ECU
EDITH COWAN UNIVERSITY

2025 Biology ATAR Revision Session

Presented by Alison Siciliano

Creative thinkers made here.

Unit 3

The golden opportunity you are seeking is in yourself.

It is not in your environment; it is not in luck or chance, or the help of others; *it is in yourself alone*.

Orison Swett Marden

Feedback from the SCSA Examiners Board 2016-2024

- ***Read questions carefully*!** Often students lose marks by not answering the question fully or by misinterpreting the question. (see SCSA Glossary of Key Words in the formulation of questions. Appendix 1)
  - Know the question verbs. for example, '*compare*', you should systematically compare the similarities and differences.
- Use *formal* and *precise* language.
- Use *science* terminology. Using the correct science words demonstrates your understanding.
- *Be clear* in your answers- **just state the answer**, especially in the short answer section where time and space is at a premium.
- Do not *repeat or rephrase* the question.
- *Annotate diagrams* (label them), lines need to point directly to structure being labelled and refer to them in your written answer, this demonstrates your understanding.
- Spend time *planning your answers* to extended response questions.
  - Dot points, sub-headings are acceptable
- Write *legibly*.

Feedback from the SCSA Examiners Board 2016-2024

In 2019 questions changed to become more open-ended or required the application of knowledge (not just factual recall). You need to be prepared to apply your knowledge to a range of contexts. Therefore:

- You need to **develop** an **in-depth understanding** of important concepts.
- Concepts such as:
  - Scientific method: validity and reliability.
  - Replication of genetic material (eg meiosis).
  - Protein synthesis.
  - Variation.
  - DNA technology- in particular recombinant DNA, DNA identification.
  - Natural selection.
  - Conservation planning- use of population dynamics and biogeography
  - Homeostasis- maintaining *internal* environment.

Science Inquiry Skills

- Writing a hypothesis: **The independent variable changed the dependent variable by...**
  - A hypothesis states a relationship between variables.
  - A prediction is what you expect to happen if your hypothesis is supported.

- An ***independent variable*** is the factor chosen and manipulated by the experimenter.

- A ***dependent variable*** is the factor responding to the independent variable. (It is dependent upon the independent variable) The experimenter collects results about this variable.

- A ***Controlled variable*** is the factor which is the same for all the subjects being tested. It stays the same for the whole experiment.

TIME is the dependent variable

VOLUME is the independent variable

Table 1: Volume of a marble and speed.

Marble volume (cm^3)	Time taken to roll 2 metres (secs)				Speed (ms^{-1})
	trial 1	trial 2	trial 3	average	
20	*30*	*32*	*31*	*31*	*0.06*
40	*23*	*20*	*24*	*22.3*	*0.08*

SPEED is included because this is the value used for comparison of data.

Notice **UNITS OF MEASUREMENT** are found in the titles **NOT** next to the data.

Why you can't use "to make it a fair test" as an answer!

This is not a valid answer because it **doesn't show any understanding of the concept** of a fair test.

- A **FAIR TEST** is one that has **VALIDITY** and **RELIABILITY**.
- An investigation is **VALID** if it tests what it is supposed to test.
  - Validity is increased when variables are controlled. Any variable that is not the independent or dependent should be controlled.
- **RELIABILITY** means that if the same experiment is repeated many times the same results will be collected.
  - Reliability can be increased by repeating the experiment many times or increasing the sample size.

Graphing

- Bar or Line?
  - 8 line graphs (6 of these had 2 sets of data to plot)
  - 1 bar graph
- Join the data points or line of best fit?
  - Always a ruled line joining the data points.

See summary booklet for more information.

Science Inquiry Question 1. WACE 2023

Biologists measured the duration of meiosis (in minutes) at different environmental temperatures in *two plant species*. The results are given in the table below.

No table available due to copyright.

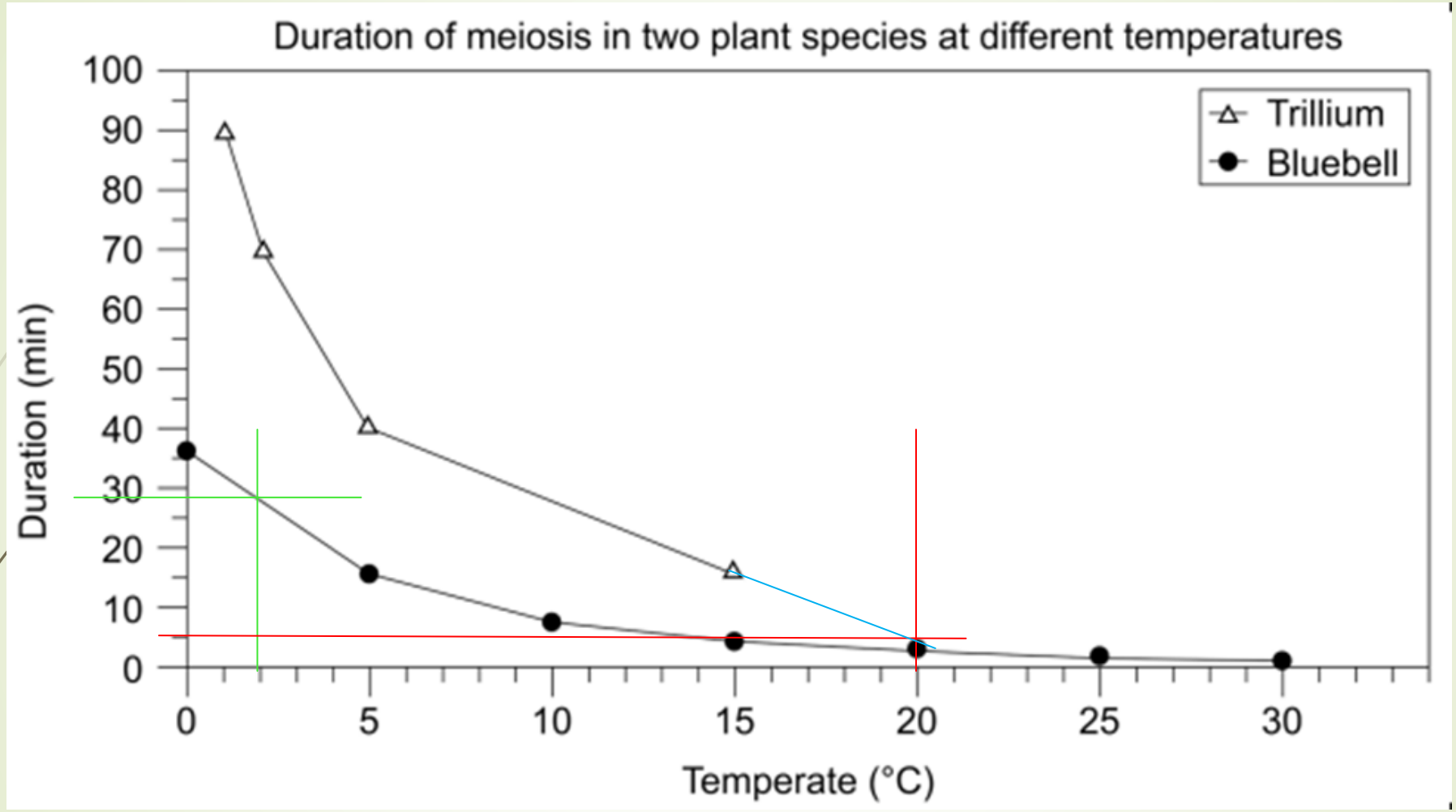
I. Using your graph, estimate the duration of meiosis in the common bluebell at 2 oC.

II. Using your graph, estimate the duration of meiosis in red trillium at 20 oC.

III. State which estimate you have the most confidence in. Justify your answer.

c, d, and e are all about meiosis and mitosis

I.



II

III. **Bluebell (or 29 minutes),** because the data is within the range OR interpolation.
OR the data for the red Trillium is extrapolated / outside the data range.

Unit 3: Continuity of the Species

- **Understand the cellular processes and mechanisms that ensure the continuity of life, and how these processes contribute to unity and diversity within a species**

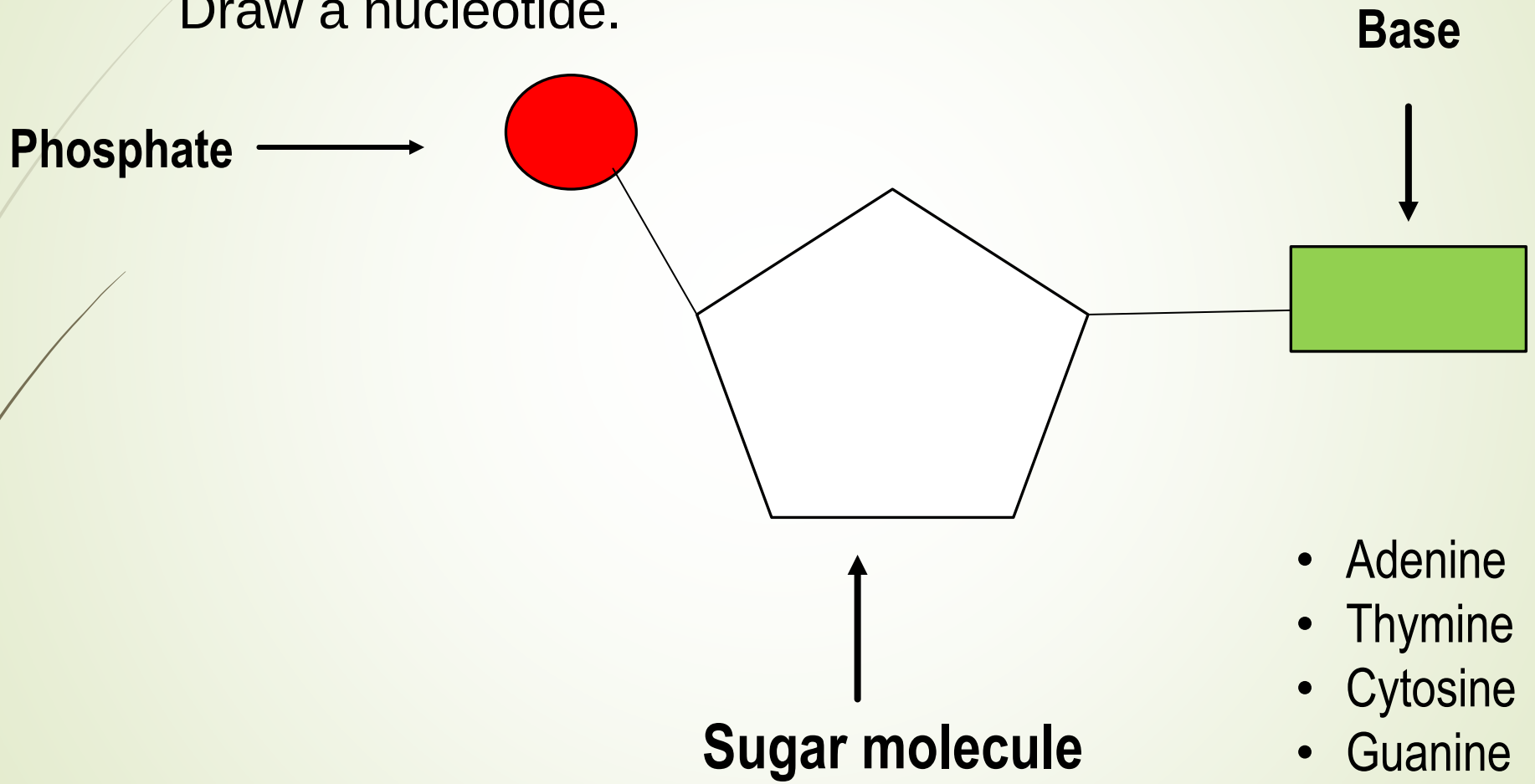
PART ONE

- Structure of DNA
- DNA Replication
- Genetic Code
- Protein Synthesis
- DNA Technologies
  - Genetic engineering techniques
  - DNA sequencing
  - DNA profiling
  - Recombinant DNA
  - Transgenic organisms

- Continuity of Life
  - Cell reproduction
  - Mutations
  - Patterns of Inheritance

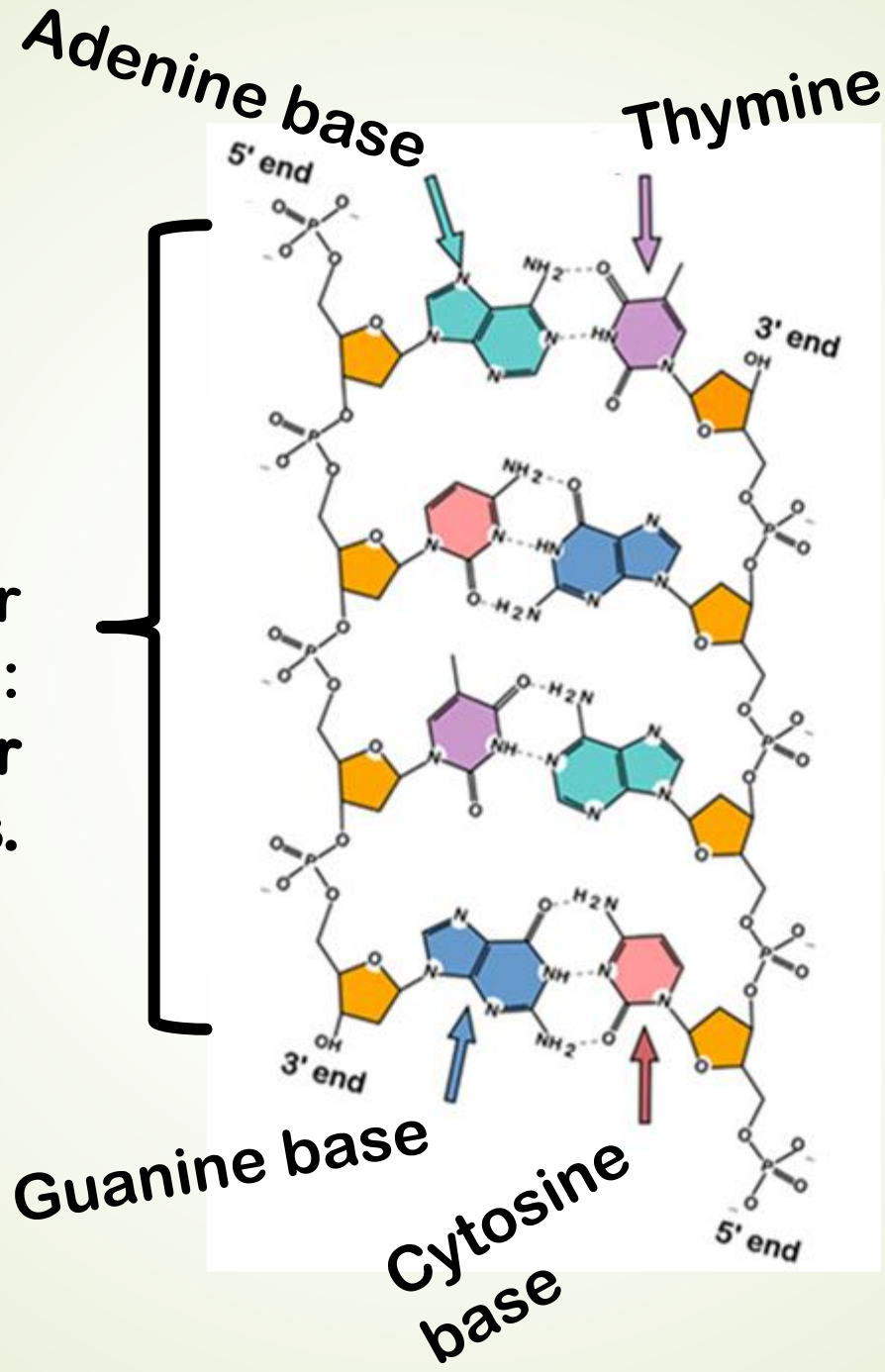
DNA

Draw a nucleotide.



- Adenine
- Thymine
- Cytosine
- Guanine

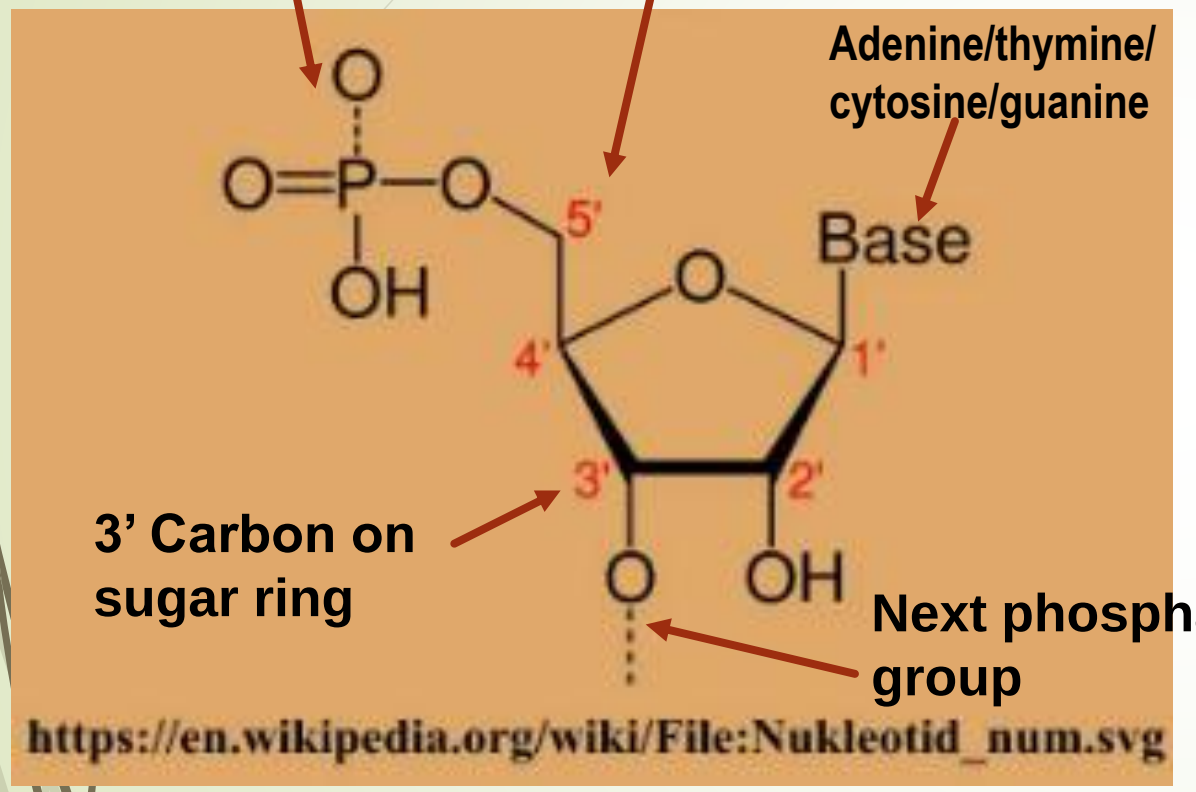
Phosphate-sugar backbone: **phosphodiester bonds.**



Hydrogen bonds join bases together:

- adenine-thymine (2 H-bonds)
- guanine-cytosine (3 H-bonds)

5’/3’ ??????

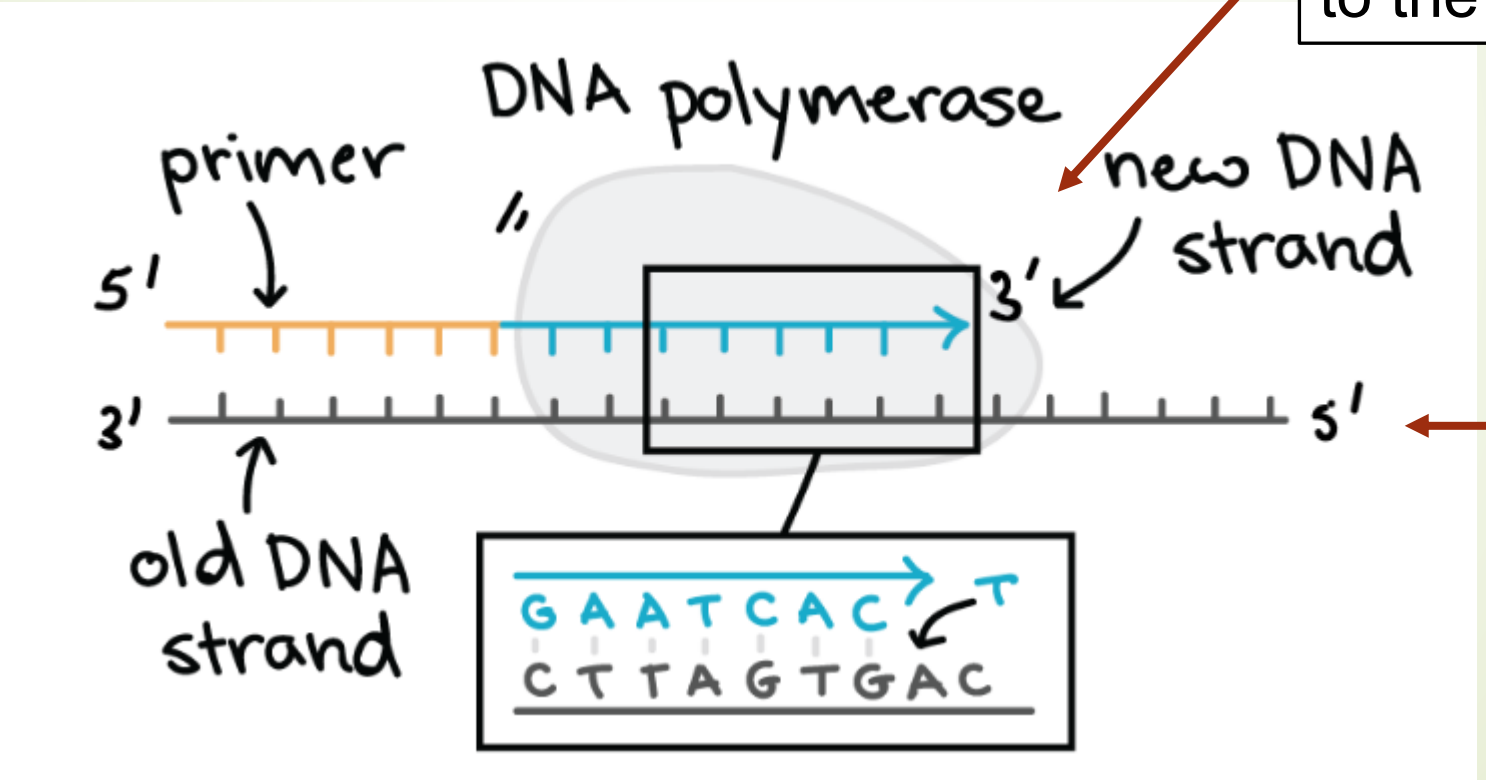


- DNA has ‘directionality’.
- Described as 5’ to 3’ (5-prime to 3-prime)
- The 5 and 3 relates to the C on the 5 carbon atoms of the sugar ring. (numbered 1-5)
- The 5’ end starts with a phosphate group
- The 3’ end finishes with a sugar

Why is this important?

DNA polymerase only works in 1 direction.

- Can only add nucleotides on the 3’ end.
- **Read UP, Write DOWN**



Writing the new strand by adding nucleotides to the 3’ end

Reading the original strand 3’ to 5’

Graphic from Khan Academy

DNA Replication: the basics!

- What is the purpose of DNA replication?
  - To reproduce 2 identical strands of DNA
- But why does the body need more DNA?
  - Essential for cell division during **growth or repair of damaged tissues.**
  - **DNA replication** ensures that each new cell receives its own copy of the **DNA**.

Question 2 DNA Replication

The process of DNA replication requires enzymes.

Identify the **two (2)** main enzymes that *attach* to the DNA molecule and describe their function. (4 marks)

DNA helicase (1) unwinds/unzips the DNA molecule so other molecules can attach to it (1)

RNA primase (1) attaches short sequence of RNA (primer) to mark the 'start' point (1)

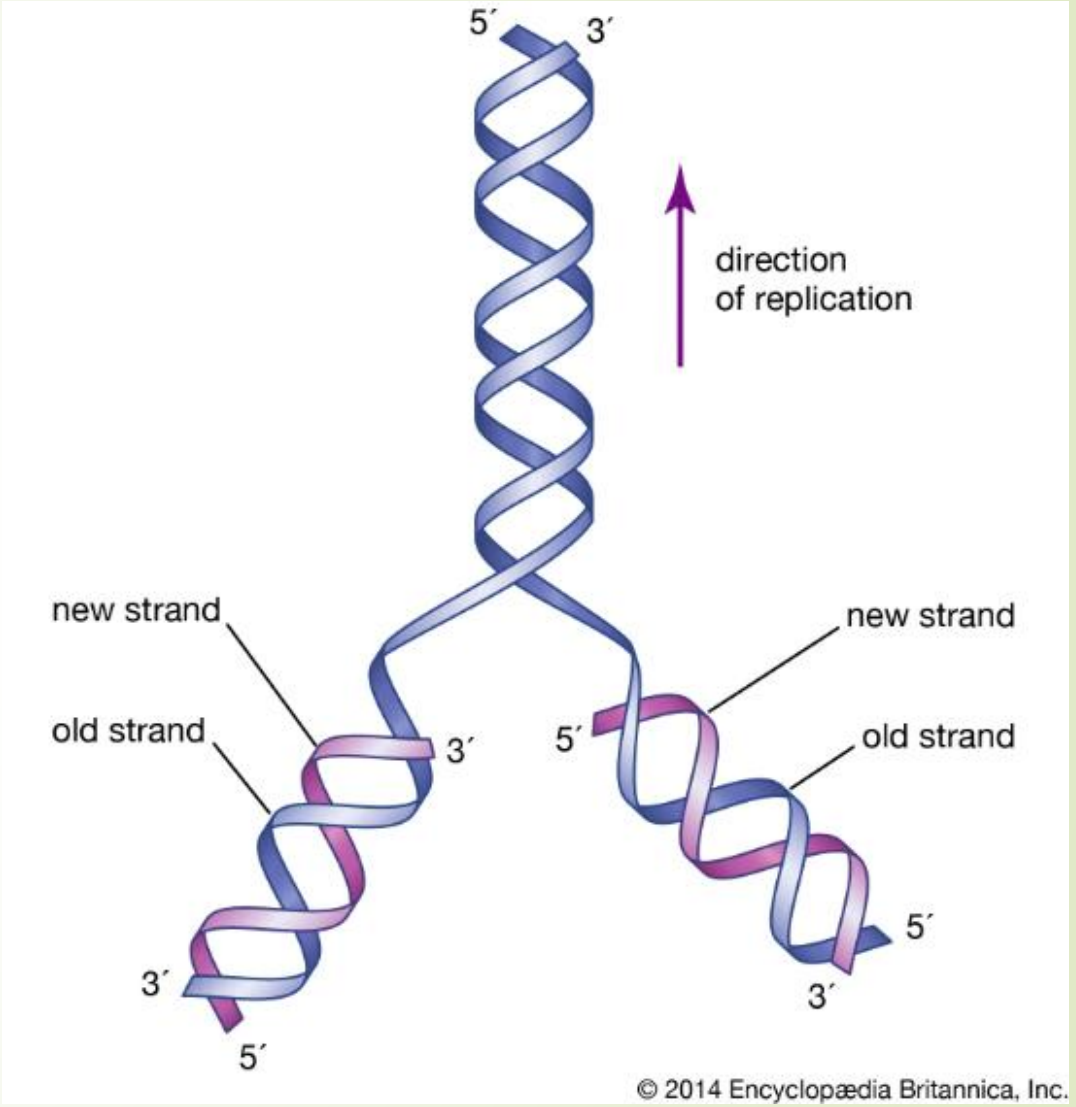
DNA polymerase (1) binds to the DNA and synthesises a new complimentary strand of DNA (1) from the 5' to 3' end.

Question 3: DNA Replication

Q37 2022 WACE Exam Extended Response Section

"Cell reproduction is needed for growth and to replace damaged cells. It involves DNA replication followed by mitosis.

(a) Describe how a DNA molecule replicates itself and the process of mitosis. (10 marks)

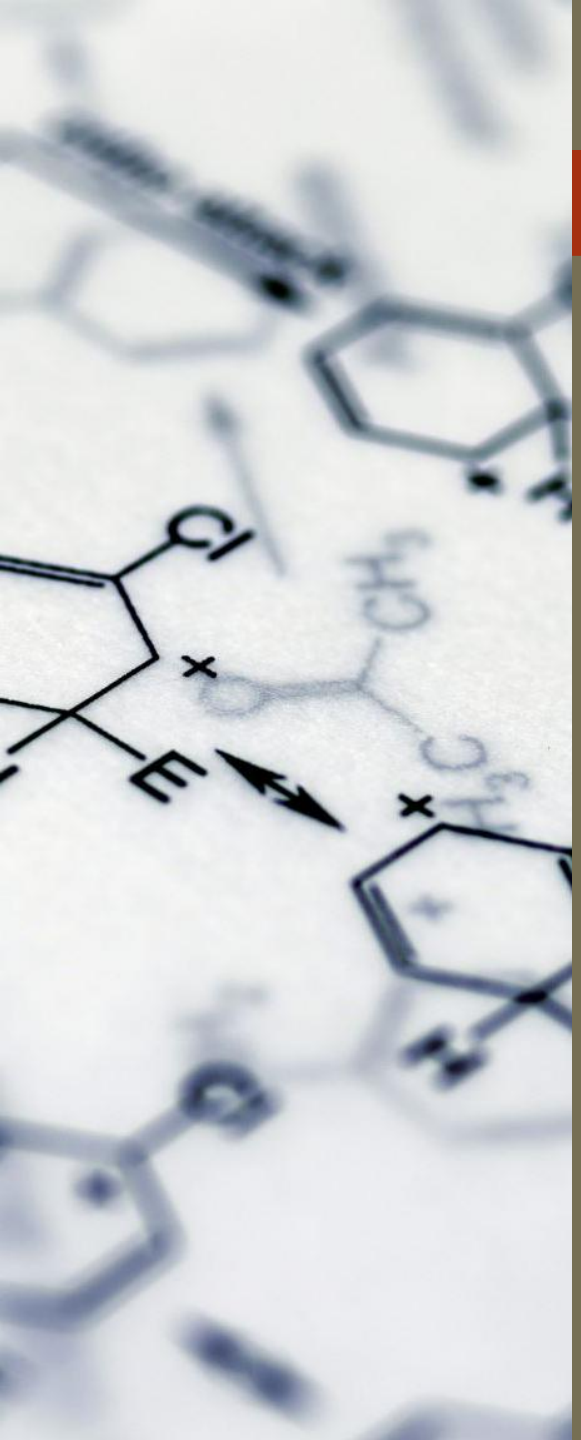


DNA Replication WACE marking key

- Two strands of the DNA molecule separate/unwind/unzip. 1
- (Weak) hydrogen bonds between (nitrogenous) bases are broken. 1
- Each strand acts as a template for synthesis of the other strand **or** DNA replication is semiconservative **or** each DNA strand is copied. 1
- Base pairing ensures that the new strand is complimentary to the template **or** A and T, and G and C are paired on template and new strands. 1
- Subtotal 4

The IMPORTANT bits to KNOW about DNA Replication!

- DNA helicase unwinds the DNA double helix into separate strands.
- Weak hydrogen bonds between (nitrogenous) bases are broken, exposing the bases.
- Each single strands acts as a template.
- RNA primase marks the start point (primer)
- DNA Polymerase adds complementary free nucleotides to the single strand in a 5' → 3' direction. (nucleotides added to the 3' end)
- The Leading strand runs towards the replication fork and nucleotides are added continuously.
- The Lagging strand runs away from the replication fork and nucleotides are added in fragments.
- These fragments are called OKAZAKI fragments.
- DNA Ligase fills these fragments to make a complete strand.
- DNA replication is semi-conservative (each new strand consists of 1 original strand and 1 new strand.)



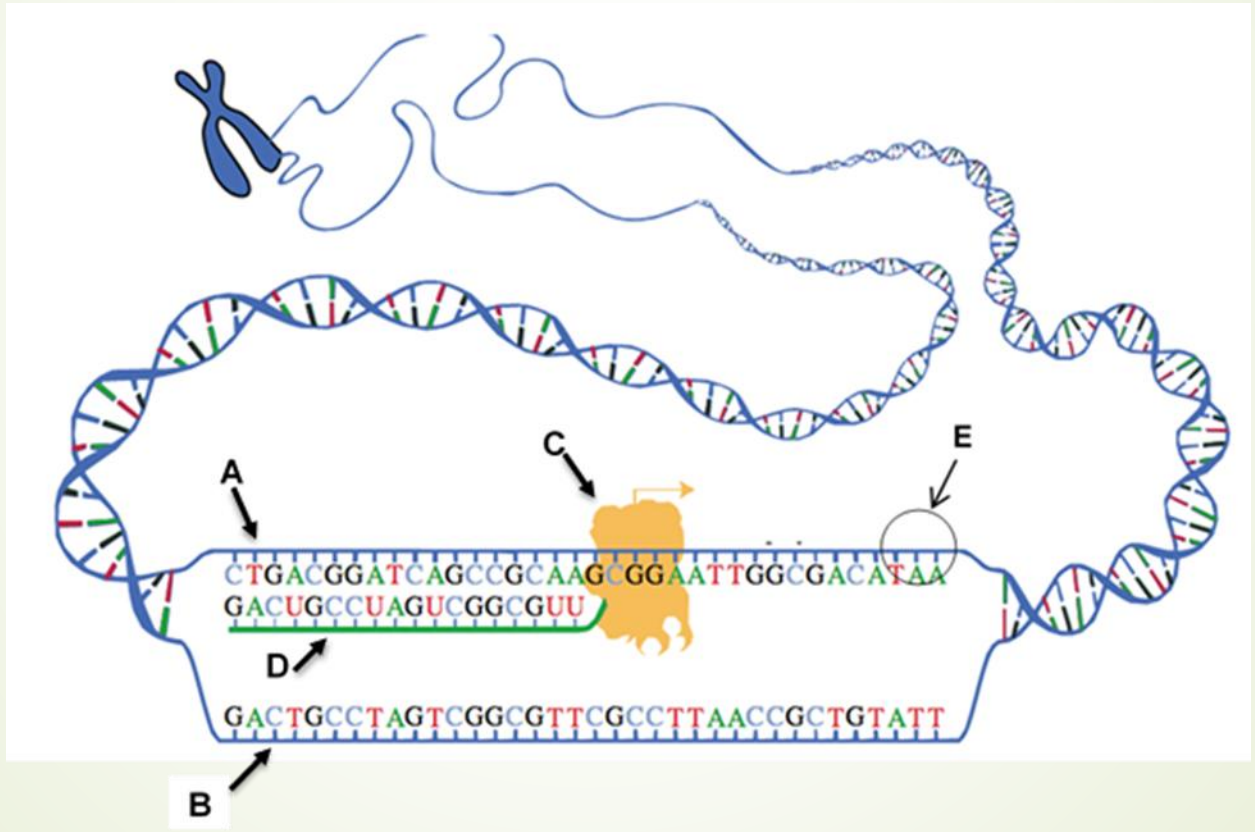
The Genetic Code

A set of rules by which the genetic information in DNA or mRNA is translated into proteins.

Questions about protein synthesis will not always have “protein synthesis” in the question! Look for:

- gene expression
- genetic code
- synthesising or producing a protein OR enzyme

Question 4: refer to the diagram below depicting the transcription stage of protein synthesis.



Genetic Code. Question 4 answers

HOW do you know this?

- The DNA double helix is only partially unwound.
- Only one strand is being copied.

Identify the structures on the diagram above at the areas labelled A – E.

A. Template Strand

B. Non-template strand

C. RNA Polymerase

D. mRNA

E. Stop codon/codon

Genetic Code question 4 answers continued

Distinguish between the structures labelled A and B (2 marks)

A. Template Strand: mRNA is **complementary** to this strand.

B. Non-template strand: mRNA is a **matching copy** of this strand.

Genetic Code: Question 5

What is the purpose of protein synthesis?

- To produce proteins.
- Proteins are important molecules; they are involved in nearly all cellular processes.
- The most important proteins are enzymes, biological catalysts that speed up rates of reactions.

There are two processes occurring in the diagram, what are they and where in the cell do they occur? (4 marks)

- Transcription: nucleus
- Translation: cytoplasm

Genetic Question 5 continued.

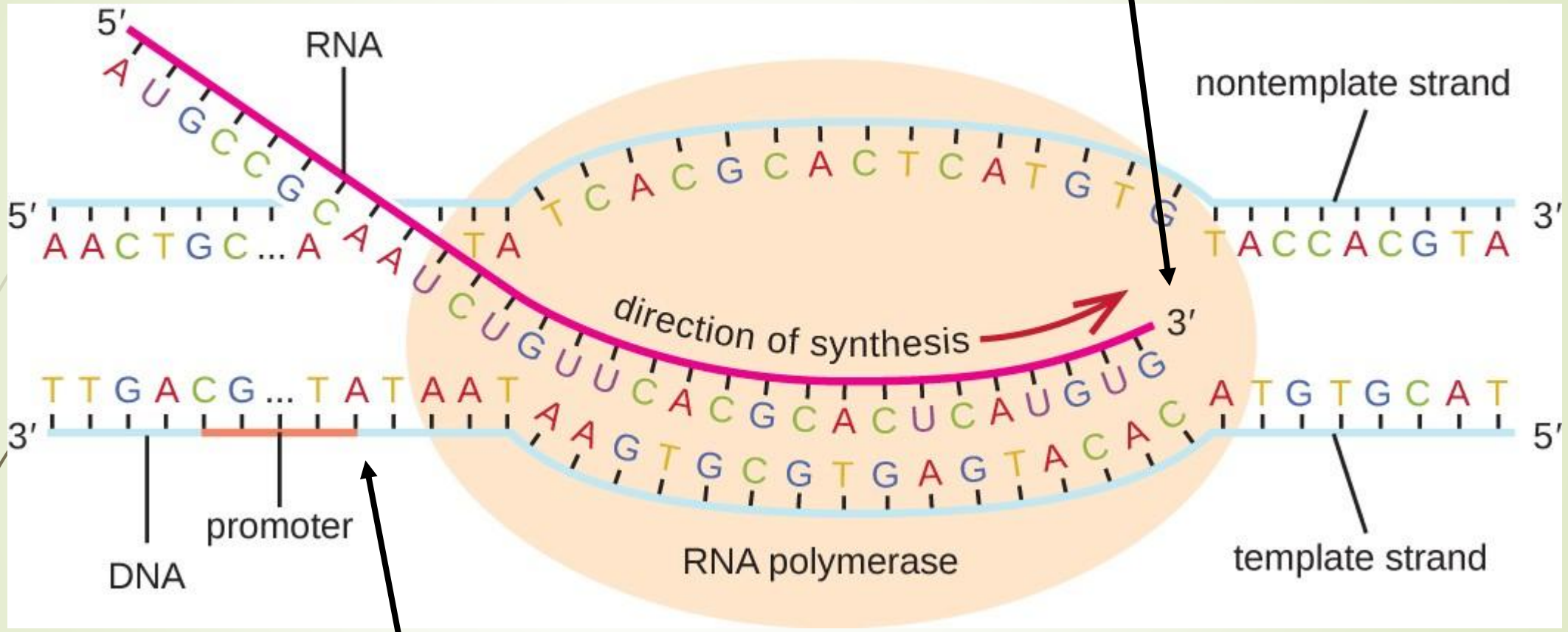
Describe the sequence of events from start to finish.(10 marks)

1. Transcription (max 6 marks)

- mRNA produced from DNA
- mRNA is formed using the TEMPLATE strand

1. Initiation: RNA polymerase binds to promoter, signalling the DNA to unwind a portion of the double helix.
2. Elongation: RNA polymerase builds mRNA (moving in a 3' to 5' direction but building in a 5' to 3' direction), until it reaches the STOP base sequence
3. Termination: Pre-mRNA is released and DNA zips up
4. Methylated cap is added to the 5' end and poly A-tail to the 3' end.
5. Introns (non-coding) are removed via splicing

Free nucleotides added to the 3’ end

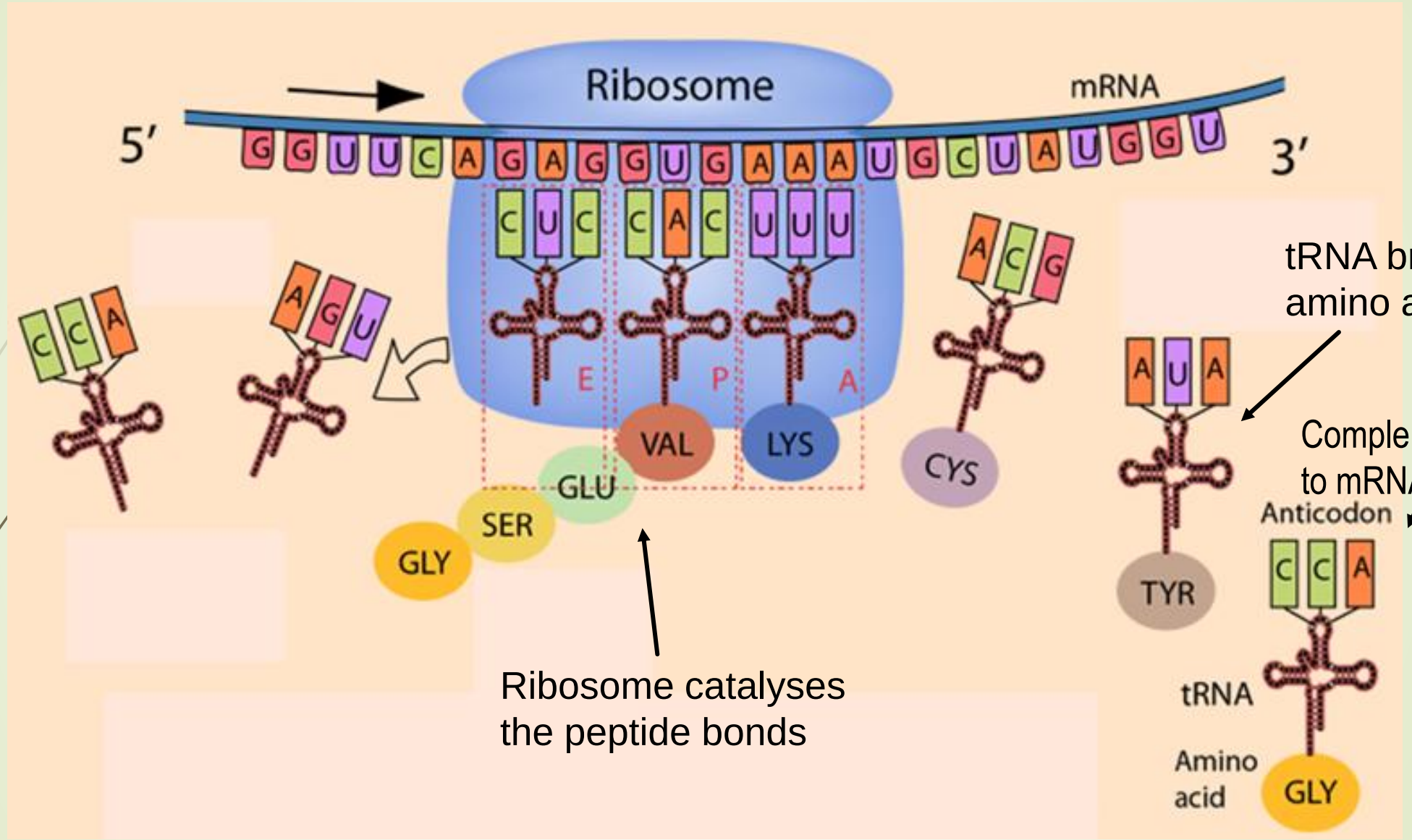


Begins at promoter sequence, reads from the 3’ to 5’ direction. (READ UP, WRITE DOWN)

Genetic Question 4 continued.

2. Translation (any 4 for 4 marks total)

1. Initiation: *Ribosome binds to methylated cap on mRNA*
   - *Ribosome scans to find the Start codon (AUG/methionine)*
   - *Ribosome "reads" the mRNA , selecting tRNA with the complementary anti-codon*
2. *Elongation: tRNA brings amino acids to the ribosome*
   - *tRNA anticodon binds temporarily to the ribosome*
   - *Amino acids link to form proteins (or peptide chains)*
   - *The ribosome catalyses the peptide bonds*
3. *Termination: when a stop codon (UAG, UAA, UGA) is reached, the polypeptide is released.*
   - mRNA separates from the nucleus.
   - Polypeptide may fold to become protein or join another polypeptide and then fold.



http://hyperphysics.phy-astr.gsu.edu/hbase/Organic/translation.html


BREAK

DNA Technologies

Biotechnology:

The use of living things to make new products or systems.

Traditional:

The manipulation of crops/animals through “selective breeding”.

Modern (Genetic Engineering):

Changing the genetic sequence of an organism through human use of biotechnology techniques.

Produces: Genetically Modified Organisms OR Transgenic organisms.

Tools of the Trade!

Biotechnology requires the use of biological “tools”. These are mostly derived from organisms. They are used to:

- Synthesising, cutting and pasting DNA
- Viewing and analysing DNA

Question 6: Distinguish between; **Cutting DNA**, **Recombining DNA** and **Amplifying DNA**. (6 marks)

- Cutting DNA:
  - ***restriction enzymes*** **"cut" DNA at** ***specific sites*** **(restriction sites)**
- Recombining DNA:
  - ***DNA ligase*** **is used to "*glue" the two restriction fragments together, it catalyses phosphodiester bonds.***
- Amplifying DNA:
  - ***Polymerase Chain Reaction*** **(PCR) is used to make** ***more DNA. Each cycle doubles the amount of DNA.***

Same, same but different- notice the two questions below are after the same answer?

- WACE 2018: A breeder kept only albino guinea pigs. The breeder put one female and two male guinea pigs in the same enclosure. The female had a litter of offspring. The breeder wanted to know which of the male guinea pigs was the father of the litter.
- ***Explain* how biotechnology can be used to determine the father of the litter**. (4 marks)
- WACE 2016: A number of people who had visited a particular dental practice were later found to be infected with a hepatitis virus. Health authorities suspected that these people had contracted the virus through the dental practice.
- ***Explain* how DNA profiling could be used to determine whether these people had contracted the virus through the dental practice.** (4 marks)

DNA Profiling continued…

1 mark each

- **Create a profile (via gel electrophoresis) of the known person/virus/animal.**
- **Create DNA profiles of individuals involved**
- **Compare the DNA profiles.**
  - **If patients contain same/related strains of virus, then it likely came from the dental practice.**
  - **If offspring have shared genes with male then they are the father.**

DNA profiling and Conservation

More recent exams link DNA profiling to conservation.

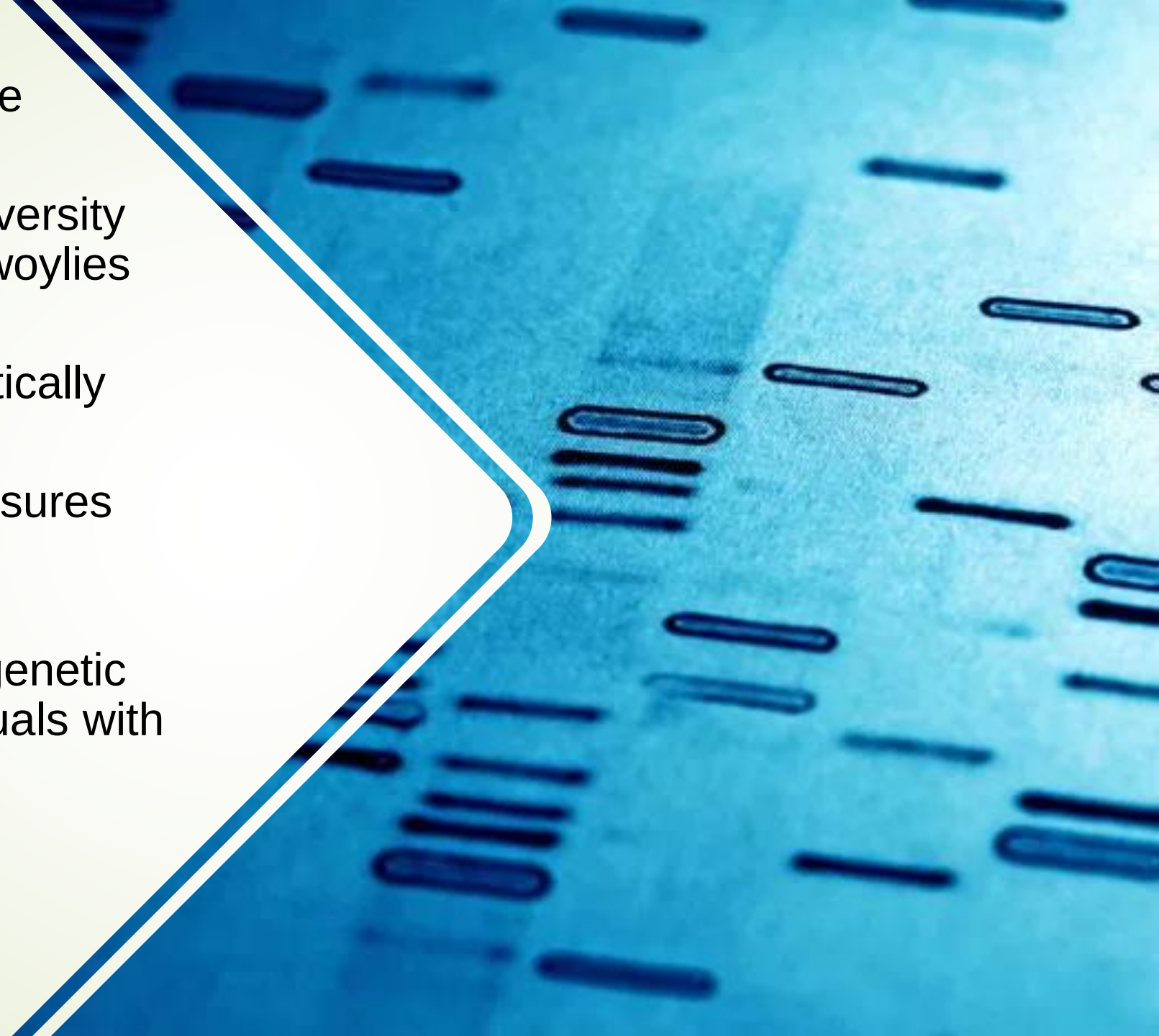
Q7.The Woylie is a critically endangered Australian mammal. Some populations are held in wildlife sanctuaries. Woylies have been translocated from the Karakamia Wildlife Sanctuary east of Perth to a sanctuary in the Northern Territory, where they have been locally extinct for 60 years.

Explain how DNA profiling and a consideration of population dynamics can help to ensure that **the gene pool** of the Woylies translocated to the sanctuary in the Northern Territory **is viable**.

WACE 2023

DNA Profiling: any three of the following

- Estimate relatedness OR diversity OR genetic background of woylies before translocation.
- Translocate unrelated/genetically different individuals
- This prevents inbreeding/ensures gene pool has diversity
- Identify/prevents transfer of individual woylies carrying genetic disease OR transfer individuals with favourable alleles.



Gene Cloning: Question 8. [*application of DNA technology concepts*]

Among Australia's key cotton pests is the global insect nemesis of agriculture; *Helicoverpa armigera*, better known as the bollworm. Since the mid-1990s, Australia's **cotton breeders have begun creating transgenic, or genetically modified, organisms by incorporating genes from a common soil bacterium, *Bacillus thuringiensis* (Bt)**. These genes encode for the production of toxic insecticidal proteins.

- **Name two** possible positive outcomes resulting from this genetic modification.

(2 marks)

- **Outline the sequence of events** undertaken to produce the Bt cotton.

(5 marks)

Biotechnology Question 8 continued

Name two possible positive outcomes resulting from this genetic modification.(2 marks)

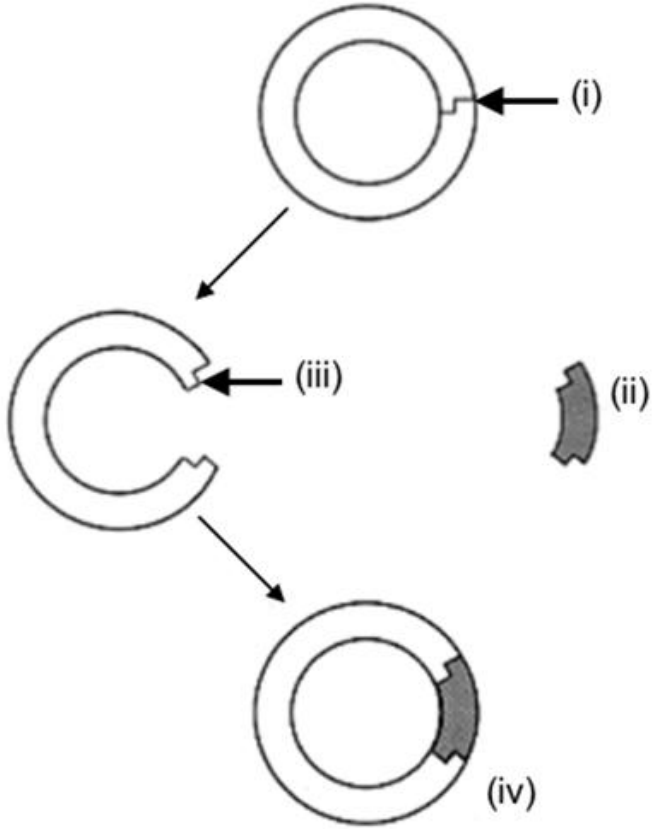
- **IMPROVED YIELD – 1**
- **REDUCES THE NEED TO SPRAY INSECTICIDE- 1**

Outline the sequence of events undertaken to produce the Bt cotton. (5 marks)

- **IDENTIFY AND ISOLATE THE Bt GENE – 1**
- ***(using a restriction enzyme)* EXTRACT/CUT Bt GENE OUT OF DNA ALONG WITH PLASMID/AGROBACTERIUM – 1**
- ***(using the same restriction enzyme)* SPLICE/LIGATE Bt GENE INTO PLASMID/AGROBACTERIUM- 1**
- **TRANSFER/TRANSFORM/INTRODUCE RECOMBINANT PLASMID/AGROBACTERIUM INTO TISSUE CULTURE OF COTTON- 1**
- **CULTURE/GROW Bt COTTON PLANTS- 1**

(i) **RESTRICTION SITE- PLASMID IS SPLICED BY RESTRICTION ENZYME.** (1)

(ii) **THE SAME** (1) **RESTRICTION ENZYME CLEAVES/SPLICES/CUTS THE FOREIGN GENE SEQUENCE** (1)



(iii) **COMPLEMENTARY STICKY ENDS ALLOW FOREIGN GENE FRAGMENT TO BIND TO PLASMID** (1)
Attracted by hydrogen bonds

(iv)**DNA LIGASE GLUES/BINDS (***catalyses phosphodiester bonds***) DNA FRAGMENT TO PLASMID TO FORM RECOMBINANT DNA** (1)

The Continuity of Life: Cell Reproduction

- Refer to Summary booklet for information on chromosomes.

- So, what are the really important things to know?
  - Mitosis: purpose, stages
  - Meiosis: purpose, stages
  - Mutations: types of.
  - Patterns of Inheritance
    - Know how to construct a punnet square
    - Recognise patterns of inheritance in pedigrees
    - Know examples of the types of inheritance

Cell Reproduction: Question 9.

Question 9: Genetic recombination in eukaryotes occurs via several processes including *crossing over* and *independent assortment* during *meiosis*.

Describe each of these processes and **explain** briefly how they produce genetic variation.

(4 marks)

Cell Reproduction: Question 9. continued

CROSSING OVER:

PROPHASE 1, HOMOLOGOUS CHROMATIDS TANGLE AND EXCHANGE GENETIC MATERIAL.

CREATING NEW COMBINATIONS OF ALLELES

[Law of] INDEPENDENT ASSORTMENT:

METAPHASE 1: HOMOLOGOUS CHROMOSOMES LINE UP AT THE EQUATOR INDEPENDENT TO EACH OTHER (RANDOM-NO PARTICULAR ORDER)

THIS LEADS TO

[Law of] RANDOM SEGREGRATION- THE ALLELES SEPARATE INTO GAMETES INDEPENDENTLY; THEREFORE, EACH GAMETE IS UNIQUE (A RANDOM COMBINATION).

A word on **variation**.

Variation is important because during times of environmental change there is a greater likelihood of some individuals will hold favourable genes that allow them to survive.

Variation is increased by:

- the process of meiosis
  - **Crossing Over**- (during prophase 1) allows for genetic exchange of material, again random.
  - **Law of Segregation**- when alleles separate into the gametes this is done independently from other genes (random/in no particular order)
- **Random Fertilisation**
  - ova are fertilised by a random sperm/gamete. It is pure chance as to which gametes meet.
- **Mutation:** the only (and rare) source of new alleles

Mutations

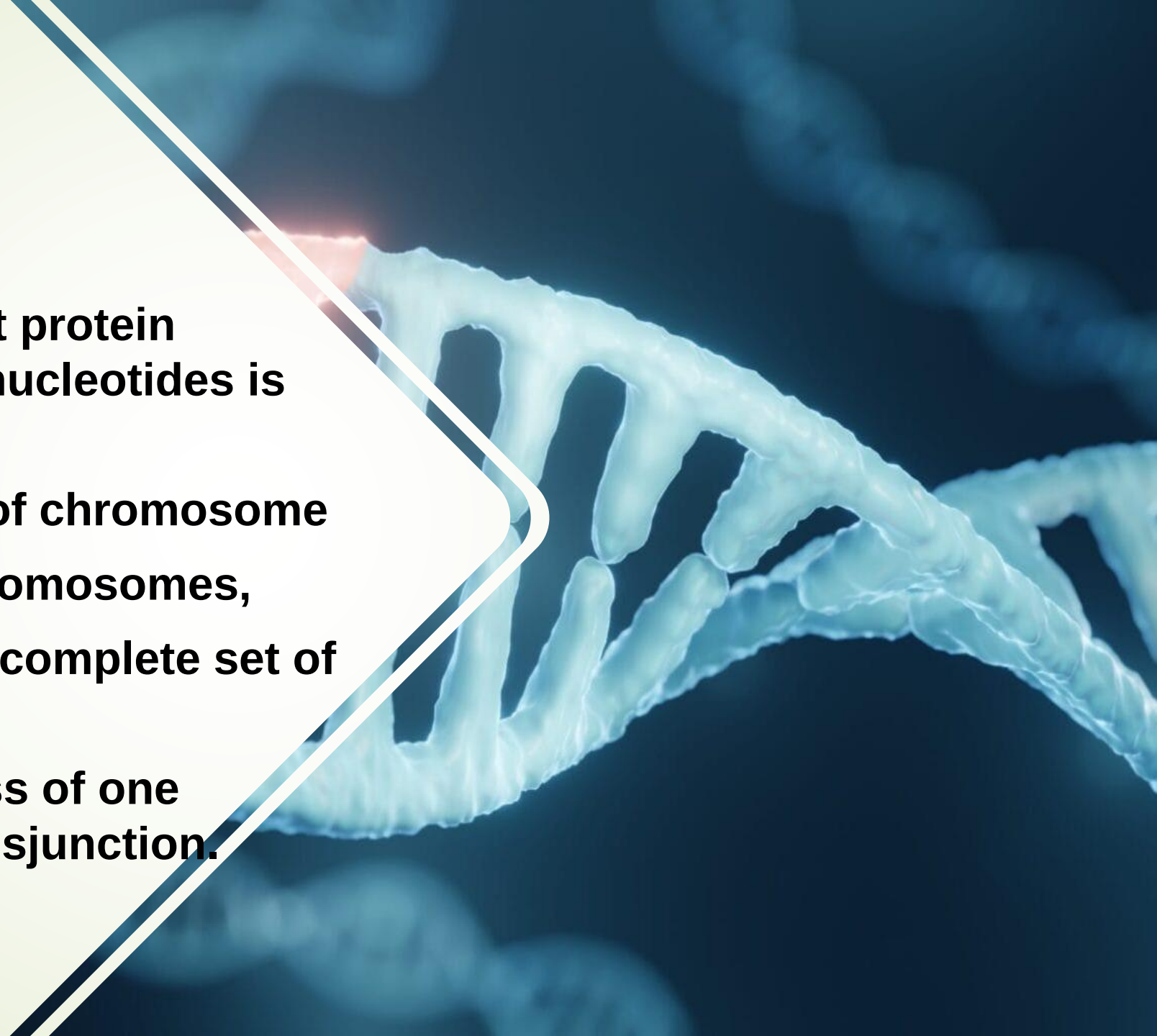
Point v's Chromosome

<u>Point</u>: single nucleotide

- **In somatic cells: may affect protein synthesis as sequence of nucleotides is changed.**

<u>Chromosome</u>: whole or part of chromosome

- **Monoploidy: one set of chromosomes,**
- **Polyploidy: more than one complete set of chromosomes, and**
- **Aneuploidy: addition or loss of one chromosome due to non-disjunction.**

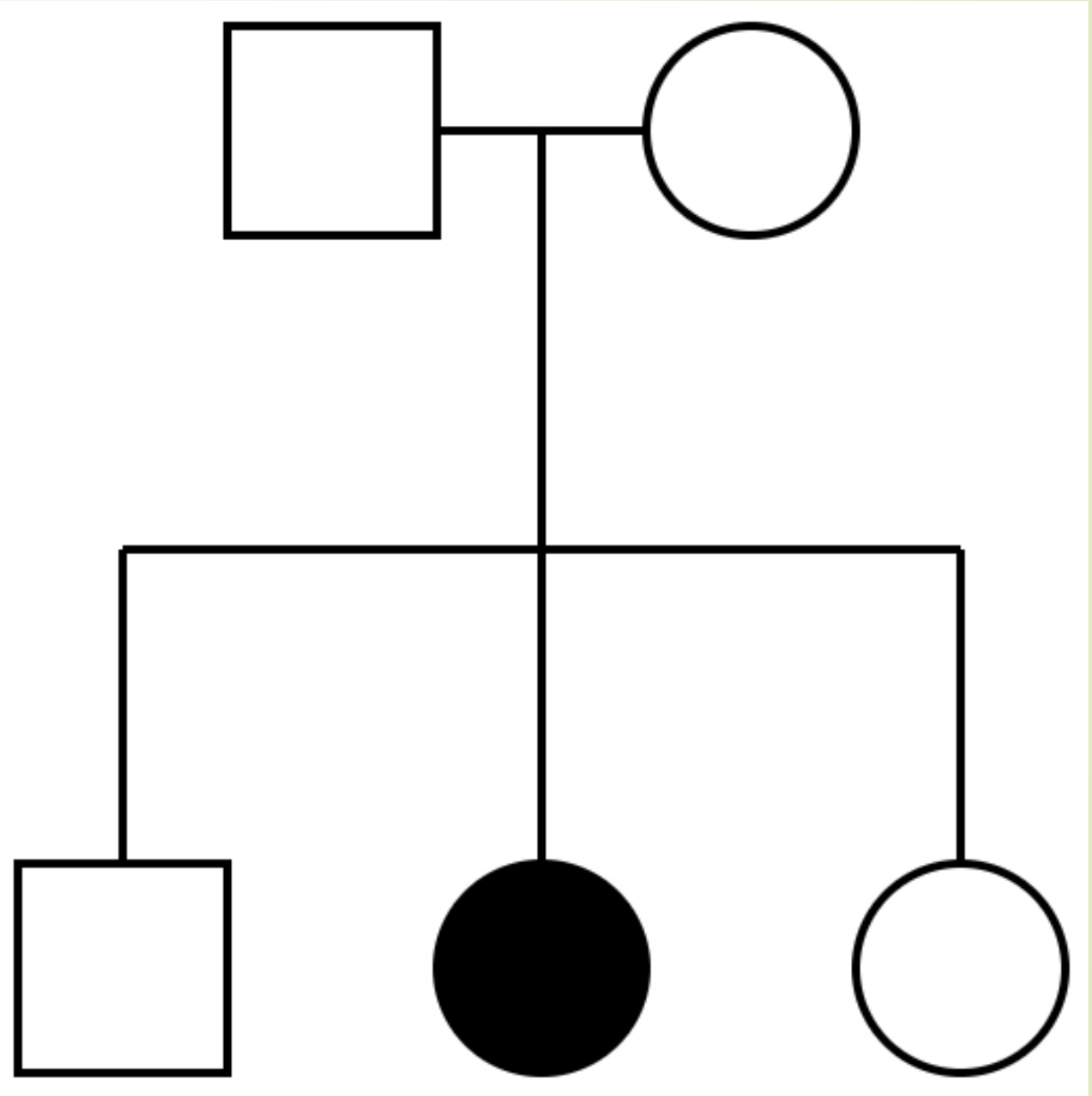


Patterns of Inheritance

Monohybrid crosses (the most common examples you will see in an exam)

Important to remember:

- If a question asks you for evidence or to show working out, then use a punnet square.
- Show your working out in full. Answers involving punnet square are worth up to **4** marks.



A heterozygous yellow pea plant is crossed with another heterozygous yellow pea plant. What are the possible genotypes and phenotypes of the offspring. Show all working out.

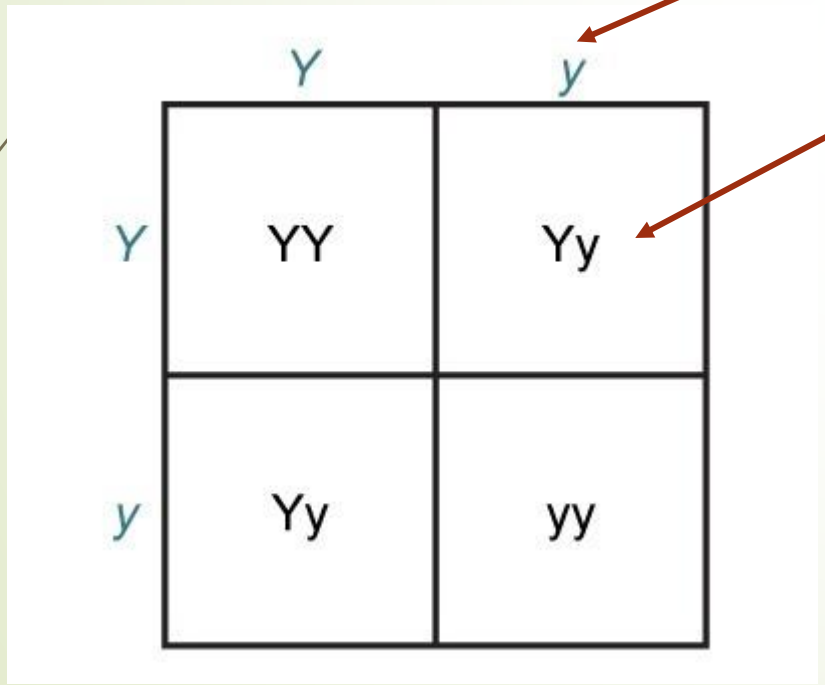
Y= yellow y= green

1 mark for the allele key

P: Yellow x Yellow

Yy x Yy

1 mark for correct parent alleles.



1 mark for correct offspring genotypes

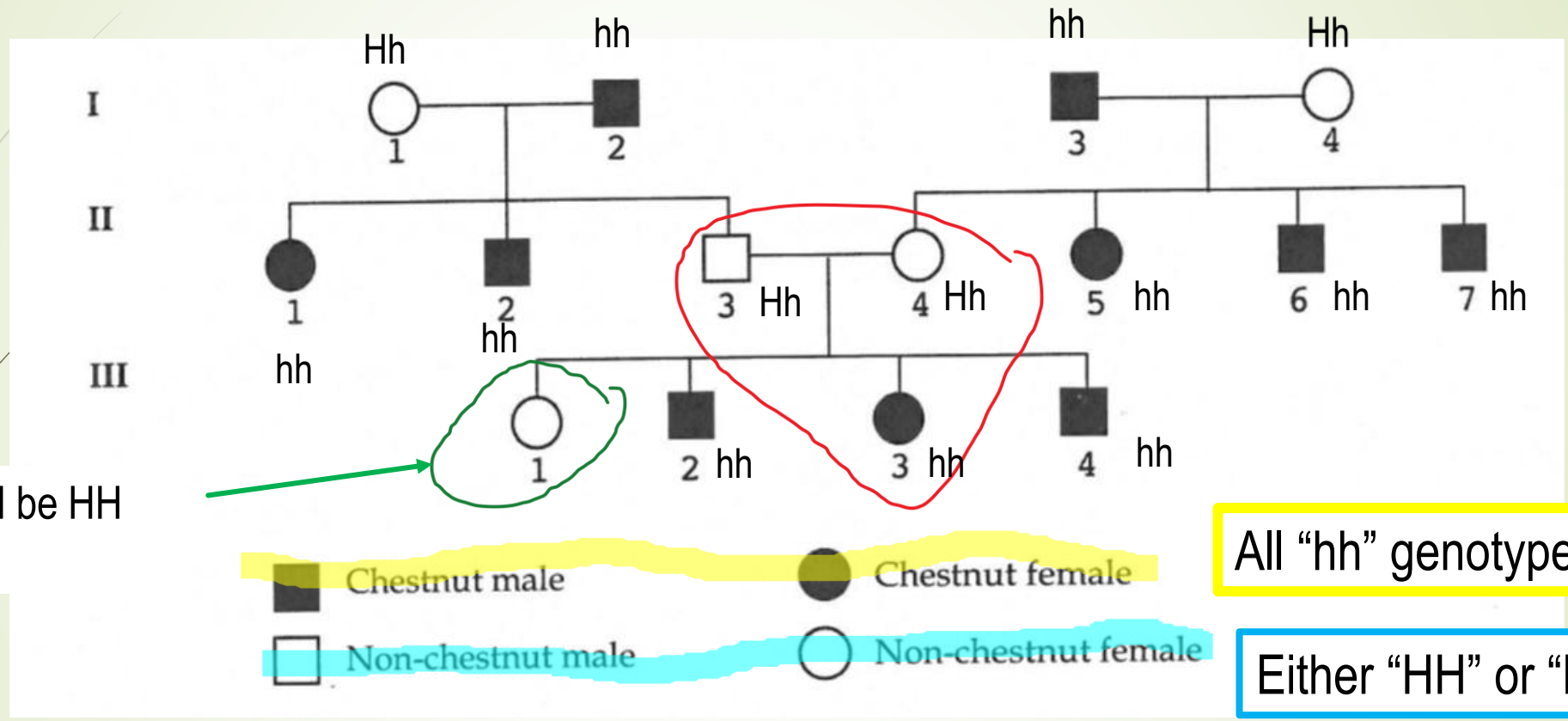
75% (or ¾) Yellow

- 25% (or ¼) homozygous yellow
- 50% (or 2/4) heterozygous yellow

25% (or ¼) homozygous green

1 mark for correct phenotype & ratios

Autosomal recessive



Could be HH or Hh

All “hh” genotype

Either “HH” or “Hh”

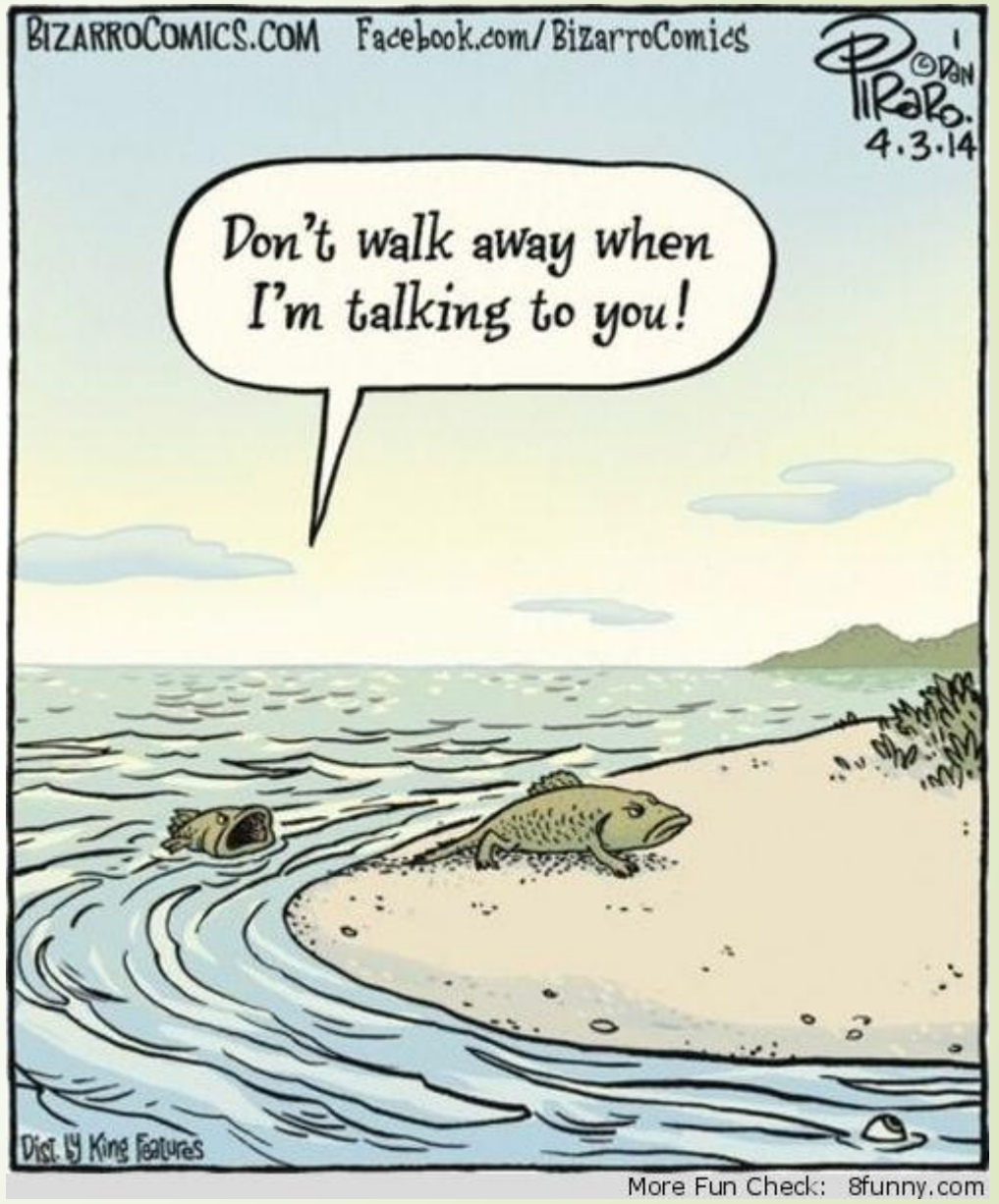
Understand the processes and mechanisms that explain how life on Earth has persisted, changed and diversified over the last 3.5 billion years

PART TWO

- Fossils
- Evidence for Evolution
- Phylogenetic Trees
- Natural Selection
- Changes in allele frequency
- Speciation
- Evolution
- Extinction
- Environmental Conservation

Evidence for Evolution

- The Fossil Record
- Comparative Anatomy and Embryology
- Comparative genomics (molecular evidence)
- Biogeography



Question 10. Glossopteris is a genus of flowerless seed ferns, common 250 million years ago, it is now extinct. Many species of Glossopteris have been identified from leaf fossils.

a. Define the term ‘fossil’. (1 mark)

- preserved remains/impression/traces of an old/ancient/extinct organism

b. Outline how fossils can provide evidence for evolution. (3 marks)

- show past life/extinct organisms 1
- show that life has changed over time or that life on earth has a long history 1
- show how one type of organism/structure has transitioned to another 1

WACE 2020

c. It has not been possible to determine the total number of Glossopteris species because the fossil record is incomplete. List four reasons why the fossil record is incomplete. (4 marks)

- only hard parts are likely to form fossils or soft parts are unlikely to form fossils
- only organisms that avoid decomposition/scavengers/predators form fossils or fossils only form in areas with no oxygen/bacteria
- only organisms that are buried in sediment/mineral rich water form fossils or rapid burial
- not all fossils have been found yet
- some fossils have been destroyed (by volcanic eruptions/human activities/earthquakes)

d. Approximately when did life first evolve on Earth? (1 mark)

- 3.5 billion years ago (accept any answer between 3 and 4 billion) or Archaean or Palaeozoic

e. Describe the first life forms on Earth. (3 marks)

- microbes/single cell
- simple cells/prokaryotes
- bacteria/bacteria-like/archaea
- aquatic/anaerobes/marine

The table below shows the number of amino acid differences in a protein molecule in five different types of monkey.

	Saki	Macaque	Colobus	Squirrel	Woolly
Saki					
Macaque	6				
Colobus	8	2			
Squirrel	4	7	9		
Woolly	1	8	8	4	

f. Use these data to describe the evolutionary relationships of these monkeys. (4 marks)

- saki and woolly are closely related/most closely related 1
- colobus and macaque are closely related/next most closely related 1
- squirrel, saki and woolly form a related group or colobus and macaque are distantly related to others or form a distinctive group 1
- any accurate quote of data (must give names of monkeys and number of amino acid substitutions)

g. Explain how differences in the amino acid sequence of a protein can provide evidence of evolutionary relationships between organisms. (4 marks)

Either

- sequence of amino acids in a protein is determined by a DNA sequence
- the more similar the amino acids, the more similar the DNA sequence
- organisms with similar DNA/amino acid sequences are closely related
- because they diverged more recently
- less time to accumulate mutations/differences

or

- sequence of amino acids in a protein is determined by a DNA sequence
- the more different the amino acids, the more different the DNA sequence
- organisms with different DNA/amino acid sequences are not closely related
- because they diverge a long time ago
- more time to accumulate mutations/differences

Natural Selection …*“the selection of those alleles (genes) in a population that give an organism greater survival advantage.”*

Q11. The islands in the Caribbean Sea are home to more than 150 species of lizard, all belonging to the genus Anolis. It has been hypothesised that all these species are the descendants of two original populations of lizard. Each species has unique features that enable it to live in its habitat. The lizards are found in mountain ranges, woodlands, and rainforests. Many Caribbean islands have only one species of Anolis lizard. [SACE Biology 2014]

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Describe:

- two important events that occur during gamete production, increasing the chances of survival and reproduction of Anolis lizards
- **how natural selection resulted in the evolution** of more than 150 species of Anolis lizards in the Caribbean islands.

1. COMMON ANCESTOR (1) *WIDE SPREAD DISTRIBUTION*
2. COMPETITION (1) for *RESOURCES* Environmental pressure
3. POPULATIONS BECOME SEPARATED/**ISOLATED** or OCCUPY A SPECIFIC NICHE

   (1) Isolation (may be physical, or behavioural)
4. SURVIVAL OF THE FITTEST: MOST FIT INDIVIDUALS SURVIVE TO PASS ON GENES TO NEXT GENERATION (1)
5. ADAPTION TO ENVIRONMENT (1)
6. LEADING TO SPECIATION – UNABLE TO INTERBREED (1)

   (Adaptive Radiation)

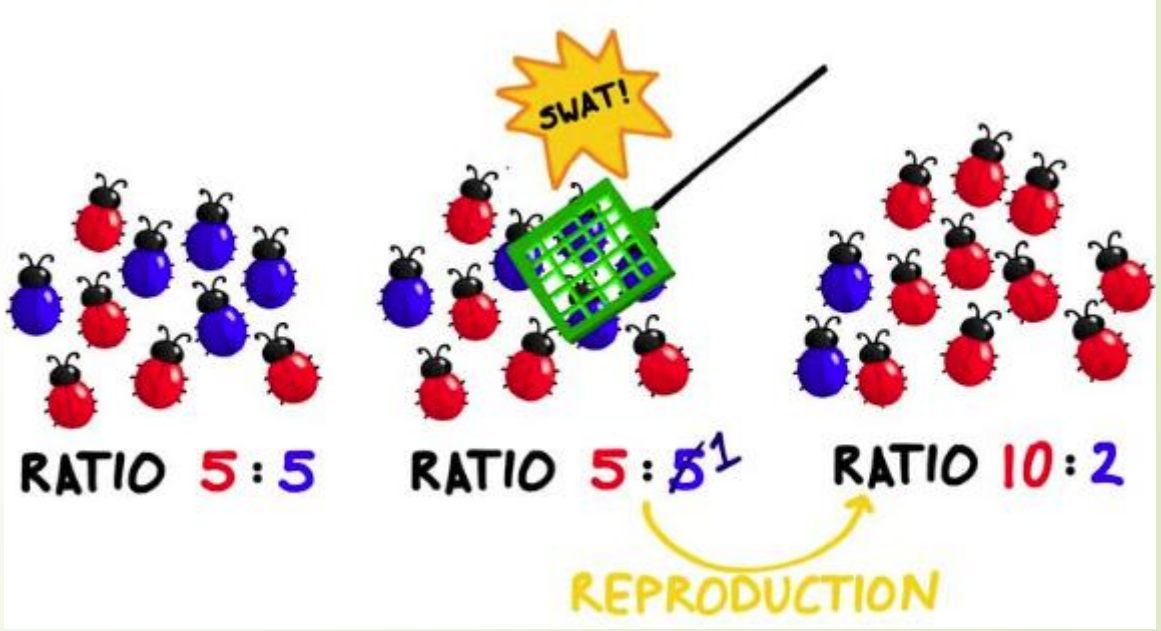
Rise in frequency of alleles that favour survival

Allele Frequencies in a gene pool

- Question 12: **Describe how** *mutation* and *genetic drift* **change the frequency of alleles** in a population and **explain** the *significance of these changes*.

Answer in two parts:

- Mutation
- Genetic drift



Allele Frequencies in a gene pool continued

Question 12.

Mutation (2 marks)

- Permanent change to DNA
- Changes one allele to another/creates new alleles
- Random

Significance (3 marks)

- Deleterious effects on individuals OR result in death of individuals OR neutral/advantageous/disadvantageous effects
- Limited effect due to low occurrence/low mutation rate
- Source of genetic variation/new alleles
- Populations can not evolve without genetic variation

Allele Frequencies in a gene pool continued

Genetic drift (2 marks)

- Random death of individuals OR selection of gametes OR founder effect
- Random/chance changes in allele frequencies
- Has the biggest effect in small populations

Significance (3 marks)

- Leads to loss of diversity/alleles OR can result in the loss of advantageous alleles.
- Places populations at risk of extinction
- Due to increase in breeding OR inability to adapt OR susceptibility to pathogens/disease

Environmental Conservation.

Linked to:

- DNA profiling
- Genetic Drift
- Extinction

Always part of a question that covers more than one concept.

Q13 The malleefowl (*Leipoa ocellata*) is a ground dwelling bird that is found in scrubland in southern Australia. It is vulnerable to extinction.

a. The following terms are relevant to developing conservation plans for the malleefowl. Define each term.
   i. Gene pool
   ii. Population dynamics
   iii. Biogeography
   iv. Reproductive behaviour

b. To investigate genetic diversity, biologists produced DNA profiles for malleefowl. List the main steps involved in producing a DNA profile.

Q13 continued

c. Biologists are breeding malleefowl in captivity to assist in the recovery of wild populations. **Describe two ways** in which **captive breeding** can *assist in the recovery* of wild populations.

d. **Explain how** a consideration of **population dynamics** can assist conservation planning to **maintain viable gene pools** in a vulnerable species, such as the malleefowl.

e. Habitat destruction has reduced the opportunity for gene flow between malleefowl populations. **Explain how** *gene flow* affects the **gene pool** of a population.