INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL



**BIOLOGY**
**HIGHER LEVEL**
**PAPER 1**

Wednesday 15 November 2000 (afternoon)

1 hour

---

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

**1.** Which scientist first used the term *cell*?

A. Robert Hooke

B. Anton van Leeuwenhoek

C. Theodore Schwann

D. Rudolf Virchow

**2.** What is the only membranous structure inside a prokaryotic cell?

A. Mesosome

B. Ribosome

C. Mitochondrion

D. Rough endoplasmic reticulum

**3.** The table shows the normal concentration of two ions in red blood cells and in the surrounding plasma:

| | **concentration / mM dm$^{-3}$** | |
|---|---|---|
| **Ions** | **Red blood cells** | **Blood plasma** |
| Potassium ($K^+$) | 150 | 5 |
| Sodium ($Na^+$) | 26 | 144 |

What does this information show?

A. Sodium is actively transported out of the cell.

B. Sodium is transported out of the cell by diffusion, but potassium does not move.

C. Sodium moves into the red blood cells by diffusion and then potassium moves out by diffusion.

D. Osmosis is occurring.

**4.** Amino acids are used to synthesise proteins. What elements are contained in proteins?

A. carbon, hydrogen and oxygen

B. carbon, hydrogen, oxygen and sulphur

C. carbon, hydrogen, nitrogen and oxygen

D. carbon, hydrogen, nitrogen, oxygen and sulphur

**5.** Monosaccharides are the building blocks of polysaccharides. By which process are polysaccharides formed?

A. Addition of hydrogen

B. Removal of hydrogen

C. Hydrolysis

D. Condensation

**6.** Which property of enzymes makes them useful for biotechnology?

A. Enzymes work in a wide pH range.

B. Enzymes can increase the rate of specific reactions.

C. The active site of enzymes can bind many different substrates.

D. Enzymes are not easily denatured.

**7.** What is the arrangement of sub-units in a DNA nucleotide?

A. sugar – base – phosphate

B. sugar – phosphate – base

C. phosphate – sugar – base

D. sugar – phosphate – base – base – phosphate – sugar

**8.** What is the function of helicase in DNA replication?

I. Breaking hydrogen bonds between complementary bases
II. Forming hydrogen bonds between complementary bases
III. Unwinding the double helix

A. I only
B. I and III only
C. II and III only
D. III only

**9.** What is the difference between the alleles of a gene?

A. Their position on the chromosome
B. Their amino acid sequence
C. The number of codons that each contains
D. Their base sequence

**10.** In which substance(s) does gene mutation occur in animals?

I. DNA
II. RNA
III. Protein

A. I only
B. I and II only
C. I and III only
D. I, II and III

*The following table refers to question 11.*

| | **Blood Groups** | |
|---|---|---|
| Families | Child 1 | Child 2 |
| I. | AB | AB |
| II. | A | B |
| III. | O | O |

**11.** In which of the families could one parent have had blood group A and the other blood group B?

A. I only

B. I and II only

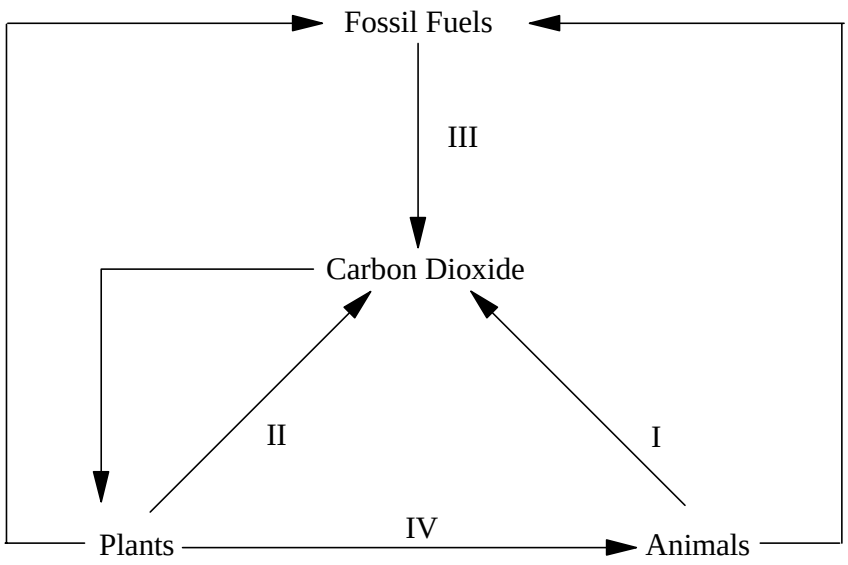
C. II and III only

D. I, II and III

**12.** What is the difference between detritivores and saprotrophs?

| | **Detritivores** | **Saprotrophs** |
|---|---|---|
| A. | Feed on living organic matter | Feed on dead organic matter |
| B. | Autotrophic | Heterotrophic |
| C. | Ingest organic matter and then digest it | Digest organic matter and then absorb it |
| D. | Found in communities | Found in ecosystems |

*The diagram below shows part of the carbon cycle. It refers to question 13.*




**13.** Which arrows show respiration?

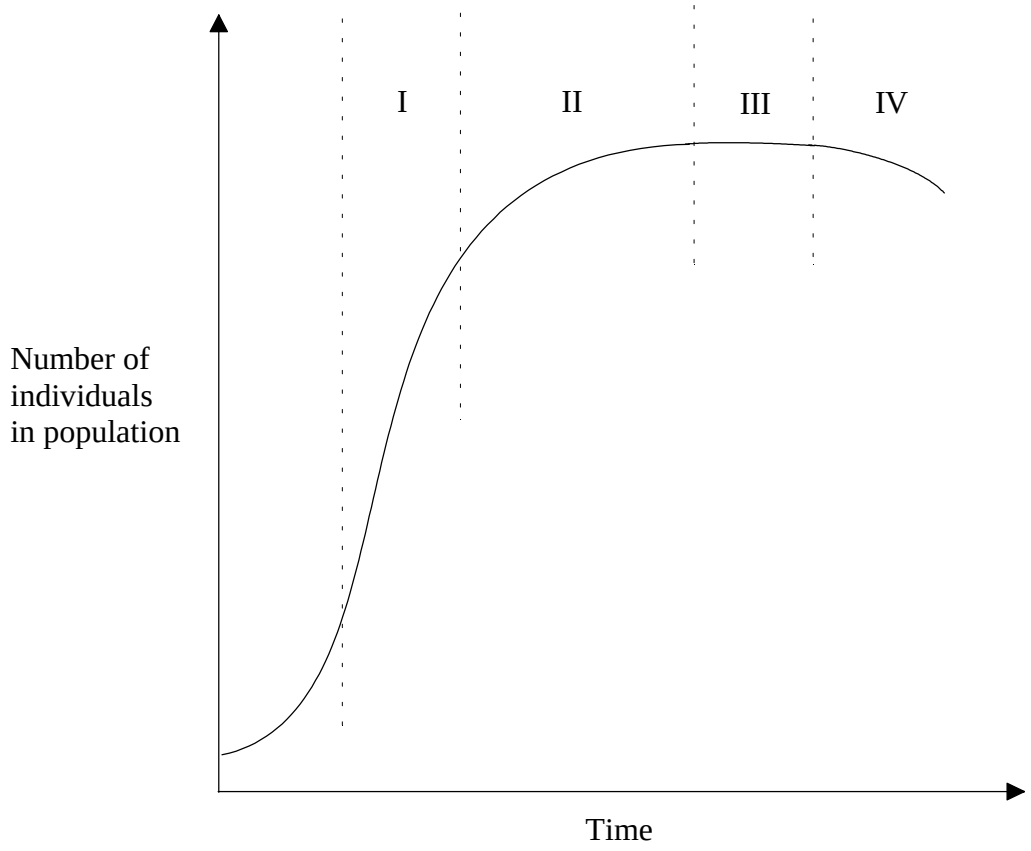
A. I only

B. I and II only

C. I, II and III only

D. I, II, III and IV

*The graph below represents a population growth curve. It refers to questions 14 and 15.*




**14.** In which phase do limiting factors **start** to have an effect?

A. I

B. II

C. III

D. IV

**15.** In which phase can natural selection occur?

A. All phases

B. Phases II, III and IV only

C. Phases III and IV only

D. Phase IV only

**16.** What is a similarity between the minerals and vitamins that are needed in the human diet?

A. They are complex substances which cannot be synthesised in the body.

B. Plants do not need them.

C. They are not formed by hydrolysis in the digestive system.

D. Babies do not need them.

**17.** Which is a reason for veins having thinner walls than equivalent arteries?

A. Veins carry less blood per minute than arteries.

B. Arteries help to pump blood but veins do not.

C. Veins have valves but arteries do not.

D. Veins have a wider lumen than arteries.

**18.** AIDS has many possible symptoms. Which feature is always present in AIDS sufferers?

A. Inactive antibodies

B. Reduced number of helper T-cells

C. Increased number of antibodies

D. Increased activity of phagocytic leucocytes

**19.** What effect does exercise have on the heart and lungs?

↑ = increases ↓ = decreases

| | **Stroke volume of heart** | **Tidal volume of lungs** |
|---|---|---|
| A. | ↑ | ↓ |
| B. | ↓ | ↑ |
| C. | ↓ | ↓ |
| D. | ↑ | ↑ |

**20.** What does *in vitro* fertilisation (IVF) require?

A. Genetic screening of sperm

B. The stimulation of the ovaries to produce many eggs

C. Collection of eggs at many stages of development from the ovaries

D. Implantation of fertilised eggs into the vagina

*The list below shows events that occur in cells. It refers to questions 21 and 22.*

I. Condensation (shortening) of chromosomes
II. Synthesis of DNA
III. Crossing over of non-sister chromatids
IV. Separation of sister chromatids

**21.** Which events occur during mitosis?

A. I and II only

B. I and III only

C. I and IV only

D. I, II and IV only

**22.** Which events occur during the first division of meiosis?

A. I and II only

B. I and III only

C. I and IV only

D. I, III and IV only

**23.** What is a feature of DNA replication in eukaryotic chromosomes?

A. It occurs in the 3’ – 5’ direction.

B. It is initiated at many points.

C. It only occurs inside nuclei.

D. It involves hydrogen bonding between purine molecules.

**24.** Malonic acid is similar in structure to succinic acid and can occupy the active site of succinate dehydrogenase.

$$\text{Succinic acid} \xrightarrow[\text{dehydrogenase}]{\text{Succinate}} \text{Fumaric acid}$$

What does malonic acid cause?

A. Positive feedback

B. Negative feedback

C. Competitive inhibition

D. Non competitive inhibition

**25.** What happens during cell respiration?

A. $NAD^+$ is oxidised to $NADH + H^+$ in the Krebs cycle.

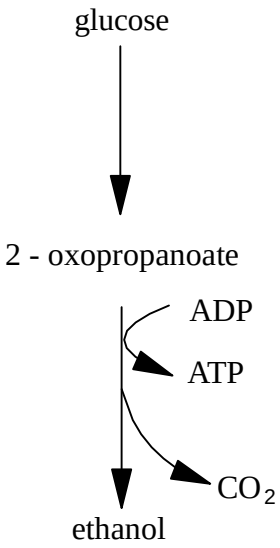
B. $NAD^+$ is reduced to $NADH + H^+$ in the Krebs cycle.

C. $NAD^+$ is oxidised to $NADH + H^+$ in the electron transport chain.

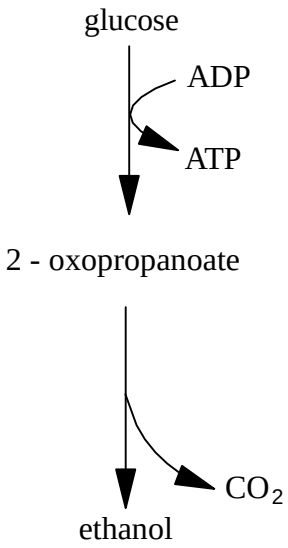
D. $NAD^+$ is reduced to $NADH + H^+$ in the electron transport chain.

**26.** What is the pathway used by yeast cells in anaerobic respiration?

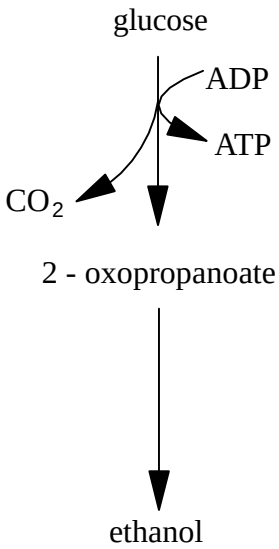
A.



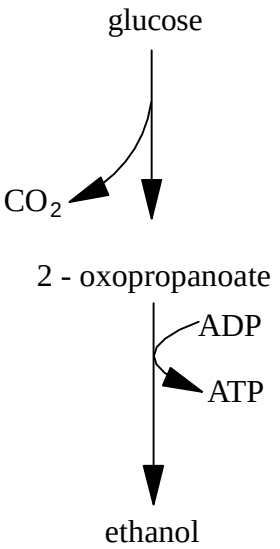

B.




C.




D.



**27.** Which substances are produced in the light-**dependent** reactions of photosynthesis?

✓ = produced X = not produced

| | **ADP** | **NADPH + $H^+$** | **Oxygen** | **Triose phosphate** |
|---|---|---|---|---|
| A. | ✓ | ✓ | X | X |
| B. | X | X | ✓ | ✓ |
| C. | ✓ | X | X | ✓ |
| D. | X | ✓ | ✓ | X |

**28.** In peas, two unlinked genes control height and flower colour.

Tall (T) is dominant over dwarf (t)
Red (R) is dominant over white (r)

Which pairing of parents and offspring is possible?

| | **Parents** | **Offspring** |
|---|---|---|
| A. | tall red × dwarf red | 25% tall red: 25% tall white: 25% dwarf red: 25% dwarf white |
| B. | tall white × dwarf white | 75% tall white: 25% dwarf white |
| C. | tall white × dwarf red | 50% tall red: 50% dwarf red |
| D. | tall red × dwarf white | 9 tall red: 3 tall white: 3 dwarf red: 1 dwarf white |

**29.** What is the difference between autosomes and sex chromosomes?

A. There are two types of sex chromosome but only one type of autosome.

B. Sex chromosomes control gender, puberty and reproduction. Autosomes control all other characteristics.

C. Males and females have the same types of autosomes but different sex chromosomes.

D. Autosomes form homologous pairs in Prophase I of meiosis but sex chromosomes remain unpaired.

**30.** Fertilisation in humans involves a series of processes:

I. Sperm swim to the egg

II. The cortical reaction

III. The acrosome reaction

IV. Penetration of the egg membrane by the sperm.

What is the correct sequence?

A. I, II, III, IV

B. I, II, IV, III

C. I, III, II, IV

D. I, III, IV, II

**31.** Which parts of the male reproductive system are involved in semen production, after the formation of sperm by the testes?

A. Epididymis and prostrate gland

B. Epididymis and seminal vesicle

C. Prostate gland and seminal vesicle

D. Epididymis, prostate gland and seminal vesicle

**32.** Which is a difference between cytotoxic T-cells and B-cells?

A. Only B-cells can produce memory cells.

B. Only B-cells can produce antigens.

C. B-cells attack pathogens and cytotoxic T-cells attack tumour cells.

D. B-cells produce antibodies and cytotoxic T-cells attack infected cells.

**33.** Against which diseases can immunisation give protection?

A. All viral and some bacterial diseases.

B. Some viral but no bacterial diseases.

C. Some bacterial but no viral diseases.

D. Some bacterial and some viral diseases.

**34.** Which groups include some species that contain chloroplasts?

I. Plantae
II. Prokaryotae
III. Protoctista

A. I only

B. I and II only

C. I and III only

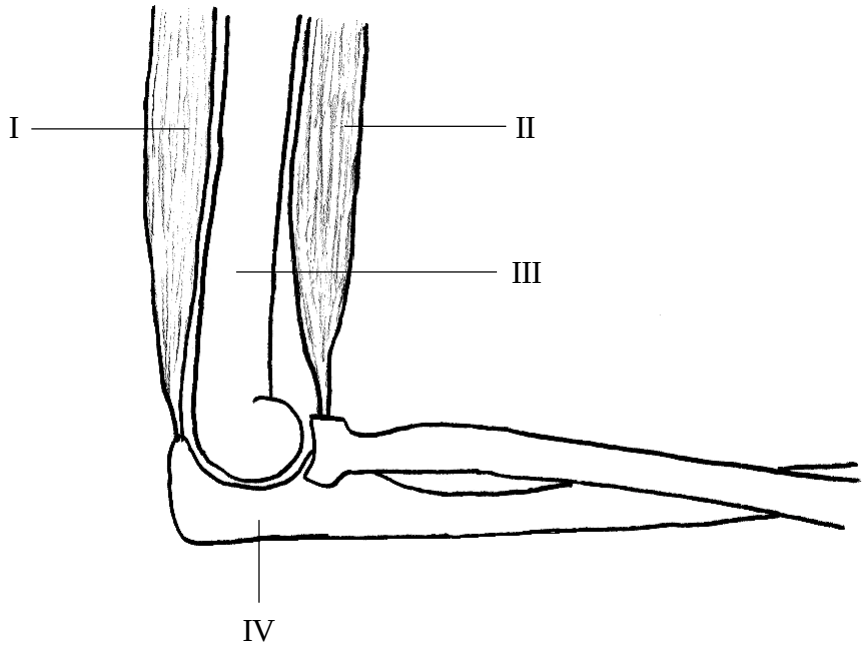
D. I, II and III only

**35.** Seeds and flowers are produced by some groups of plants. Which row in the table below is correct for all **four** groups of plants?

X = no flowers or seeds

| | **Bryophytes** | **Filicinophytes** | **Coniferophytes** | **Angiospermophytes** |
|---|---|---|---|---|
| A. | seeds only | seeds only | seeds and flowers | seeds and flowers |
| B. | X | seeds only | seeds only | seeds and flowers |
| C. | X | X | seeds only | seeds and flowers |
| D. | X | X | X | seeds and flowers |

*The diagram below represents the human elbow joint. It refers to question 36.*




**36.** Which statement about the joint is correct?

A. I flexes (bends) the arm at the elbow and II extends it (straightens it).

B. III is the humerus and IV the radius.

C. The contraction of I causes the relaxation of II.

D. Ligaments prevent friction between III and IV.

**37.** Which substance is a nitrogenous waste product of birds?

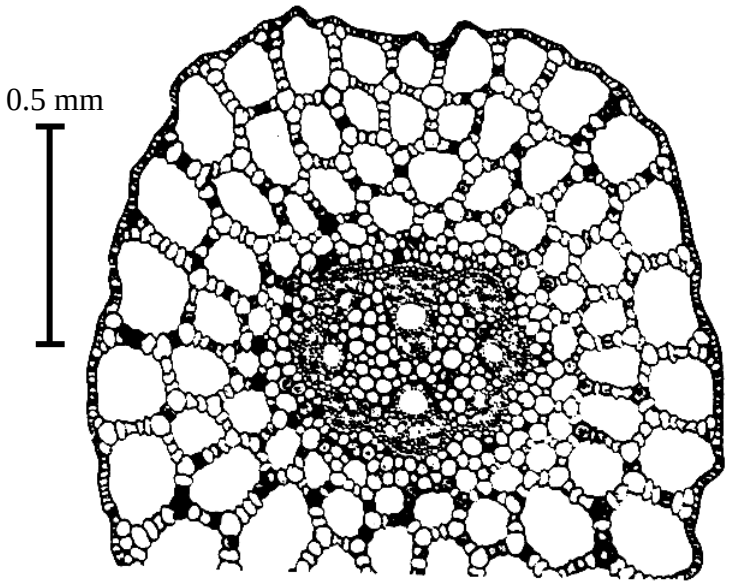
A. Uric acid

B. Faeces

C. Ammonia

D. Urea

*The micrograph below shows a section through the stem of a plant. It refers to question 38.*




**38.** To which environment is this plant adapted?

A. Desert

B. Lake or pond

C. Rainforest

D. Saline soil

**39.** Plants growing in pots sometimes die if they are given too much water. What kills the plant?

A. Water enters the air spaces in the plant's roots and causes the roots to decompose.

B. Water excludes carbon dioxide from the soil so the roots cannot respire.

C. Active transport is blocked as the roots are deprived of oxygen.

D. The sugar concentration in phloem tissues becomes too dilute.

**40.** What is the sequence of events during the germination of a dry starchy seed?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A. | absorption of water | ⇨ | formation of gibberellin | ⇨ | production of amylase | ⇨ | hydrolysis of starch to sugar |
| B. | absorption of water | ⇨ | production of amylase | ⇨ | hydrolysis of starch to sugar | ⇨ | formation of gibberellin |
| C. | formation of gibberellin | ⇨ | absorption of water | ⇨ | production of amylase | ⇨ | hydrolysis of starch to sugar |
| D. | formation of gibberellin | ⇨ | production of amylase | ⇨ | hydrolysis of starch to sugar | ⇨ | absorption of water |