

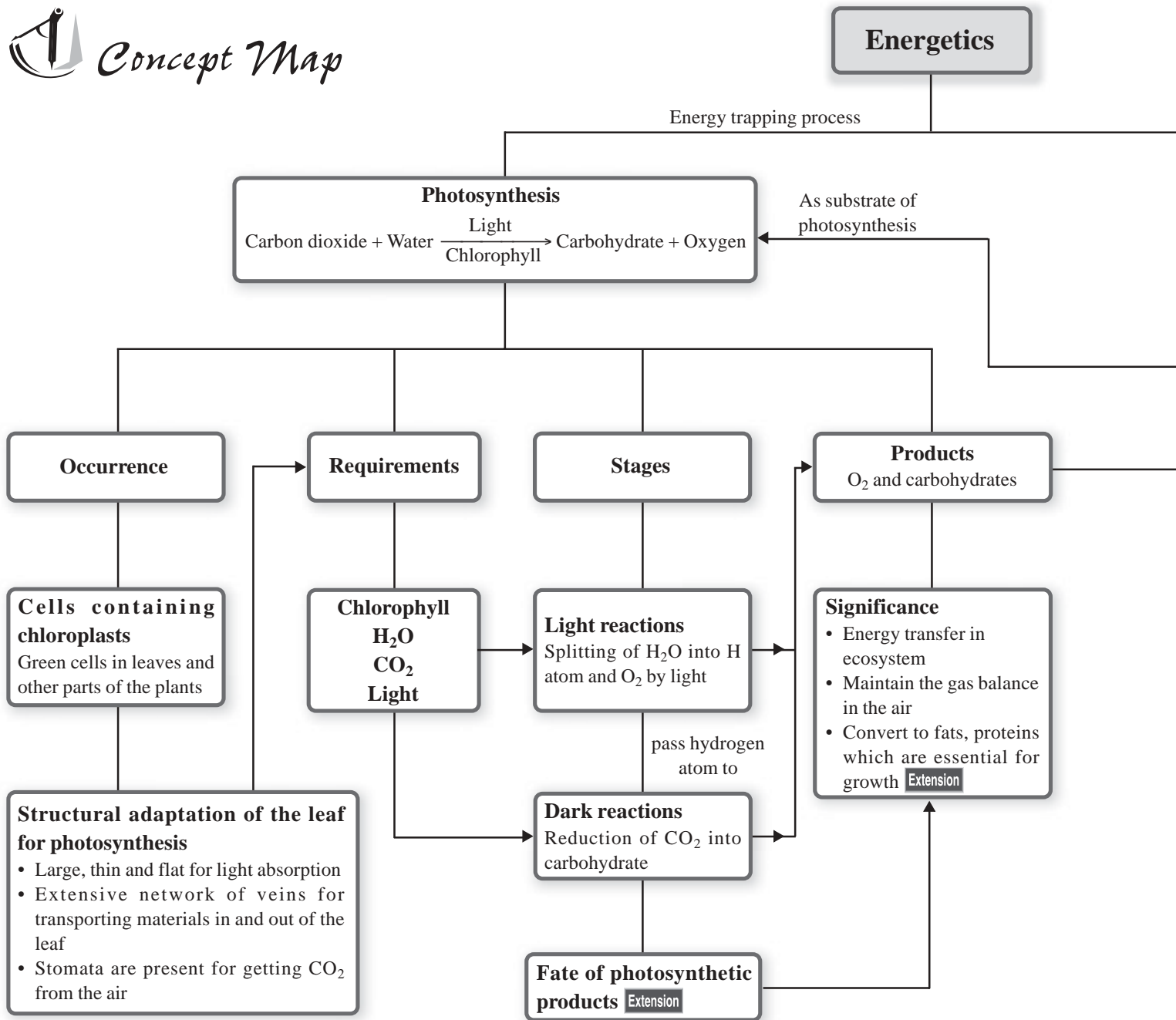
Comparison between NEW and OLD syllabuses

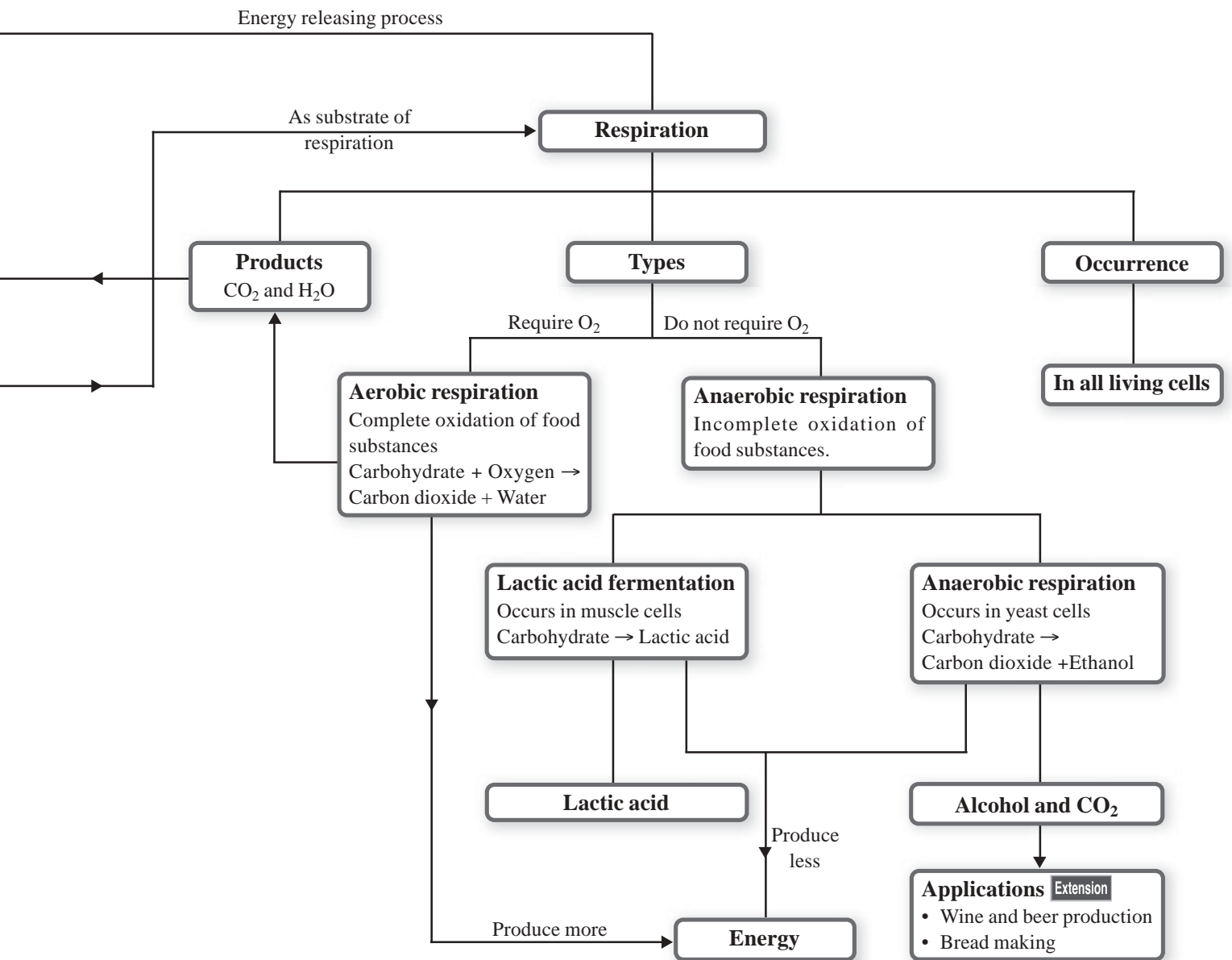
In the New Biology syllabus, some topics are newly added and some are removed. Moreover, the syllabus is divided into two parts: **core** and **extension**. Some difficult topics are grouped under the extension part and they will only be asked in Section B of both Papers 1 and 2.

(a) Topics added to the syllabus

Sections	Topics added
The Cell	<ul style="list-style-type: none"> • Discovery of cells • Functions of mitochondrion
Organisms and Their Environment	<ul style="list-style-type: none"> • Classification of organisms into five kingdoms • Virus as a non-cellular entity • Concept of sustainable development
Energetics	—
Obtaining Essentials for Life	<ul style="list-style-type: none"> • Using data logger to study: (P) <ul style="list-style-type: none"> – the effect of light on gas exchange; and – the change in breathing rate during exercise. • Test for glucose using Clinistix paper (P) • Test for protein using Albutix paper (P) • Health problems resulting from improper diet • Periodontal disease and its prevention
Coordination and Response	<ul style="list-style-type: none"> • General effects of glucagon • Similarities and differences between hormonal and nervous coordination • Feedback mechanism in homeostasis
Regulation and Defence	<ul style="list-style-type: none"> • Regulatory role of glucagon in blood glucose level
Reproduction and Growth	<ul style="list-style-type: none"> • Structure of ovum • Formation of identical twins and fraternal twins • Advantages of breast-feeding
Genetics and Evolution	<ul style="list-style-type: none"> • Down syndrome, colour blindness and G6PD deficiency • Human Genome Project • Genetic engineering • Evolution

3 Energetics





3.1 Photosynthesis



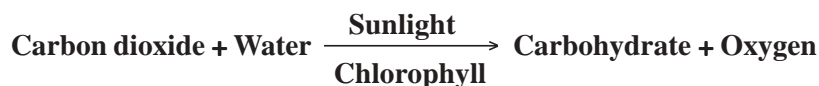
Learning Focus

- Explore the significance of photosynthesis in converting light energy to chemical energy in plants.
- Understand the requirements for photosynthesis, including light, carbon dioxide, water and chlorophyll.
- Learn the photosynthetic process involving the splitting of water and the formation of carbohydrate.
- Explore the fate of photosynthetic products in plants. **Extension**
- Explore the effects of environmental factors on the rate of photosynthesis. **Extension**
- Understand the relationship between the structural features of leaf and its adaptation as a photosynthetic organ.
- Design and perform investigations to:
 - detect the photosynthetic product;
 - study the requirements for photosynthesis; and
 - study the effects of environmental factors on the rate of photosynthesis. **Extension**

- Green plants are photosynthetic autotrophs (自養生物) which use light energy to make complex food from simple inorganic substances.
- Not all autotrophs use light energy to produce food.
- Some autotrophic bacteria can obtain chemical energy through oxidation.

A. Definition of photosynthesis

- Photosynthesis (光合作用) is an anabolic process in which green plants produce complex organic food (e.g. glucose) from simple inorganic substance.
- Plants use chlorophyll (葉綠素) to absorb solar energy.
- Oxygen is released as a by-product.
- Word equation for photosynthesis:



- Chemical equation for photosynthesis (for reference only):



Reminder

All plants containing chlorophyll can carry out photosynthesis. But not all of them may be green in colour.



Reminder

- Only word equation is required in the HKCEE.
- Oxygen released in photosynthesis comes from water rather than carbon dioxide.

B. Requirements for photosynthesis

There are four requirements for photosynthesis, they are light, carbon dioxide, chlorophyll and water.

- Light is a source of energy to drive photosynthesis. It usually comes from the Sun.
- Carbon dioxide is a raw material of photosynthesis. It comes from the surrounding air and respiration of plant cells.
- Chlorophyll is a green pigment which traps light energy and converts it to chemical energy.
- Water is a raw material of photosynthesis. It comes from soil, moving up the stem and into the leaf.

C. Processes of photosynthesis

(a) Light reaction (光反應) (photolysis of water)

- Light and chlorophyll are required at this stage.
- The chlorophyll traps the light energy.
- The energy is used to split water molecules into hydrogen atoms and oxygen molecules.



(b) Dark reaction (暗反應)

- Light and chlorophyll are not required at this stage.
- The hydrogen atoms produced in light reaction combine with carbon dioxide to form carbohydrates.

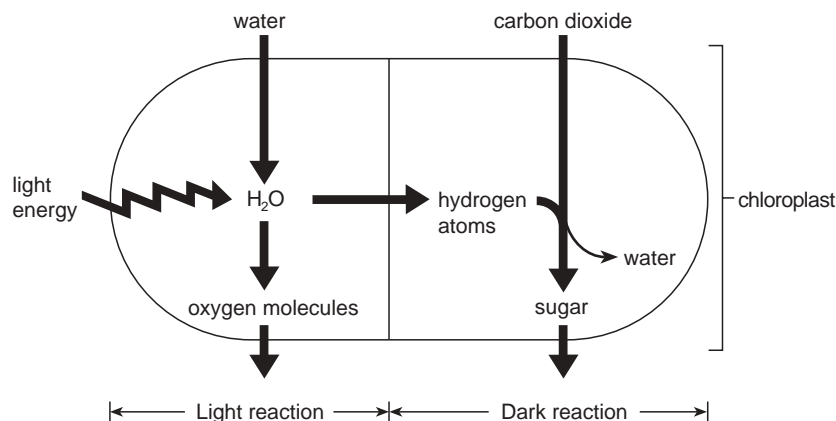
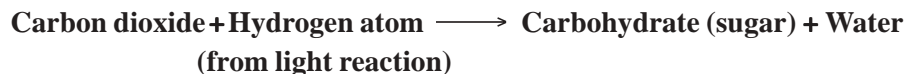


Figure 3.1



Reminder
During light reaction, hydrogen atoms, instead of hydrogen gas, are produced.



Reminder
Dark reaction takes place just after the light reaction.

Guided Example 6

The diagram below shows the feeding relationship between certain organisms which are found in grassland:

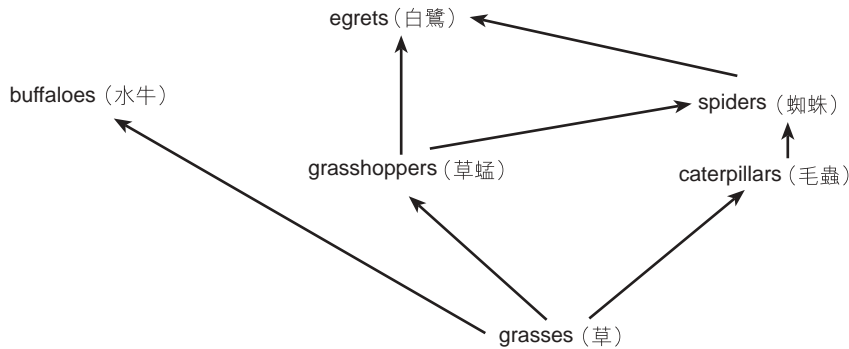


Figure 2.58

- (a) Name the relationship between
- grasshoppers and caterpillars;
 - caterpillars and spiders; and
 - egrets and spiders.
- (b) The diagram below shows an association of the egret and buffalo:

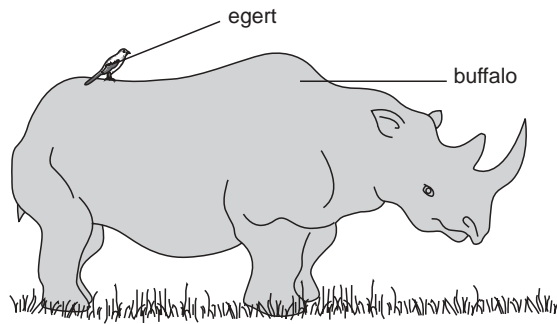


Figure 2.59

The egret feeds on the insects hidden in the grass which are disturbed by the buffalo when it move around the grass. Name the association between the egret and the buffalo.

Suggested Answer

- Competition
 - Predation
 - Predation and competition
- Commensalism

 *Reminder*

Two species living in the same area may have more than one type of interaction.

 *Reminder*

The buffalo neither benefits nor is harmed in this association.

1. Boil a glucose solution and cool it to room temperature.
2. Mix the glucose solution with the yeast in a sterilized flask.
3. Pour a layer of liquid paraffin oil on the top of the solution.
4. Prepare a control by setting the same apparatus but using killed yeast.
5. Leave the set-up for a few hours and record the results.

 **Reminder**

Sterilization kills other microorganisms which, if do exist, may affect the normal growth of yeast cells.

• **Result**

	Bicarbonate indicator	Temperature	Smell of alcohol
Experimental set (with living yeast)	Turns from orange to yellow (Carbon dioxide is released.)	Rises (Heat is released.)	Yes
Control set (with killed yeast)	Remains orange	No change	No

Table 3.9

• **Explanation**

- Yeast cells carry out anaerobic respiration (fermentation) in the presence of glucose.
- Carbon dioxide, heat energy and alcohol are produced during the process.

Glossary

aerobic respiration	需氧呼吸	lactic acid fermentation	乳酸發酵
air space	氣室	light reaction	光反應
alcoholic fermentation	酒精發酵	limiting factor	限制因素
anaerobic respiration	缺氧呼吸	lower epidermis	下表皮
ATP	三磷酸腺苷	mesophyll	葉肉
autotroph	自養生物	mitochondrion	粒腺體
breathing	呼吸	oxygen debt	氧債
chlorophyll	葉綠素	palisade tissue	柵狀組織
chloroplast	葉綠體	phloem	韌皮部
cuticle	角質層	photosynthesis	光合作用
cytoplasm	細胞質	respiration	呼吸作用
dark reaction	暗反應	sodium hydrogencarbonate	碳酸氫鈉
destarching	脫澱粉	spongy tissue	海綿組織
differential air thermometer	差示空氣溫度計	stoma / stomata	氣孔
epidermis	表皮	upper epidermis	上表皮
ethanol	乙醇	variegated leaf	斑葉
guard cell	保衛細胞	vein	葉脈
hydrogencarbonate indicator	碳酸氫鹽指示劑	xylem	木質部
lactic acid	乳酸	yeast	酵母菌

Examination Question Analysis

Topics	Structured Questions (Year)	Multiple-choice Questions (Year)
Significance of photosynthesis	—	93(17)
Requirements for photosynthesis	97(4a)	96(10)
Processes of photosynthesis	95(4aiii)	93(23), 94(7), 01(13), 02(05), 03(7, 8), 04(8, 9), 05(10)
Factors affecting photosynthesis Extension	01(2bi, ii), 04(2b), 06(8a)	93(16)
Utilization of photosynthetic products Extension	04(4ciiii)	93(15), 94(8), 98(12), 02(21)
Leaf structure	94(2bi), 95(4ai, ii), 98(2aii), 00(1b), 02(2bi, ii), 04(4ci, iii)	95(10), 97(17, 18), 03(27, 28)
Significance of respiration	—	—
Aerobic respiration	91(4a), 96(3c), 98(3c), 99(4b), 01(2biii)	96(17, 18), 00(04), 05(15)
Alcoholic fermentation	94(1b)	96(22, 23), 98(17, 18, 19), 00(05), 02(07), 03(24, 25), 06(9)
Lactic acid fermentation	04(4a)	00(4), 01(6), 02(07, 32, 33), 03(9), 06(09)
Importance of anaerobic respiration Extension	97(4bi, ii, iii)	00(05)
Comparison of aerobic and anaerobic respiration	—	—
Experiments on heat production	—	93(24, 25)
Experiments on CO ₂ production	98(3c)	06(21, 22)
Experiments on O ₂ consumption	91(4a), 96(3c), 99(4b), 01(2biii)	05(6, 7), 06(19, 20)

Demonstration

Paper I Structured Questions

Section A

1. The following paragraph describes the two main phases of photosynthesis. Complete the paragraph with suitable words selected from the list below:

air	chloroplast	water
chlorophyll	nitrogen fixation	carbon fixation
oxygen	nitrogen	hydrogen
carbon dioxide	enzyme	nitrate
light reaction	respiration	

Photosynthesis has two main phases. During the light-dependent stage, light energy is trapped by (a) _____ molecules. Some of the energy is used to split water molecules into (b) _____ atoms and (c) _____ gas. The (d) _____ is used in the light-independent stage as a reducing power. In the light-independent stage, the reducing power produced in light reaction combine with (e) _____ to form a simple sugar. This stage is also known as (f) _____.

(6 marks)

Total: 6 marks

Suggested Answer

- | | |
|---------------------|---|
| (a) chlorophyll | 1 |
| (b) hydrogen | 1 |
| (c) oxygen | 1 |
| (d) hydrogen | 1 |
| (e) carbon dioxide | 1 |
| (f) carbon fixation | 1 |

Paper II Multiple-choice Questions

Section A

1. The following table lists some features of three animals X, Y and Z:

	Animals		
	X	Y	Z
Backbone	✓	x	✓
Scales	x	x	✓
Lungs	✓	x	✓

Key: ✓ = present
x = absent

Table 2.21

The three animals are probably

- | | X | Y | Z |
|----|----------|------------|------------|
| A. | rabbit | jelly fish | sparrow |
| B. | frog | jelly fish | salamander |
| C. | frog | goldfish | snake |
| D. | starfish | goldfish | turtle |

Guidelines

Both X and Z are vertebrates while Y is an invertebrate. Note that a salamander is an amphibian and its body is not covered with scales.

Answer: A

2. Which of the following pairs of animals are correctly classified?

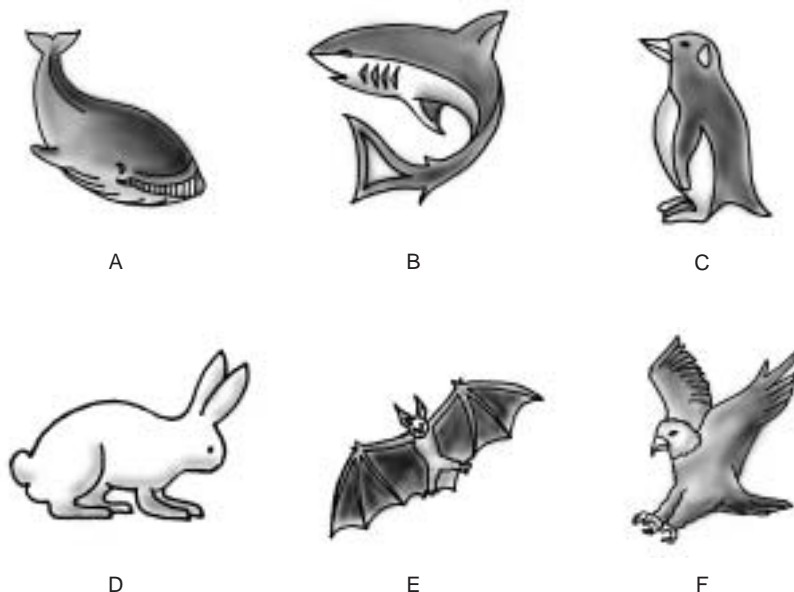


Figure 2.75

Practice

Paper I Structured Questions

Section A

1. The following paragraph describes the energy flow within an ecosystem. Complete the paragraph with suitable words.

The relationship between specific species of organisms can be shown in sequence according to their feeding habits. Such a sequence is called a (a) _____. In such feeding sequence, each stage is known as a feeding or (b) _____ level. There are rarely more than five levels in each feeding sequence because there is not enough energy to support more. Transfer of energy is inefficient because energy is (c) _____ at each feeding level due to (d) _____, excretion and egestion. Pyramids of numbers represent the (e) _____ at each feeding level. Their main disadvantage is that they can be (f) _____ and fail to give information of energy change through the feeding sequence.

(6 marks)

Total: 6 marks

2. The diagram below shows four types of cells. Cells A and B are taken from two different multicellular organisms while both cells C and D are unicellular organisms.

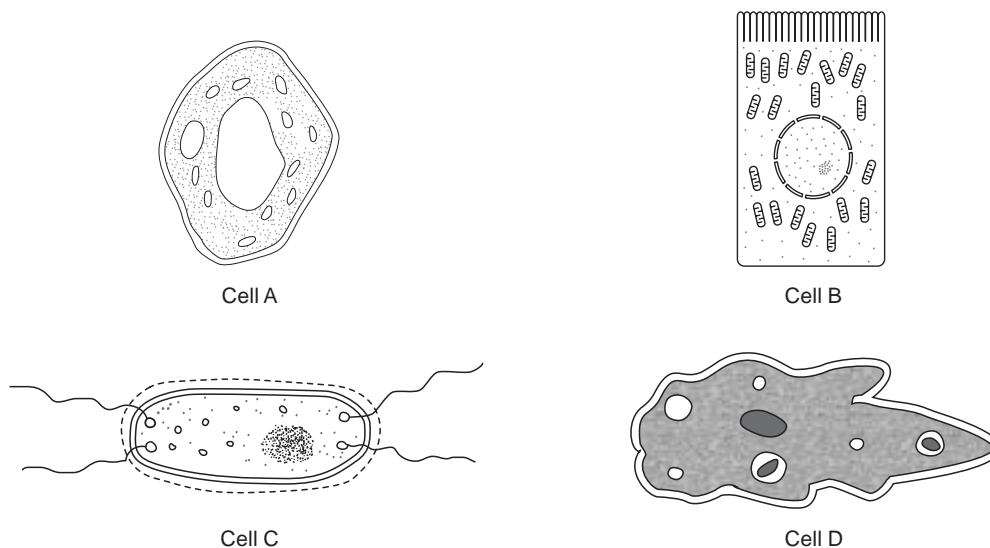


Figure 2.79

- (a) Name the kingdom to each organism belongs. (4 marks)
- (b) According to the diagram above, state **one** feature of each cell which is characteristic of the kingdom. (4 marks)

Total: 8 marks