Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/12**

Paper 1 Multiple Choice **May/June 2022**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

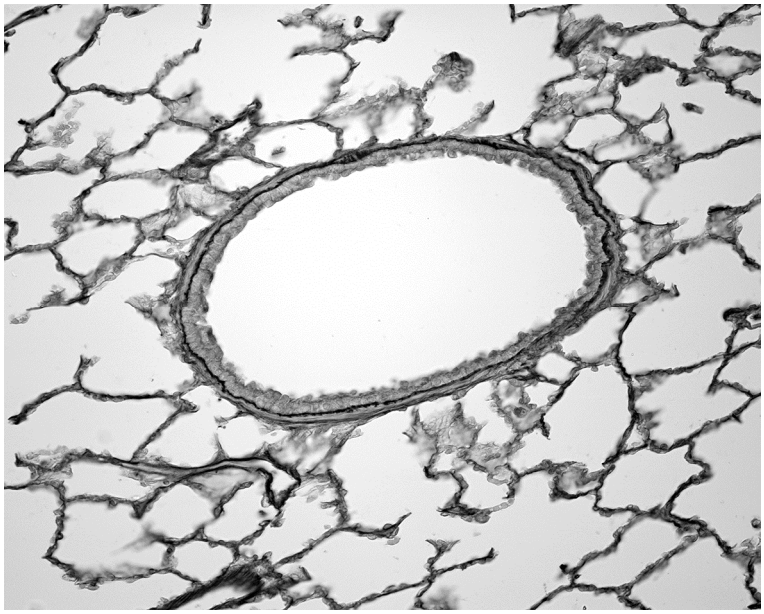
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

This document has **16** pages.

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1 The photomicrograph shows a bronchiole and alveoli.



The magnification of the image is ×360.

What is the maximum diameter of the bronchiole lumen?

A 14 μm **B** 80 μm **C** 140 μm **D** 170 μm

2 A specimen is observed twice with a microscope, firstly using green light with a wavelength of 510 nm and then using red light with a wavelength of 650 nm.

What happens to the magnification and resolution when using red light compared to green light?

	magnification	resolution
A	decreases	remains the same
B	increases	increases
C	remains the same	decreases
D	remains the same	increases

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3 Four students were asked to match the function with the appearance of some cell structures in an animal cell.

The functions were listed by number.

1 produces the mitotic spindle during cell division

2 synthesis of polypeptides

3 synthesis of lipids

The appearances were listed by letter.

V membranes which surround an enclosed inner cavity

W non-membrane-bound, spherical structures

X a double membrane interspersed with pores

Y non-membrane-bound, cylindrical structures

Z membrane-bound sacs, arranged as a flattened stack

Which student correctly matched the numbered functions with the appearance of the cell structure?

	1	2	3
A	W	X	Z
B	W	Z	V
C	Y	W	V
D	Y	Z	W

4 What is found in chloroplasts **and** mitochondria?

A 70S ribosomes only

B 70S ribosomes and circular DNA

C 80S ribosomes and circular DNA

D circular DNA only

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5 Which feature is correct for all known viruses?

A capsid made of lipid and protein

B DNA core

C outer envelope of phospholipid

D non-cellular structure

6 Four extracts from different plant materials were made and tested with Benedict's solution.

The extracts were boiled with Benedict's solution for 240 seconds and the final colour was recorded.

extract	colour produced after 240 seconds
1	red
2	yellow
3	blue
4	green

Which sequence of plant extracts represents an increasing quantity of reducing sugar?

A $1 \rightarrow 2 \rightarrow 4 \rightarrow 3$

B $3 \rightarrow 1 \rightarrow 2 \rightarrow 4$

C $3 \rightarrow 2 \rightarrow 1 \rightarrow 4$

D $3 \rightarrow 4 \rightarrow 2 \rightarrow 1$

7 Which have properties that are dependent on hydrogen bonds?

1 cellulose

2 a molecule of haemoglobin

3 water

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

8 Which statement is correct?

A Cellulose, glycogen and amylopectin are all polymers.

B Ribose, amylase and phospholipid are all macromolecules.

C Starch, glucose and amylose are all monomers.

D Sucrose, deoxyribose and amylopectin are all polysaccharides.

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9 The diagram shows two amino acids. Some of the hydrogen atoms are numbered 1 to 6.



Which two numbered hydrogen atoms could contribute to the production of a molecule of water when a peptide bond forms between these two amino acids?

A 1 and 4 **B** 1 and 6 **C** 3 and 5 **D** 2 and 4

10 A student wrote four statements about water.

1 Water has a high specific heat capacity which maintains the temperature of water within cells.

2 Mammals rely on water having a relatively low latent heat of vaporisation to keep them cool.

3 When a negatively charged ion is added to water, the δ^+ charge on the hydrogen atom is attracted to the ion.

4 When surrounded by water, non-polar molecules tend to be pushed apart from one another.

Which statements are correct?

	1	2	3	4
A	✓	✗	✓	✓
B	✓	✗	✓	✗
C	✗	✓	✗	✓
D	✗	✓	✗	✗

key

✓ = correct

✗ = not correct

11 Typical enzymes are large globular proteins with a specific tertiary shape.

Which molecular interactions are directly involved in maintaining the tertiary shape?

1 hydrogen bonding

2 disulfide bridges

3 hydrophobic interactions

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

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12 Which statement about the Michaelis–Menten constant (K_m) is correct for an enzyme with a low affinity for its substrate?

A It has a high K_m and reaches V_{max} at a high substrate concentration.

B It has a high K_m and reaches V_{max} at a low substrate concentration.

C It has a low K_m and reaches V_{max} at a high substrate concentration.

D It has a low K_m and reaches V_{max} at a low substrate concentration.

13 Long chain, saturated fatty acids change from solid to liquid at higher temperatures compared with short chain, unsaturated fatty acids.

Which fatty acids would be more likely to form triglycerides in mammals that live in cold climates?

A long chain saturated

B long chain unsaturated

C short chain saturated

D short chain unsaturated

14 When animal cells are cultured, salt solution is added to keep the cells alive.

What is the purpose of the salt solution?

A to allow facilitated diffusion of salts into the cells

B to prevent diffusion of other ions in or out of the cells

C to prevent net movement of water into or out of the cells

D to provide a source of energy for active transport

15 The following are all processes that allow movement into cells.

1 phagocytosis

2 active transport

3 facilitated diffusion

Which processes require ATP?

A 1 and 2 **B** 2 and 3 **C** 1 only **D** 2 only

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16 Which features are required to allow for efficient diffusion?

1 a large surface area

2 a short diffusion pathway

3 maintenance of a constant diffusion gradient

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

17 What is a role of mitosis?

A growth of organisms

B production of genetically different cells

C repair of cells

D replacement of cancerous tissue

18 Telomeres prevent the loss of genes from the ends of chromosomes during DNA replication, but they become shorter each time they are copied.

In cancer cells and stem cells, the telomeres remain the same length.

Which statement is correct for **all** human cells?

A If telomeres become too short, a cell may stop dividing.

B Adding telomeres could increase the rate of ageing of cells.

C Telomeres are repaired by the enzyme RNA polymerase.

D Telomeres prevent all damage occurring to DNA molecules.

19 The nucleus of a mouse body cell in G_1 phase of the cell cycle has 1.2×10^{-12} g of DNA.

What will be the mass of DNA in the nucleus of the cell at the end of S phase and at the end of G_2 phase of the cell cycle?

	end of S phase	end of G_2 phase
A	1.2×10^{-12} g	1.2×10^{-12} g
B	1.2×10^{-12} g	2.4×10^{-12} g
C	2.4×10^{-12} g	1.2×10^{-12} g
D	2.4×10^{-12} g	2.4×10^{-12} g

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20 What occurs during prophase in animal cells?

1 fragmentation of the nuclear envelope

2 nucleolus disappears

3 stained chromosomes become visible

4 centrioles replicate

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 2 and 3 only

D 1 and 4 only

21 Which statement describes the structure of ATP?

A It is a DNA nucleotide with two extra phosphates.

B It is a DNA nucleotide with three extra phosphates.

C It is an RNA nucleotide with two extra phosphates.

D It is an RNA nucleotide with three extra phosphates.

22 Rifampicin is an antibiotic used to treat tuberculosis.

It works by inhibiting RNA polymerase in bacteria.

Which processes are directly inhibited by this antibiotic?

1 DNA replication

2 enzyme synthesis

3 ATP synthesis

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 only

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23 The table shows the DNA triplet codes for some amino acids.

amino acid	DNA triplet code	amino acid	DNA triplet code
arginine	GCA	glycine	CCA
arginine	GCC	glycine	CCG
arginine	GCG	glycine	CCT
asparagine	TTA	lysine	TTC
asparagine	TTG	lysine	TTT
cysteine	ACA	proline	GGA
cysteine	ACG	proline	GGC
STOP	ATC	valine	CAC

The base sequence on the template DNA strand coding for part of a polypeptide is shown.

CCA ACG GCG TTA TTC GCA

Two mutations occur in this sequence during DNA replication.

Which mutated template DNA strand would result in a shorter polypeptide?

A CCA ACA GCA TTA TTC GCA

B CCA ACG CCG TTA TTC GCC

C CCA ACG GCG TTG ATC GCA

D CCT ACG GCG TTA TTC GGA

24 Some of the features present in transport tissues are listed.

1 lignified walls

2 cytoplasm

3 mitochondria

4 pits

5 plasmodesmata

Which features are present in xylem vessel elements?

A 1, 2, 3 and 4

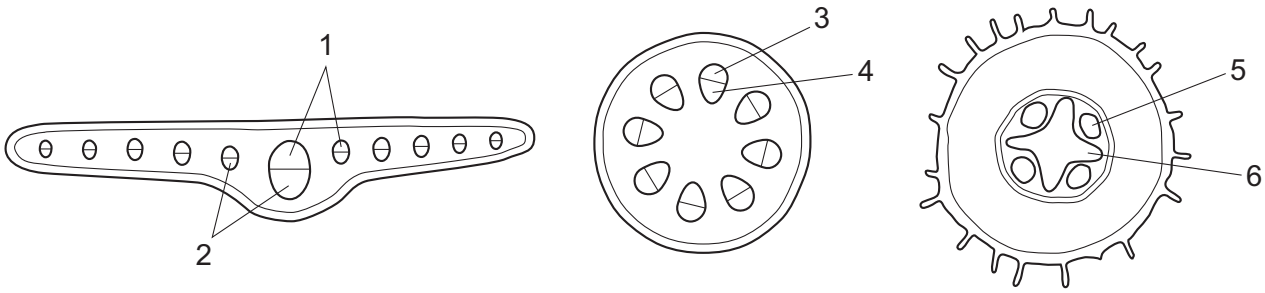
B 1, 4 and 5

C 1 and 4 only

D 2, 3 and 5

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25 The diagrams show transverse sections through parts of plants.



Which row is correct?

	contains lignin	transports organic solutes
A	1, 4, 5	2, 3, 6
B	1, 4, 6	2, 3, 5
C	2, 3, 5	1, 4, 6
D	2, 4, 6	1, 3, 5

26 Which molecules form hydrogen bonds with water during transpiration?

1 cellulose in the xylem wall

2 suberin in the xylem wall

3 other water molecules in the xylem

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

27 Some plant species can take up heavy metal contaminants that are dissolved in soil water and then transport them within the plant. Within plant cells, the heavy metals accumulate mainly in the vacuole.

Which suggestions about the transport and accumulation of heavy metals are valid?

1 After initial entry into the root, some of the heavy metals can pass through the tonoplast to be stored in the vacuole of cells in the cortex.

2 The heavy metals take an apoplastic pathway in the xylem but at the endodermis must take a symplastic pathway.

3 The rate of accumulation of the heavy metals in leaf cells will be faster at night, when photosynthesis is not occurring, than during the day.

4 The presence of heavy metals causes the transpiration stream to slow down and reduce the rate of transpiration.

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

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28 What is the correct route for the movement of water from cell to cell in the apoplast pathway?

A through adjacent cell surface membranes

B through intercellular spaces

C through plasmodesmata

D through the Casparian strip

29 Which row shows the correct sequence for the movement of sucrose into phloem sieve tubes?

	first	second	third
A	diffusion of sucrose into the companion cell cytoplasm	active transport of protons into the companion cell cytoplasm	cotransport of protons and sucrose into the sieve tubes
B	cotransport of protons and sucrose into the companion cell cytoplasm	active transport of protons out of the companion cell cytoplasm	diffusion of sucrose into the sieve tubes
C	active transport of protons into the companion cell cytoplasm	diffusion of sucrose into the companion cell cytoplasm	cotransport of protons and sucrose into the sieve tubes
D	active transport of protons out of the companion cell cytoplasm	cotransport of protons and sucrose into the companion cell cytoplasm	diffusion of sucrose into the sieve tubes

30 What occurs during ventricular systole in a mammalian heart?

1 Aortic pressure increases.

2 Atrial pressure does not change.

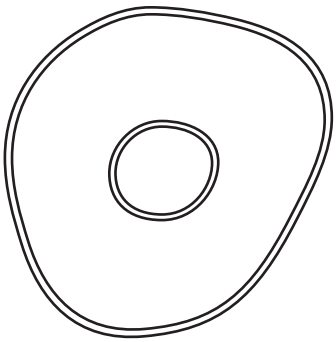
3 Ventricular pressure increases.

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 only

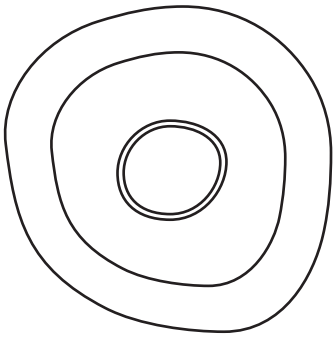
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31 Which plan diagram represents the tissues in a major vein?

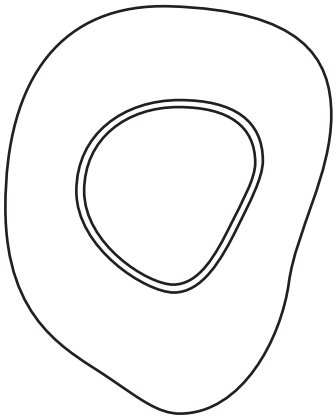
A



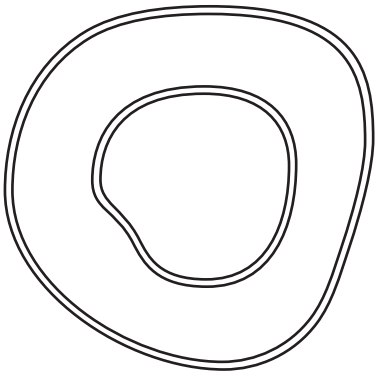
B



C

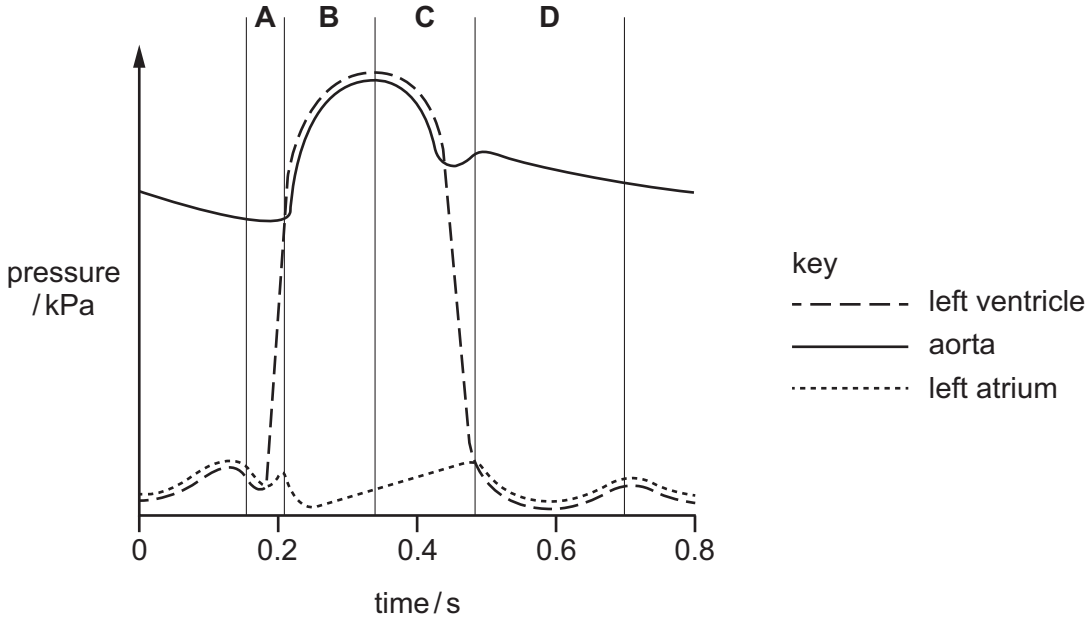


D



32 The diagram shows the pressure changes in various structures of the left side of the heart during the cardiac cycle.

At the end of which period is the ventricle full of blood?



33 Which description of movement of substances during tissue fluid formation is correct?

A Low hydrostatic pressure forces substances out of the capillary at the arterial end allowing small substances to enter the fluid that bathes the cells.

B Tissue fluid moves back into the venule due to a net hydrostatic pressure change in the capillary.

C Movement of water in tissue fluid into the capillary by osmosis is due to the low water potential and low hydrostatic pressure inside the capillary.

D A high water potential of the surrounding tissue fluid causes substances to leave the capillaries at the arterial end.

34 Which row shows the change in concentration of some substances in red blood cells when carbon dioxide diffuses from active cells?

	carbonic anhydrase	hydrogencarbonate ions	hydrogen ions
A	decreases	no change	no change
B	increases	increases	increases
C	no change	decreases	increases
D	no change	increases	increases

35 Which statements about the human gas exchange system are correct?

1 The absence of cartilage in small bronchioles allows them to expand.

2 The walls of the alveoli are made of cuboidal epithelium.

3 Alveoli secrete a substance which reduces surface tension.

4 The trachea and bronchi are supported by rings of cartilage.

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

36 Four types of cell in the gas exchange system are listed.

J alveolus epithelium cell

K ciliated cell

L goblet cell

M smooth muscle cell

The ticks (✓) in the table show specialised features of three of these types of cell.

	many mitochondria	lots of endoplasmic reticulum	many Golgi bodies
1	✓		
2	✓		
3	✓	✓	✓

Which row correctly matches the specialised feature with the correct cell?

	1	2	3
A	J	M	K
B	K	J	M
C	K	M	L
D	M	L	J

37 Why is it difficult to control the spread of tuberculosis?

1 Global air travel for commerce and tourism has increased.

2 The bacterium that causes tuberculosis has evolved resistance to some antibiotics.

3 The bacterium that causes tuberculosis shows great antigenic variability.

4 Civil unrest and poverty result in overcrowded living conditions.

A 1, 2 and 4 **B** 1 and 4 only **C** 2 and 3 **D** 4 only

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38 Rabies is a viral disease which can be spread to humans by a bite from an infected animal.

One method of treatment is to inject the patient with antibodies specific to the rabies virus.

Which statements about this treatment are correct?

1 The patient will have natural passive immunity to rabies.

2 The injected antibodies will be broken down by the patient.

3 The patient's memory cells will be able to produce this antibody more rapidly in the future.

4 The immunity provided will only last a short time.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

39 A person's blood group is determined by antigens present on the red blood cells. The table shows the antigens and antibodies in the blood of people with different blood groups.

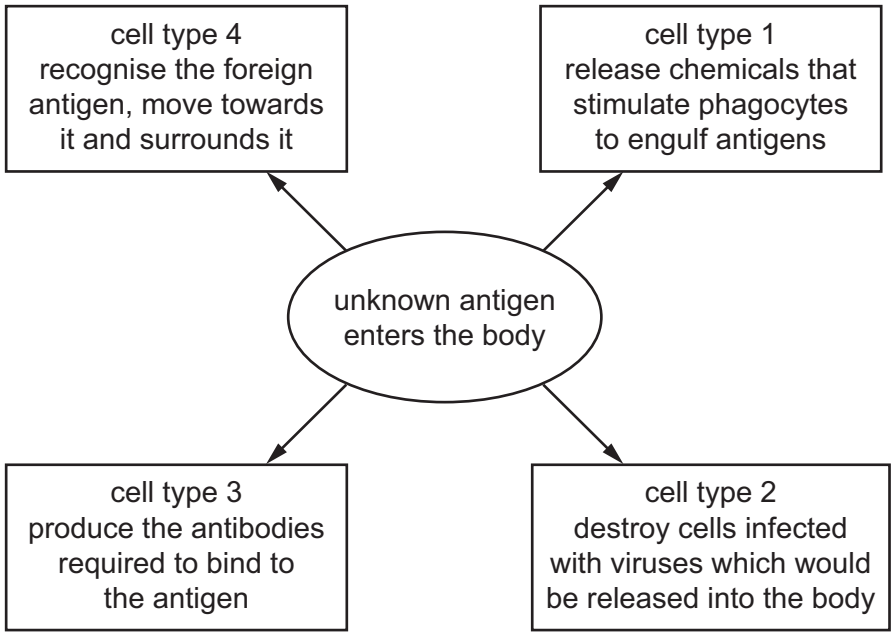
blood group	presence of A or B antigens on red blood cells	presence of antibodies to A or B in plasma
A	A only	anti-B only
B	B only	anti-A only
AB	A and B	neither
O	neither	anti-A and anti-B

During a blood transfusion, it is essential that the person who receives the blood does **not** have antibodies to the donor's blood.

Which blood groups can be given to a person with blood group B?

A A and B **B** AB and B **C** AB and O **D** B and O

40 A student used a diagram to show four types of cells involved in the primary immune response.



Which row is correct?

	cell 1	cell 2	cell 3	cell 4
A	B-lymphocyte	macrophage	T-killer cell	T-helper cell
B	macrophage	B-lymphocyte	T-helper cell	T-killer cell
C	T-helper cell	T-killer cell	B-lymphocyte	macrophage
D	T-killer cell	T-helper cell	B-lymphocyte	macrophage

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