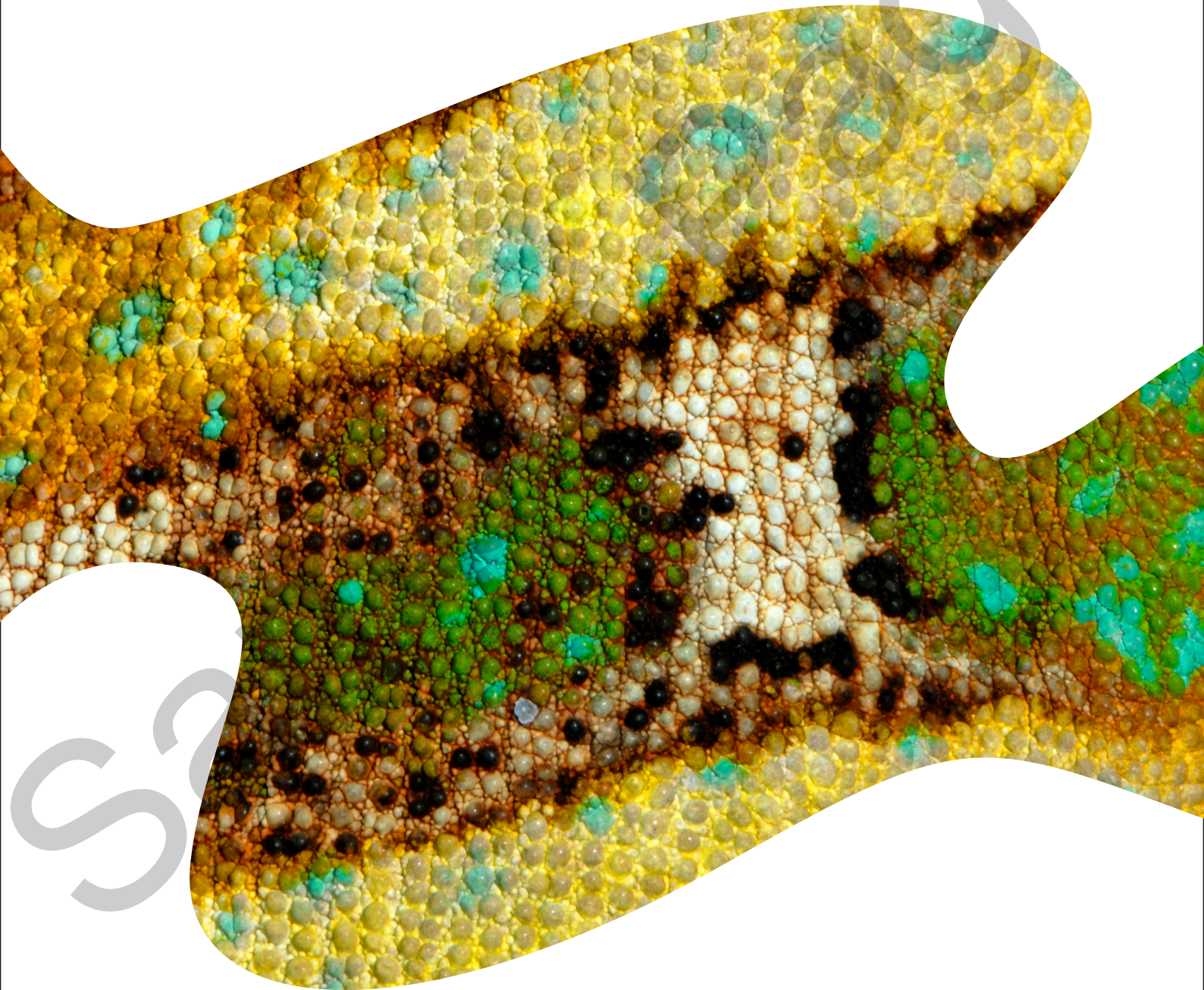


HEINEMANN **BIOLOGY2**

SKILLS AND ASSESSMENT



VCE UNITS 3 AND 4 • 2022-2026

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Unit 3 How do cells maintain life?

AREA OF STUDY 1

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How to use this book

The *Heinemann Biology 2 Skills and Assessment* book provides the opportunity to practise, apply and extend your learning through a range of supportive and challenging activities. These activities reinforce key concepts and skills and enable a flexible approach to learning. There are also regular opportunities for reflection and self-evaluation in the final worksheet in each area of study.

This resource has been written to the VCE Biology Study Design 2022–2026 and is divided into five areas of study—two in Unit 3 and three in Unit 4.

The first four areas of study consist of four main sections:

- key knowledge
- worksheets
- practical activities
- past VCE exam questions.

Area of Study 3 in Unit 4 supports development of the key science skills that you need to successfully design and conduct a scientific investigation.

BIOLOGY TOOLKIT

The Biology toolkit supports development of the skills and techniques required to undertake primary- and secondary-sourced investigations, and covers examination techniques and study skills. It also includes checklists, models, exemplars and scaffolded steps. The toolkit can serve as a reference tool to be consulted as needed.

Biology toolkit

This toolkit provides support for developing the skills and techniques required to undertake primary- and secondary-sourced investigations, and covers examination techniques and study skills. It also includes checklists, models, exemplars and scaffolded steps. The toolkit can serve as a reference tool to be consulted as needed.

Scientific investigation

A scientific investigation is an investigation in which the researcher uses a systematic approach to investigate a question or problem. The investigation is designed to test a hypothesis or to answer a question. The investigation is carried out in a systematic and controlled manner. The investigation is designed to test a hypothesis or to answer a question. The investigation is carried out in a systematic and controlled manner. The investigation is designed to test a hypothesis or to answer a question. The investigation is carried out in a systematic and controlled manner.

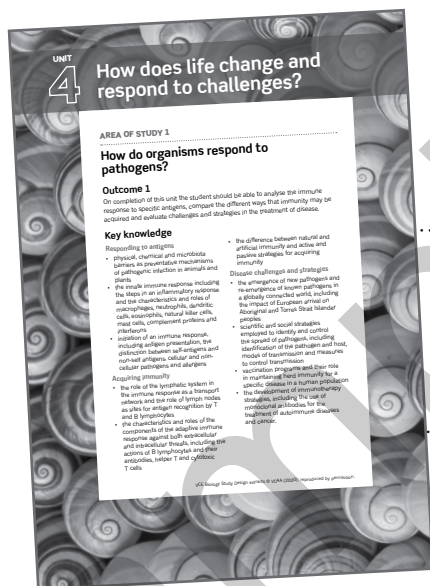
NOTE-TAKING AND ORGANISING NOTES

Note-taking and organising notes are essential skills for students. They help students to record information accurately and to organise it in a way that is easy to understand and use. There are many different ways to take notes, and students should choose the one that works best for them.

Organising notes	Plagiarised text	Reorganised text
Copy text from a source into your notes. This is not acceptable as it is not your own work. It is plagiarism.	Copy text from a source into your notes. This is not acceptable as it is not your own work. It is plagiarism.	Copy text from a source into your notes. This is not acceptable as it is not your own work. It is plagiarism.

- Use a variety of note-taking techniques to record information accurately and to organise it in a way that is easy to understand and use.
- Use a variety of note-taking techniques to record information accurately and to organise it in a way that is easy to understand and use.
- Use a variety of note-taking techniques to record information accurately and to organise it in a way that is easy to understand and use.

Many scientists working in the field of population genetics are interested in the genetic variation within and between populations. This variation is caused by mutations, which are changes in the DNA sequence. Mutations can be harmful, beneficial, or neutral. They can also be used to study the evolution of a species.



UNIT AND AREA OF STUDY OPENER

Heinemann Biology 2 Skills and Assessment is structured to follow the study design units and areas of study. The area of study opening page lists the key knowledge for easy reference to the activities that follow.

KEY KNOWLEDGE

Each area of study begins with a key knowledge section. This consists of a set of summary notes that cover the key knowledge for that area of study. Key terms are in bold and are included in the glossary of the student book. The section also serves as a ready reference for completing the worksheets and practical activities.

KEY KNOWLEDGE

Responding to antigens

The cells of organisms display protein molecules called antigens. Antigens are substances that can be recognised by the immune system. They can be foreign substances, such as bacteria or viruses, or they can be self-substances, such as cells that are damaged or dying. Antigens are recognised by the immune system and trigger a response.

PATHOGENS

Antibodies	Antigens
• composed of proteins	• composed of proteins
• composed of two heavy and two light chains	• composed of two heavy and two light chains
• composed of two heavy and two light chains	• composed of two heavy and two light chains

Antibodies

Antibodies	Antigens
• composed of proteins	• composed of proteins
• composed of two heavy and two light chains	• composed of two heavy and two light chains
• composed of two heavy and two light chains	• composed of two heavy and two light chains

KEY KNOWLEDGE

Disease challenges and strategies

The global community and in particular the scientific community are challenged to respond creatively to the problem of disease, currently present in the world and in the responses to manage potential future disease crises.

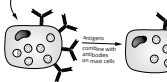
VACCINATION PROGRAMS

Continuing vaccination programs continue a significant role in the control of infectious diseases. Vaccination programs are designed to prevent the spread of infectious diseases by stimulating the immune system to produce antibodies against the disease.

ALLERGIC RESPONSES

An allergic response occurs when the body's immune system reacts to a substance that is not harmful. This reaction is caused by the release of histamine, which causes the symptoms of an allergic reaction.

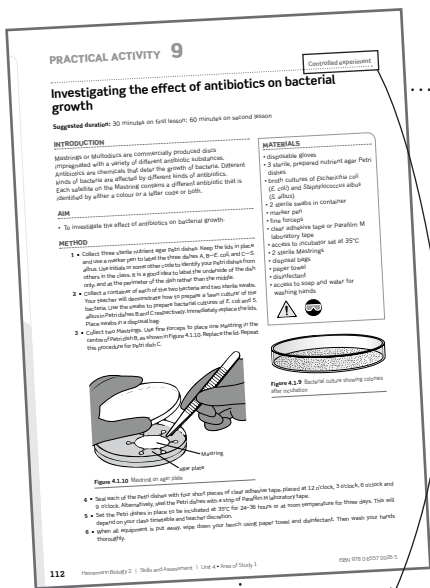
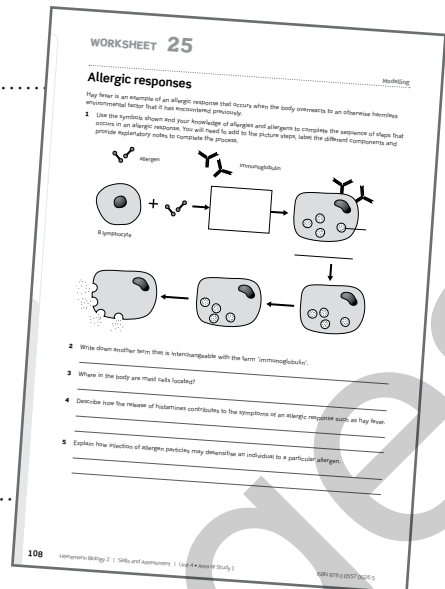
Figure 4.1.7 Allergies stimulate an overreaction by the immune system



WORKSHEETS

The worksheets feature questions that allow you to practise and apply your knowledge and skills. Each area of study includes a 'Knowledge review' worksheet, to activate prior knowledge, and a 'Reflection' worksheet, which you can use for self-assessment. Other worksheets provide opportunities to revise, consolidate and further your understanding.

All worksheets function as formative assessment and are clearly aligned with the study design. A range of questions building from foundation to challenging is included in each worksheet.



PRACTICAL ACTIVITIES

Practical activities offer you the chance to complete practical work related to the various themes covered in the study design. You have the opportunity to design and conduct scientific investigations, generate, evaluate and analyse data, appropriately record results and prepare evidence-based conclusions. Where relevant, you will also need to conduct risk assessments to identify any potential hazards.

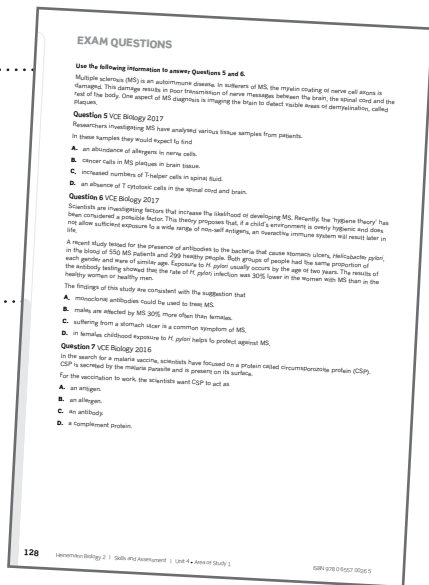
Each practical activity includes a suggested duration. Together with the Area of Study 3 practical investigation, the practical activities meet the 30 hours of practical work mandated for Units 3 and 4 in the study design.

Each worksheet and practical activity is mapped to one or more of the scientific investigation methodologies outlined in the study design. Completing these activities gives you experience in applying the methodologies in a wide variety of contexts and prepares you for designing and conducting your own scientific investigation in Unit 4 Area of Study 3.

Controlled experiment

EXAM QUESTIONS

Each area of study finishes with a selection of past VCE Biology exam questions. This gives you the opportunity to draw together your knowledge and understanding, and to gain valuable experience applying this to actual exam questions.



TEACHER SUPPORT

Comprehensive answers and fully worked solutions for all worksheets, practical activities and exam questions are provided via the *Heinemann Biology 2* <TBC>. In-depth support for Unit 4 Area of Study 3 in the form of samples, templates and teacher notes is also included, along with an interactive SPARKlab for every practical activity.

Biology toolkit

This toolkit provides support for developing the skills required to undertake scientific investigations. It also covers study skills and examination preparation. The toolkit can serve as a reference tool to be consulted as needed.

Scientific investigation

A scientific investigation can be conducted in many different ways. Some examples of scientific investigation approaches (also known as methodologies) are controlled experiments, fieldwork, literature reviews, modelling and simulation. The type of scientific investigation methodology and the methods (also known as procedures) selected will depend on the aim of the investigation and the research question.

Practical work (also known as practical activities) is an important component of many scientific investigations and involves direct experiences or hands-on activities. Examples of scientific investigation methodologies that involve practical work are controlled experiments, fieldwork and modelling.

An investigation that you conduct yourself is known as a primary investigation, and the data and information you collect is called primary data or a primary source. An investigation that involves the analysis of data collected by others is known as a secondary-sourced investigation. You will learn more about this type of investigation on page xv.

When planning and conducting a scientific investigation, you are required to maintain a logbook to record information related to your investigation, such as materials and methods, raw data, data analysis and evaluation, and sources of information.

The findings of a scientific investigation may be presented in a variety of formats, such as a scientific report, an article or a scientific poster.

CONDUCTING A SCIENTIFIC INVESTIGATION

Scientific investigations follow a precise scientific method. The checklist on the following page provides a summary of the elements that are common to many scientific investigation methodologies and scientific reports. Refer to the checklist and record important information as you conduct your scientific investigation.

PRESENTING A REPORT ON A SCIENTIFIC INVESTIGATION

Scientific findings may be presented in a variety of ways. A common presentation format at science conferences is a poster. Posters can get ideas across to a large audience in an organised, concise and creative way. Other common presentation formats are essays, reports, oral presentations and articles. Each presentation format has its own conventions. The following table summarises the characteristics of a number of presentation formats.

Presentation format	Characteristics/inclusions	
poster	<ul style="list-style-type: none">• balance of text and visuals• title, subheadings• balanced layout• captions for figures and tables	<ul style="list-style-type: none">• references• hierarchy of font size according to subheading level• consistent font style—no more than three fonts
report/article	<ul style="list-style-type: none">• structured with an introduction, paragraphs and conclusion• includes subheadings	<ul style="list-style-type: none">• mainly text• can include diagrams, graphs and tables
essay	<ul style="list-style-type: none">• structured with an introduction, paragraphs and conclusion• introduction states focus of essay• each paragraph makes a new point supported by evidence	<ul style="list-style-type: none">• each paragraph links back to last paragraph• a text-style presentation format—visuals at end in appendix• conclusion draws all ideas together but does not include any new information
oral presentation	<ul style="list-style-type: none">• needs to be engaging• refer to cue cards but do not read from them• watch audience as you speak	<ul style="list-style-type: none">• stand still and avoid fidgeting• look at audience and appear confident

PROOFREADING

After you have completed the investigation and prepared your presentation, it is important to think about and check what you have done.

Proofread your work to minimise errors and maximise effective communication of the ideas from your investigation. Use the following questions as a proofreading checklist.

Proofreading checklist	Tick ✓
Have I:	
• investigated the question fully?	
• expressed myself clearly to communicate my ideas well?	
• used the scientific writing style?	
• included data analysis?	
• checked spelling, punctuation and grammar?	
• included references?	
• met the requirements of the presentation format?	

Study skills

There are a variety of techniques and strategies you can use to help you study. You may find that you use different strategies in different situations. For example, you may prefer to highlight key phrases in your notebook throughout the year but make summaries of topics before an examination. The strategies you choose will depend on personal preference and may not be the same as those used by your classmates.

Effective study skills involve more than the learning strategies you use. Equally important is when you use those skills. It is more effective to apply study skills throughout the year, revising and consolidating your knowledge as you progress through the course, rather than doing a rushed cram just before the examination. Revise your work regularly. Being organised and setting up a study plan is key to reducing your stress.

GETTING ORGANISED

To get yourself organised, try the following steps.

- Use a diary to write down all homework and assessment tasks as soon as you get them. Note due dates and what is required.
- Be specific about the tasks you need to do. Rather than writing 'do biology', it is more effective to note things such as which questions to answer and which page to look at in your student book.
- Write a list of everything you need to do each day. Tick off or cross out items as you complete them.
- Break down larger tasks into smaller separate parts that are manageable.
- Make sure your lists and planners are realistic. Do not set yourself more than you can actually do.

STUDY TECHNIQUES

Studying requires concentration. Remove any distractions and factor in some breaks. Allow a 10-minute break every hour. Vary your study technique depending on the content to be learned and your personal preference. Although you may have already found a study technique that works for you, also consider the following options.

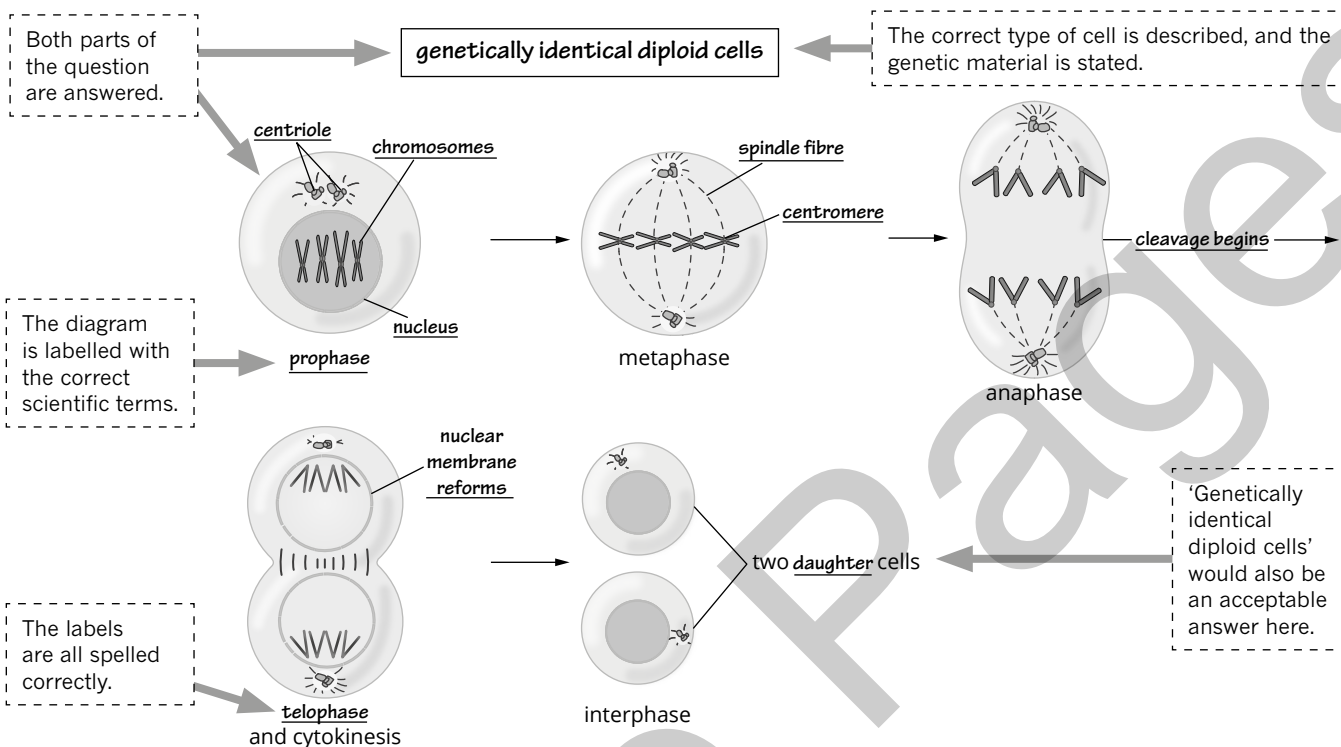
Study technique	Tips
Highlighting FUNGI Fungi often look like plants but <u>do not use photosynthesis</u> . Instead <u>they feed on dead and decaying material</u> , breaking it down further and helping chemical elements to return to the natural environment. <u>Mushrooms, toadstools, yeasts and moulds</u> are different types of fungi.	<ul style="list-style-type: none"> • Highlight or underline key points as you read your notes or text.
Summary notes ENZYMES Enzymes are: <ul style="list-style-type: none"> • composed of protein • substrate-specific • denatured by exposure to excessive heat • denatured by exposure to extremes of pH. 	<ul style="list-style-type: none"> • Create a list of key headings and add some dot points about each heading. • Write your own summary of the key ideas in each chapter. • Use headings and subheadings. • Underline key words and key phrases. • Use simple diagrams. • Remember, the most effective chapter summaries are clear, concise and uncluttered.
Diagrams 	<ul style="list-style-type: none"> • Diagrams can be used as a summary of key concepts. • Diagrams are useful memory triggers. • Diagrams cover a lot of information in a visual way, with minimal text.

High-level response

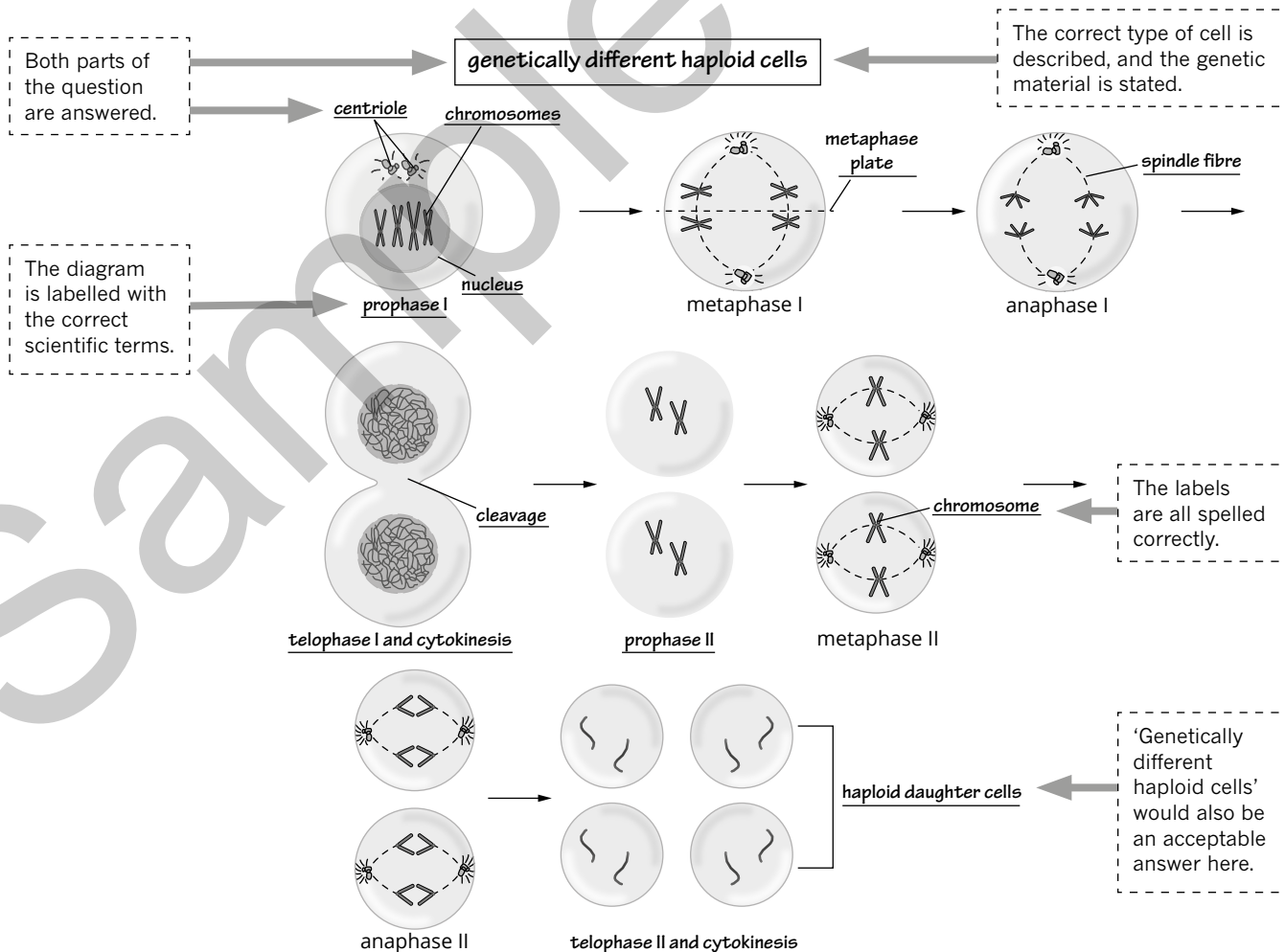
Question 1 (12 marks)

a DNA replication occurs during the synthesis phase of the cell cycle. This is followed by nuclear and cell division. Describe the type of cells that result from mitosis and meiosis, shown below, and complete the labels in the diagrams provided.

i mitosis

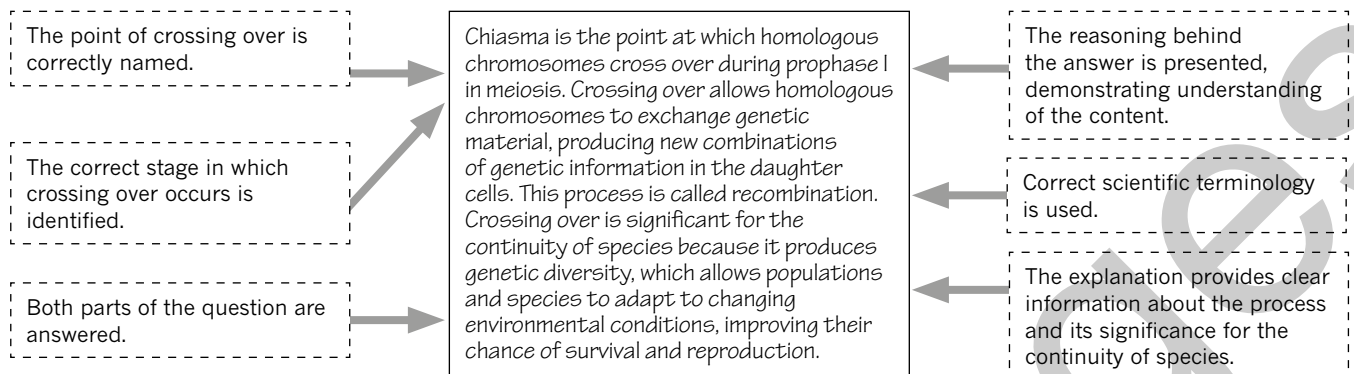


ii meiosis



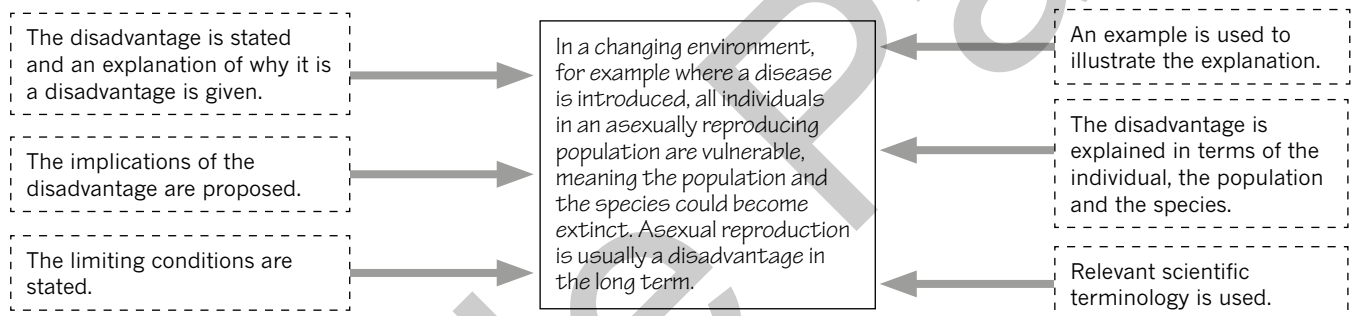
b Consider the image of two homologous chromosomes shown to the right.

Name the point at which these chromosomes cross over, and identify the stage named in part **a** in which this event occurs. Explain the significance of this event for the continuity of species.



c Identify and explain:

i one disadvantage of asexual reproduction



ii one advantage of sexual reproduction.

