

1. Part of the template (antisense) strand of a gene reads 3'–TACCTGCCACGTTGAATC–5'. Use the genetic code on the data sheet. Write the sequence of the mRNA transcribed from this strand.

- A 5'–GAUUCAACGUGGCAGGUA–3'
- B 5'–ATGGACGGTGCAACTTAG–3'
- C 5'–UACCUGCCACGUUGAAUC–3'
- D 5'–AUGGACGGUGCAACUUAG–3'

2. A student tests the hypothesis that a cross follows a 9 : 3 : 3 : 1 ratio. Of 464 offspring, the observed numbers are: round, yellow 261, round, green 75, wrinkled, yellow 96, wrinkled, green 32. (Critical value of χ^2 at $p = 0.05$: 7.81 for 3 degrees of freedom.) Calculate $\chi^2 = \Sigma (O - E)^2 \div E$.

- A 3.04
- B 0.345
- C 2.90
- D 234

3. The ABO blood group is controlled by three alleles: I^A and I^B are codominant and both are dominant to i . A mother with blood group A (heterozygous, $I^A i$) and a father with blood group B (heterozygous, $I^B i$) have a child. What is the probability that the child has blood group AB?

- A $\frac{3}{4}$
- B 0
- C $\frac{1}{2}$
- D $\frac{1}{4}$

4. A student observes a cell in which chromosomes are lined up along the equator, each consisting of two chromatids. The cell is in:

- A prophase
- B anaphase of mitosis
- C metaphase of mitosis (or metaphase II of meiosis)
- D telophase

5. In a family one parent is heterozygous for an autosomal dominant allele and the other is homozygous recessive. They plan to have 3 children. What is the probability that exactly 1 of the 3 children will be affected?

- A 0.125
- B 0.375
- C 0.500
- D 1.50

6. A mutation replaces the base at position 4 (C) with T in the coding sequence 5'-ATGCGGGTCTTGAGGGAACGCTGA-3'. The original polypeptide has 7 amino acids. Use the genetic code on the data sheet. Which term best describes this mutation and its effect?

- A A missense mutation: one amino acid is changed
- B A silent mutation: the polypeptide is unchanged
- C A frameshift mutation: the reading frame changes from the deletion onwards
- D A nonsense mutation: a premature stop codon shortens the polypeptide

7. A DNA ladder run on an agarose gel has fragments of 600, 1800, 5400 base pairs (bp). Each fragment in the ladder is 3 times longer than the previous one. The DNA ladder band of 600 bp travelled 18 mm. State which band in the ladder travelled the furthest, and explain.

- A The middle ladder band, because it is the optimum size to pass between the gel pores
- B The 5400 bp band, because larger fragments carry more charge
- C They all travel the same distance because all DNA has the same charge to mass ratio
- D The 600 bp band, because the smallest fragment moves most easily through the gel

8. In allopatric speciation, the first step is usually:

- A geographic isolation of populations, so that gene flow stops
- B polyploidy in a single generation
- C reproductive isolation by differences in courtship
- D hybridisation between the populations

WORKED SOLUTIONS

Answers & worked solutions

Multiple-choice answer key

1	D	2	C	3	D	4	C	5	B	6	A
7	D	8	A	9	A	10	B	11	B	12	C
13	B	14	C	15	C	16	D	17	B	18	A
19	D	20	A								

SECTION I

1. Part of the template (antisense) strand of a gene reads 3'–TACCTGCCACGTTGAATC–5'. Use the genetic code on the data sheet. Write the sequence of the mRNA transcribed from this strand. [DNA and protein synthesis]

Correct answer: D — 5'–AUGGACGGUGCAACUUAG–3'

- RNA polymerase reads the template strand and builds mRNA by complementary base pairing (A–U, T–A, G–C, C–G).
- Template 3'–TACCTGCCACGTTGAATC–5' gives mRNA 5'–AUGGACGGUGCAACUUAG–3'.
- Why the other options are wrong:
- A (5'–GAUUCAACGUGGCAGGUA–3'): reversed the mRNA; it must be written 5' to 3', antiparallel to the template
- B (5'–ATGGACGGTGCAACTTAG–3'): wrote the sense strand with T; RNA contains U, not T
- C (5'–UACCUGCCACGUUGAAUC–3'): copied the template instead of pairing with it

LOS: DNA and protein synthesis

KEY TAKEAWAY

Transcription: template → mRNA (complementary, U replaces T). Translation: read the mRNA in codons from AUG until a stop codon.

2. A student tests the hypothesis that a cross follows a 9 : 3 : 3 : 1 ratio. Of 464 offspring, the observed numbers are: round, yellow 261, round, green 75, wrinkled, yellow 96, wrinkled, green 32. (Critical value of χ^2 at $p = 0.05$: 7.81 for 3 degrees of freedom.) Calculate $\chi^2 = \Sigma (O - E)^2 \div E$. [Inheritance patterns]

Correct answer: C — 2.90

- Expected numbers for 9 : 3 : 3 : 1 from 464 offspring: 261, 87, 87, 29.
- $\chi^2 = (261 - 261)^2 \div 261 + (75 - 87)^2 \div 87 + (96 - 87)^2 \div 87 + (32 - 29)^2 \div 29$
- $\chi^2 = 2.90$
- Why the other options are wrong:
- A (3.04): divided by the observed instead of the expected numbers
- B (0.345): used $|O - E| \div E$ and forgot to square