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	• Discovery of cells • Functions of mitochondrion
Organisms and Their Environment	• Classification of organisms into five kingdoms • Virus as a non-cellular entity • Concept of sustainable development
Energetics	——
Obtaining Essentials for Life	• Using data logger to study: (P) – 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 Albustix paper (P) • Health problems resulting from improper diet • Peridontal disease and its prevention
Coordination and Response	• General effects of glucagon • Similarities and differences between hormonal and nervous coordination • Feedback mechanism in homeostasis
Regulation and Defence	• Regulatory role of glucagon in blood glucose level
Reproduction and Growth	• Structure of ovum • Formation of identical twins and fraternal twins • Advantages of breast-feeding
Genetics and Evolution	• Down syndrome, colour blindness and G6PD deficiency • Human Genome Project • Genetic engineering • Evolution

Key: (P) Practical work

6.2 Osmoregulation and excretion

Learning Focus

- State the functions of various parts of the urinary system.
- Recognize the osmoregulatory and excretory functions of various structures of the kidney. **Extension**
- Recognize the structure of a nephron. **Extension**
- Describe the process of ultrafiltration and reabsorption in the formation of urine. **Extension**

A. Water loss and water gain in the body

- In order to maintain a constant water potential of the body fluid, the amount of water loss must be balanced by water gain.
- The diagram below shows the ways of water gain and water loss in an adult over 24 hours:

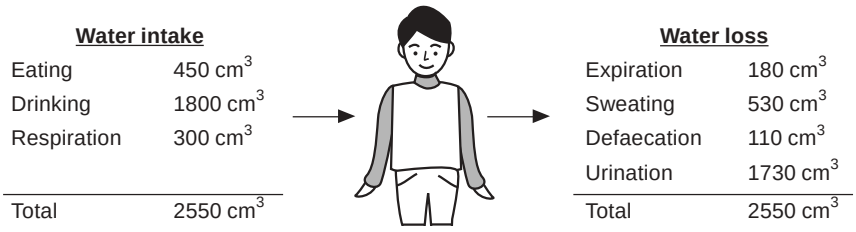

Figure 6.2

- The above data reveals that most of the water loss is due to urination.
- Since the kidney is responsible for regulating the amount of water loss in urine, it is the most important organ in controlling the body's water content.

Reminder

Besides urination, drinking water also plays an essential role in water balance.

Glossary

afferent arteriole	輸入小動脈
antibody	抗體
antigen	抗原
antitoxin	抗毒素
arteriole	小動脈
blood glucose level	血糖水平
Bowman's capsule	鮑曼氏囊
collecting duct	集尿管
cortex	皮質
dermis	真皮
diabetes mellitus	糖尿病
distal convoluted tubule	遠曲小管
efferent arteriole	輸出小動脈
epidermis	表皮
erector muscle	豎毛肌
excretion	排泄作用
glomerular filtrate	腎小球過濾液
glomerulus	腎小球
glucagon	高血糖素
hair	毛髮
hair follicle	毛囊
homeostasis	體內平衡
inflammatory response	炎性反應
insulin	胰島素
keratin	角蛋白
kidney	腎臟
liver	肝臟
loop of Henle	亨利氏套
lymphocyte	淋巴細胞
medulla	髓質
melanin	黑色素
memory cell	記憶細胞
negative feedback	負反饋
nephron	腎元
non-specific body defence	非特異性身體防禦機理
osmoregulation	滲透調節
pancreas	胰臟
pathogen	病原體
pelvis	腎盂
phagocyte	吞噬細胞
phagocytosis	吞噬作用
primary response	原發反應
proximal convoluted tubule	近曲小管
renal artery	腎動脈
renal vein	腎靜脈
sebaceous gland	皮脂腺
sebum	皮脂
secondary response	繼發反應
selective reabsorption	選擇性重吸收
skin	皮膚
specific body defence	特異性身體防禦機理
sphincter muscle	括約肌
subcutaneous fat	皮下脂肪
sweat gland	汗腺
ultrafiltration	超濾作用
urea	尿素
ureter	輸尿管
urethra	尿道
urinary bladder	膀胱
urinary system	泌尿系統
urine	尿液
vaccination	疫苗接種
vaccine	疫苗
vasoconstriction	血管舒張
vasodilation	血管收縮

Practice

Paper I Structured Questions

Section A

1. The diagram below shows a section through the skin of an animal:

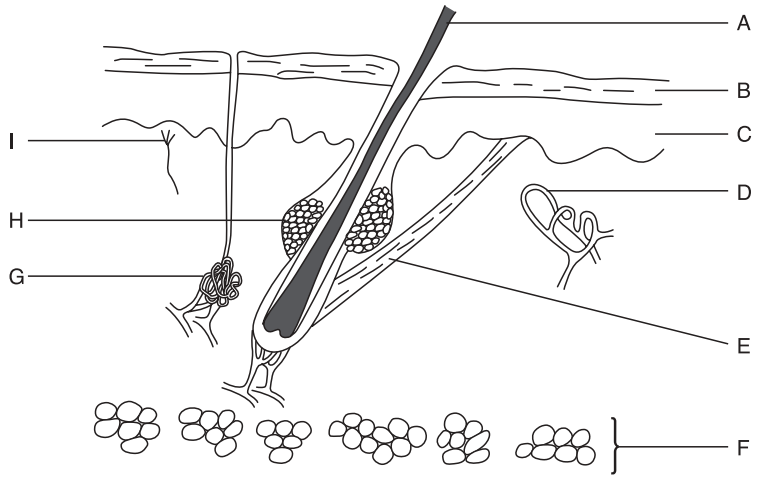

Figure 6.30

(a) Using the letters shown in the diagram, indicate:
  (i) a part whose function is motor. (2 marks)
  (ii) a part whose function is sensory. (2 marks)
  Explain your answer. Hint 1

(b) State, using the letters in the diagram, *two* structures which suggest that this skin section belongs to a mammal. Hint 2 (2 marks)

(c) (i) Name a part which is made up of dead cells. (1 mark)
  (ii) Give *one* reason to explain why severe damage to this part may cause death. Hint 3 (1 mark)

Total: 8 marks

7 Reproduction and Growth

Concept Map

- **Reproduction and Growth**
  - **Cell division**
    - **Mitotic cell division**
      - **Number of daughter cells**
        - Two
      - **Type of daughter cells**
        - Somatic cells
      - **Chromosome number in daughter cells**
        - Diploid
      - **Significance**
        - Growth
        - Repair
        - Asexual reproduction
    - **Meiotic cell division**
      - **Number of daughter cells**
        - Four
      - **Type of daughter cells**
        - Gametes
      - **Chromosome number in daughter cells**
        - Haploid
      - **Significance**
        - Formation of gametes
        - Genetic variation
  - **Types of reproduction**
    - **Asexual Reproduction** Extension
      - **Binary fission**
        - In bacteria
      - **Vegetative propagation in flowering plants**
        - Stem tuber
        - Rhizome
        - Bulb
        - Corm
    - **Sexual Reproduction**
      - **In flowering plants** Extension
        - **Structures of flower**
          - **Calyx**
          - **Corolla**
          - **Stamen**
            - Anther
            - Filament
          - **Carpel**
            - Stigma
            - Style
            - Ovary
          - **Nectary**
        - **Process**
          - **Pollination**
            - Self-pollination
            - Cross-pollination
              1. By wind
              2. By insects
          - **Fertilization**
          - **Formation of seeds and fruits**
          - **Seed germination**
      - **In mammals**
        - **Structure of human reproductive system**
          - **In male**
            - Testes
            - Epididymis
            - Sperm duct
            - Sex glands
            - Penis
          - **In female**
            - Ovary
            - Oviduct
            - Uterus
            - Cervix
            - Vagina
        - **Process**
          - **Ovulation**
          - **Transfer of sperms and egg cells**
          - **Fertilization**
          - **Implantation**
          - **Development of zygote**
          - **Birth**
          - **Parental care**
            - **Breast-feeding and its advangtages** Extension
        - **Birth control methods**
          - prevented by **Contraceptive pills**
          - prevented by **Barrier methods**
            - Condom
            - Female condom
            - Diaphragm
          - **Surgical methods**
            - Vasectomy
            - Tubal ligation
          - prevented by Intrauterine device (IUD)
  - **Growth and development** Extension
    - **Growth**
      - **Definition**
        - Irreversible increase in protoplasm
      - **Processes**
        - Cell division
        - Cell elongation
      - **Measurements of growth**
        - Length
        - Area
        - Volume
        - Fresh mass
        - Dry mass
    - **Development**
      - **Definition**
        - Increases in complexity
      - **Process**
        - Cell differentiation

Guided Example 4

The diagram below shows the longitudinal sections of a bean pod and of the flower from which the bean pod developed:

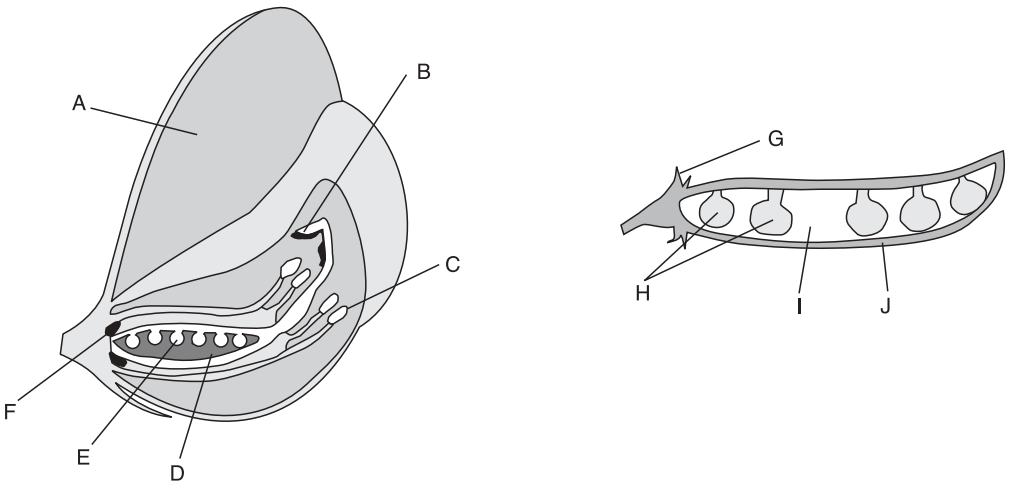

Figure 7.37

(a) With reference to the diagram only, state whether the flower is wind-pollinated or insect-pollinated. Explain your answer.

(b) (i) Name H and J.

(ii) From which parts in the bean flower have these two parts developed?

(c) Structure H is not found at position I. Suggest ***one*** possible reason for this phenomenon.

(d) State ***three*** functions of the bean pod.

Reminder

In part (d), the bean pod is green and contains chlorophyll.

Suggested Answer

(a) Insect-pollinated flower
This is because nectary / structure F is present, which produces *nectar* to attract insects.
OR Stigma / Structure B and anther / structure C are enclosed within petals / structure A, so that the insect will have close contact with the anthers and stigmas when it tries to reach the nectaries.

(b) (i) H is a seed.
J is the fruit wall / pericarp.
(ii) H has developed from E.
J has developed from D.

(c) The ovule at position I was not fertilized.

(d) It helps to disperse the seeds.
It protects the seeds.
It carries out photosynthesis to produce food.

Reminder

Answers such as 'the flower is large, colourful and has scent' are NOT acceptable.

G. Identical twins and fraternal twins

- There are two types of twins （雙胞胎）:

  (1) Identical twins（同卵雙胎）
  - They develop from a single fertilized egg. The zygote separates and develops into two embryos at an early stage of cell division. The twins are of the same sex and have the same genotypes.

  (2) Fraternal twins (non-identical twins, 異卵雙胎)
  - They result from the fertilization of two separate eggs. The twins may be of different sex and have different genotypes.

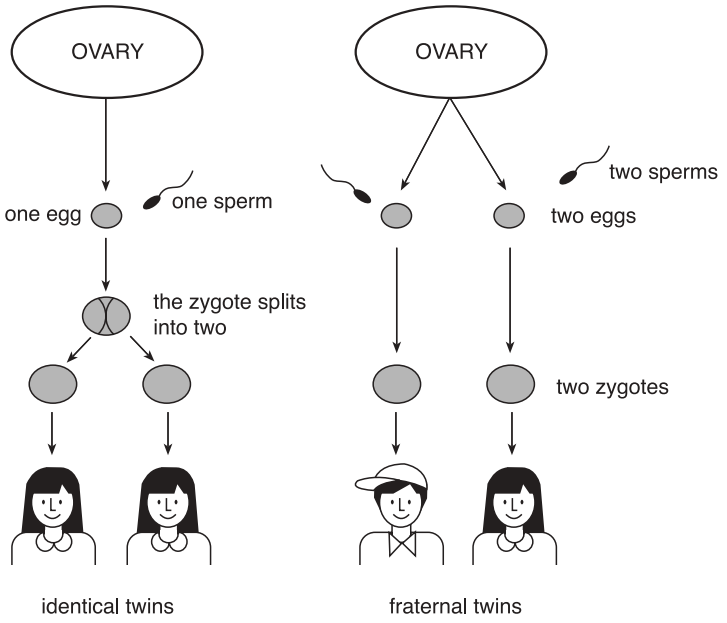

Figure 7.46

Reminder

Some students wrongly think that the identical twins arise from two sperms fertilizing one ovum.

H. Development of the zygote

(a) Implantation

- After fertilization, the zygote undergoes repeated mitotic cell division on its way towards the uterus to form a hollow ball of cells, called an embryo（胚胎）.
- The developing embryo moves down to the uterus and eventually embeds itself in the uterine lining. This process is called implantation（植入）.
- The placenta（胎盤）then forms between the embryo and the uterus wall.

Exam Questions Analysis

Topics	Structured Questions (Year)	Multiple-choice Questions (Year)
Cell division	94(3ci - ii), 99(1ai - ii), 02(2aiv)	93(3, 4), 95(4), 96(9, 46), 97(7), 99(41), 00(36), 03(11, 57)
Asexual reproduction	98(3biv), 99(1aiii - iv), 01(1a)	93(42, 43), 94(42), 95(45), 97(42, 43), 99(47, 48, 49), 02(24), 04(42)
Structures and functions of floral parts	98(3bi), 01(4ci)	95(46, 47), 96(47), 02(18), 03(58, 59)
Pollination and fertilization	97(2bi), 98(3bii), 00(2ci), 01(4cii)	93(45), 94(43), 95(42, 47), 99(42), 02(55)
Formation of seeds and fruit	97(2bii), 01(4ciii)	93(46), 94(44, 45, 46, 47), 95(43, 44), 96(48, 49, 50, 51), 97(39), 98(21, 42, 47, 48), 98(35, 36), 99(43, 44, 45), 02(57, 58), 03(58, 59), 04(41)
The human reproductive system	95(1c)	93(44), 94(40), 96(41, 42, 46), 97(40), 97(44, 45), 98(37), 00(37, 38, 39), 03(44, 45), 01(21, 33, 34), 02(18)
The menstrual cycle	93(3ci - iii), 99(3cii)	96(44, 45)
Development of the embryo	00(1aiv - v), 94(4bi - ii), 94(4biv)	95(49), 96(43), 97(58), 98(35, 36), 00(54), 01(35, 36), 03(42), 04(48)
The birth process	03(2bii), 99(3ci), 94(4biii)	95 (48), 97(47), 04(47)
Birth control	93(3civ), 96(2biii), 99(3ciii), 02(2ai - iii), 04(2a)	94(41), 96(39, 40), 97(46), 98(45, 46), 01(37)
Comparison between asexual reproduction and sexual reproduction	98(3biii)	00(51), 02(20)
Growth and development	04(1b)	97(60), 98(49, 50), 00(44), 01(45, 46, 52, 53), 03(60), 02(50, 56, 60)

Paper II Multiple-choice Questions

Section A

1. Which of the following is a correct description of mitosis and meiosis?

   A. The chromosomes are duplicated during the processes of mitosis and meiosis.
   B. Mitosis and meiosis are two different types of cell division.
   C. Both mitosis and meiosis produce diploid daughter cells.
   D. Mitosis produces new cells for growth and repair while meiosis produces gametes for sexual reproduction.

   Answer: D

Guidelines
Mitosis and meiosis involve nuclear division only, not the division of cytoplasm.

2. Which of the following is / are male secondary sexual characteristics?

   (1) Appearance of penis
   (2) Widening of the hips
   (3) Broadening of the shoulders

   A. (1) only
   B. (3) only
   C. (2) and (3) only
   D. (1), (2) and (3) only

   Answer: B

Guidelines
Secondary sexual characteristics refers to the sex-specific physical features of the body developed at puberty.

3. The diagram below shows the main stages of sexual reproduction:

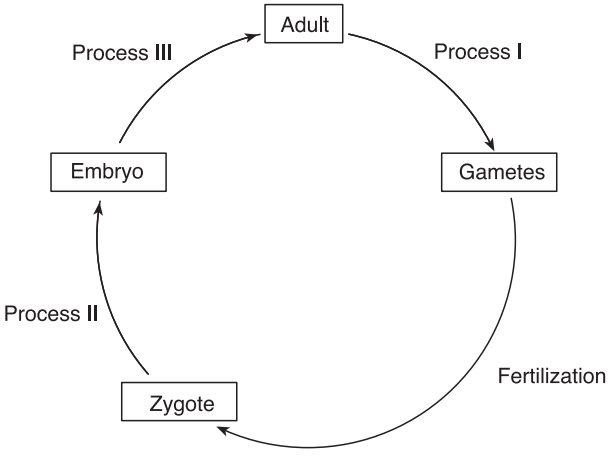

Figure 7.79

The types of cell division involved in processes I, II and III are:

	Process I	*Process II*	*Process III*
A.	Mitotic cell division	Mitotic cell division	Mitotic cell division
B.	Mitotic cell division	Meiotic cell division	Meiotic cell division
C.	Meiotic cell division	Mitotic cell division	Mitotic cell division
D.	Meiotic cell division	Meiotic cell division	Meiotic cell division

Answer: C

Guidelines
Meiotic cell division only takes place during the formation of haploid cells (i.e. gametes).

Demonstration

Paper I Structured Questions

Section A

1. A homozygous black mouse was crossed with a homozygous white mouse. All the F_1 offspring were black in colour.

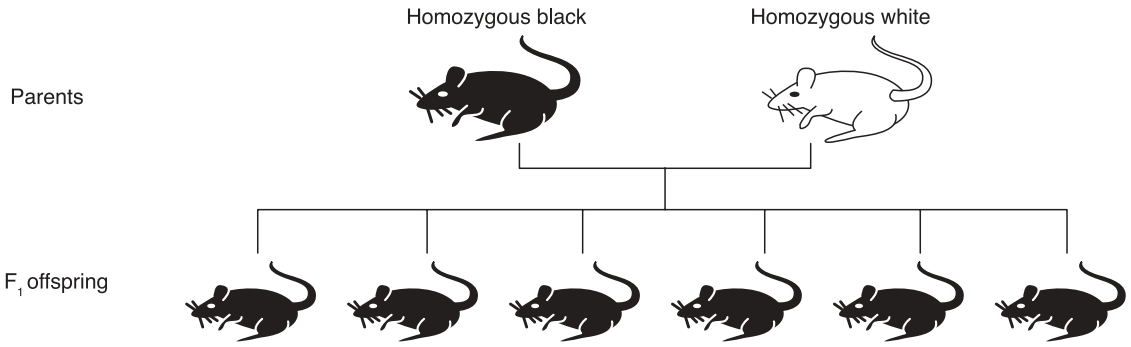

Figure 8.24

(a) Which of the characters, black coat colour or white coat colour, is dominant? (1 mark)

Guidelines

F_1 offspring receive both alleles for body colour from their parents (i.e. in the heterozygous state). Only the allele for dominant characters can be expressed in heterozygous individuals.

(b) The F_1 offspring were back-crossed to the white-coloured parent. Deduce the ratio of the different phenotypes obtained in such a cross. Explain your answer with the aid of a genetic diagram. (Use 'B' to represent the allele for the dominant character and 'b' for the recessive character.) (4 marks)

(c) A man tried to produce a mice without a tail by surgical removal of the parents' tails before mating. State and explain whether this method will achieve his aim. (2 marks)

Total: 7 marks

Guidelines

Only the genetic variations occurring in the reproductive cells are heritable.

Suggested Answer

(a) Black coat colour 1

(b) F_1 Bb x bb 1

G B b b 1

F_2 BB bb 1

The phenotypic ratio = Black : White = 1 : 1 1

(c) No 1

Removing the tail would not change the genetic composition of the gametes and therefore it is not heritable. 1

Index

Question Commands

The following table lists the question command(s) which showing the requirements of answering questions:

<table>
<tr><th>Question commands</th><th>Examples</th></tr>
<tr><td>Account for * ...
(Give reasons for, but do NOT calculate)</td><td>The table below shows the change in total dry mass in seeds before and after germination:
<table><tr><td></td><td>Seeds</td><td>Seedlings formed after germination</td></tr><tr><td>Total dry mass</td><td>39.2</td><td>28.4</td></tr></table>
Account for the difference in total dry mass between the seeds and the seedlings after germination.
Correct answer: Some stored food in the seeds is used in respiration.
Wrong answer: 39.2 g – 28.4 g = 10.8 g</td></tr>
<tr><td>Arrange in ascending order ...
(The lowest first and the highest last)
Arrange in descending order ...
(The highest first and the lowest last)</td><td>Arrange the complexity of the following terms in ascending order :
Tissue, cell, system, organ
Correct answer: Cell, tissue, organ, system
Wrong answer: System, organ, tissue, cell
(Remarks: No mark will be awarded for descending order.)</td></tr>
<tr><td>Calculate ...
(Show all the steps of calculation and give the answer with appropriate unit)</td><td>A boy breathes three times per ten seconds, calculate the rate of breathing of the boy.
Correct answer: Breathing rate of the boy
$= \frac{3}{10} \times 60$
= 18 breaths / min
Wrong answer: Breathing rate = 18</td></tr>
<tr><td>Compare ...
(Point out the similarities and / or differences between two or more subjects)</td><td>Compare the chromosome number of the sperm with that of the fertilized egg.
Answer: The chromosome number of the sperm is haploid (n) while that of the fertilized egg is diploid (2n).</td></tr>
<tr><td>Define / What is meant by ...
(State briefly the meaning of the term)</td><td>Define ‘dry weight’ of germinating seedlings.
Answer: The weight of germinating seedlings after removing all of the water from them.</td></tr>
</table>