SAMPLE

Japan University Examination

Biology

（60 min）

Do not open the examination booklet until the starting signal for the exam is given.
Please read the following instructions carefully.
Please fill in the examinee no. and name below.

Instructions

1. The booklet contains 14 pages.
2. The answer sheet is one piece of one sided paper.
3. In the case that you notice there are parts in the booklet where the print is not clear or there are missing pages or misplaced pages, or the answer sheet is soiled, raise your hand to report to the invigilator.
4. There are 5 questions to be answered.
5. Fill the examinee no. and name in the answer sheet.
6. Use black pencil to write answers in the designated section in the answer sheet.
7. Memos and calculations can be written on the examination booklet.
8. When the signal to end the exam is given, check again to see that the examinee no. and name is filled in and submit the answer sheet and the examination booklet according to the invigilator's instructions.

Examinee's No.	Name

Question 1.　Please answer questions 1-5 below.

Question 1.　Please choose the most proper one from ①～④ about the using method of microscope.

① To ensure the luminance, the microscope should be used in the place with direct sunlight.
② The lens cone should be installed with sequence of eye lens and objective lens.
③ In adjusting the focal length, the slide sample and objective lens should be closed with observing the eye lens.
④ High power objective lens should be used for observation firstly, then changing to low power objective lens.

Question 2.　Please answer the questions from (1) to (3) below.

(1)　If round pea and wrinkled pea are cross-fertilized, the first generation (F_1) are round pea. (i) What is the gene type of round pea in parental generation? (ii) What is the gene type of wrinkled pea in parental generation? (iii) Tell the gene type of F_1 respectively, where dominant gene expressed with A, and recessive gene expressed with a.

(2)　If F_1 in (1) is self-pollination, then for the proportion of round pea and wrinkled pea born F2, please choose the best one from ①～⑥.

① Round : Wrinkled = 1 : 0　② Round : Wrinkled = 0 : 1
③ Round : Wrinkled = 3 : 1　④ Round : Wrinkled = 1 : 3
⑤ Round : Wrinkled = 5 : 3　⑥ Round : Wrinkled = 3 : 5

(3)　If F_2 in(2)is self-pollination, then for the proportion of round pea and wrinkled pea born F2, please choose the best one from ①～⑥.

Question 3. For the descriptions below about somatic cell division, please choose the best one from①～④.

① In the earlier phase of cell division, DNA starts to copy.

② In the middle phase of cell division, the chromosome gathers to the equatorial plane of spindle apparatus.

③ In the anaphase, the cytoplasm starts division.

④ In the telophase of cell division, the chromosome has longitudinal division and moves to two poles.

Question 4. Fig.1 is about the carbon cycle of ecosystem. Regarding this figure, please answer (1) and (2).

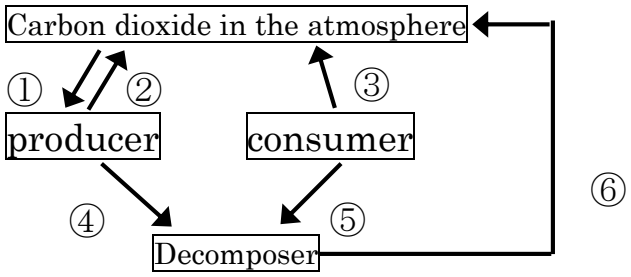

Fig.1

Carbon is moved by the biont through (1)photosynthesis and (2) cell respiration and the direction is shown as the arrows, so for ①～⑥ in the figure, please choose their functions.

Question 5. For the description about Paleozoic, please choose the best one from ①～④.

① The initial eucaryon was born in Cambrian period.

② Ordovician is a flourishing era for fish.

③ Vertebrate was born in Silurian.

④ In the end of devonian, the unprecedented great extinction of species occurred.

⑤ Carboniferous is a flourishing era for fern.

⑥ In the Permian, plant grew toward the land.

Question 2. Please answer the questions 1-5.

A. The bodies of multicellular organism are composed by the cells that have various shapes and functions. and (1) the size and shape of the cells of each creature are various, at the same time, the internal structure of cells is different through observation. In the form 1 below, the structure a-d of animal cell (liver cells of human being), plant cells (leaf cells of waterweed) and germ (lactic acid bacteria) are compared, and whether they have mitochondria is also compared here. Otherwise, in the form, +means existing, -means not existing.

Form 1

	Animal	Plant	Germ
Structure a	+	+	+
Structure b	−	+	+
Structure c	+	+	−
Structure d	−	+	−
Mitochondria	X	Y	Z

Question 1. For the description (1) with underline, please choose the wrong one from ①～④.

① The epidermis cell on the back of Saxifraga stolonifera leaf is red, because the vacuole containing anthocyanin and other pigments grow mature.

② The erythrocyte of human is red, because it contains hemoglobin.

③ As a kind of eukaryotic, paramecium can be observed with naked eyes.

④ As a kind of prokaryote, coliform cannot be observed with optical microscope.

Question 2. For the structures a-d in form 1, please choose the correct combination from ①～⑥.

	Structure a	Structure b	Structure c	Structure d
①	Cell nucleus	Cell wall	Cytomembrane	Chloroplast
②	Cell nucleus	Chloroplast	Cytomembrane	Cell wall
③	Cell wall	Cell nucleus	Cytomembrane	Chloroplast
④	Cell wall	Cytomembrane	Cell nucleus	Chloroplast
⑤	Cytomembrane	Cell wall	Cell nucleus	Chloroplast
⑥	Cytomembrane	Chloroplast	cell nucleus	Cell wall

Question 3. For the [X] ～ [Z] in form 1, the signs should be filled in. Please choose the best one from①～⑧.

	X	Y	Z		X	Y	Z
①	＋	＋	＋	②	＋	＋	－
③	＋	－	＋	④	－	＋	＋
⑤	＋	－	－	⑥	－	＋	－
⑦	－	－	＋	⑧	－	－	－

B. The figure below is the structural model of DNA. DNA is the component unit of the so-called nucleotide. It's a kind of substance generated by major combination of chain structure.

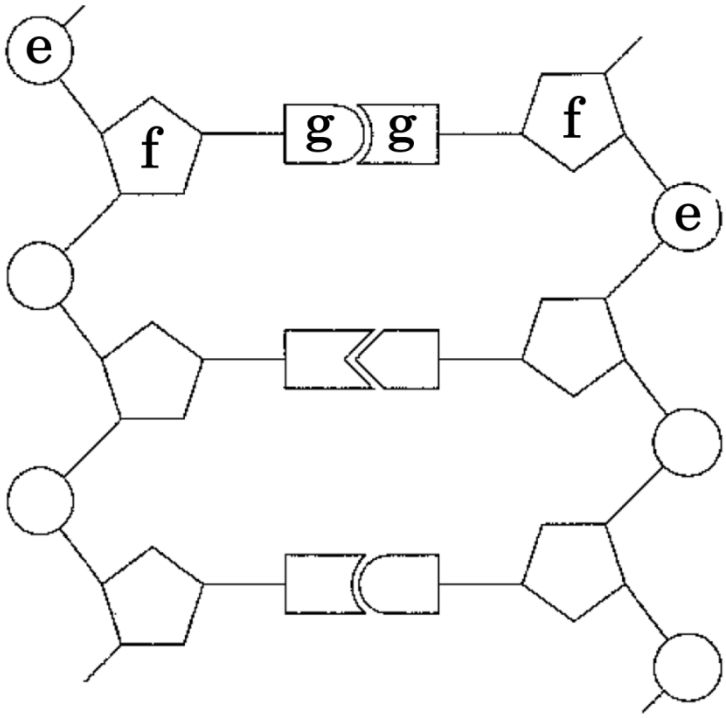

Fig. 1

Question 4. For the components e-g of nucleotide in Fig.1, please choose the best one from ①～⑥.

	e	f	g
①	Phosphoric acid	Glucose	Basic group
②	Phosphoric acid	Basic group	Glucose
③	Glucose	Phosphoric acid	Basic group
④	Glucose	Basic group	Phosphoric acid
⑤	Basic group	Glucose	Phosphoric acid
⑥	Basic group	Phosphoric acid	Glucose

Question 5. In addition to DNA that generated by nucleotide through the major combination of chain structure, there is also RNA. For the description of DNA and RNA, please choose the best from①～⑥.

① The glucose forming DNA and RNA is the same, but the basic group is different.

② The glucose forming DNA and RNA is the same, but the basic group is not all the same.

③ The glucose forming DNA and RNA is different, but the basic group is the same.

④ The glucose forming DNA and RNA is different, but the basic group is not all different.

⑤ The glucose forming DNA and RNA is not all the same, but the basic group is the same.

⑥ The glucose forming DNA and RNA is not all different, but the basic group is different.

Question 3. Please answer the questions 1-4.

A. (1) The body fluid of human is divided into blood, interstitial fluid and lymph. The blood circulation path of human body can be divided into two kinds: the lesser circulation starting from heart through lung and back to heart and the systemic circulation starting from heart through the whole body and back to heart.

Question 1. For the description (1) with underline, please choose the wrong one from ①～④.

① In the blood, the liquid component plasma takes up 55% of the blood weight.
② The interstitial fluid among cells is the substance of part of plasma effused through capillary wall.
③ Most of the interstitial fluid will be back to capillary, and part of them will become lymph.
④ The lymphatic gathers gradually and connects with the right atrium. The lymph and blood are better to gather here.

Question 2. For the description of human vascular structure and blood circulation, please choose the best one from①～④.

① The muscle layer of artery is thicker than the muscle layer of vein, and it has the valve that can bear the high pressure blood out from heart.
② The blood in pulmonary artery has more oxygen than the blood in pulmonary vein.
③ After dinner, the blood in hepatic portal vein contains more glucose and amino acid than the blood in hepatic vein.
④ The blood in renal veins contains more urea than the blood in renal artery.

B. The acquired immunity is started through transferring part of antigen from the cells [(2)] implanted foreign matters (antigen) or macrophage to the cell surface and cognizing the transitional information through the helper T cell. The acquired immunity is divided into [(3)] immunity involving antibody and [(4)] immunity of eliminating antigen without involving antibody.

Question 3. In the text above, please choose the best one from ①～④ to fill in [(2)] ～ [(4)].

	(2)	(3)	(4)
①	Arborescence	Cellularity	Humoral
②	Arborescence	Humoral	Cellularity
③	Target	Cellularity	Humoral
④	Target	Humoral	Cellularity

Question 4. For the following descriptions regarding antibody, please choose the wrong one from ①～④.

① After receiving the antigenic information, the helper T cell is activated and reproduced, and the specific B cell is differentiated into killer T cell when it's activated.

② B cells that activated by helper T cells are differentiated into the cell that can produce antibody, generating antibody.

③ Antibody is a kind of protein that is called immune globulin, and it can be combined with specific antigen to form antigen-antibody complex.

④ The activated helper T cells and part of B cells are kept in the body as immune memory cells.

Question 4. Please answer the questions 1-3.

Carbon dioxide, methane and Freon are the gases resulting in (1) the greenhouse effect, so these kinds of gases are called greenhouse gas. If the greenhouse gas increases in the atmosphere, it can be considered causing global warming.

X-Z in Fig.1 below are the diagram of random observation points in Hawaii (Mauna Loa), Japan (Lwate-ken) and the South Pole (south pole) to measure the change of carbon dioxide concentration. In the diagram, ppm means one in a million. The diagram refers to the volume proportion in the atmosphere.

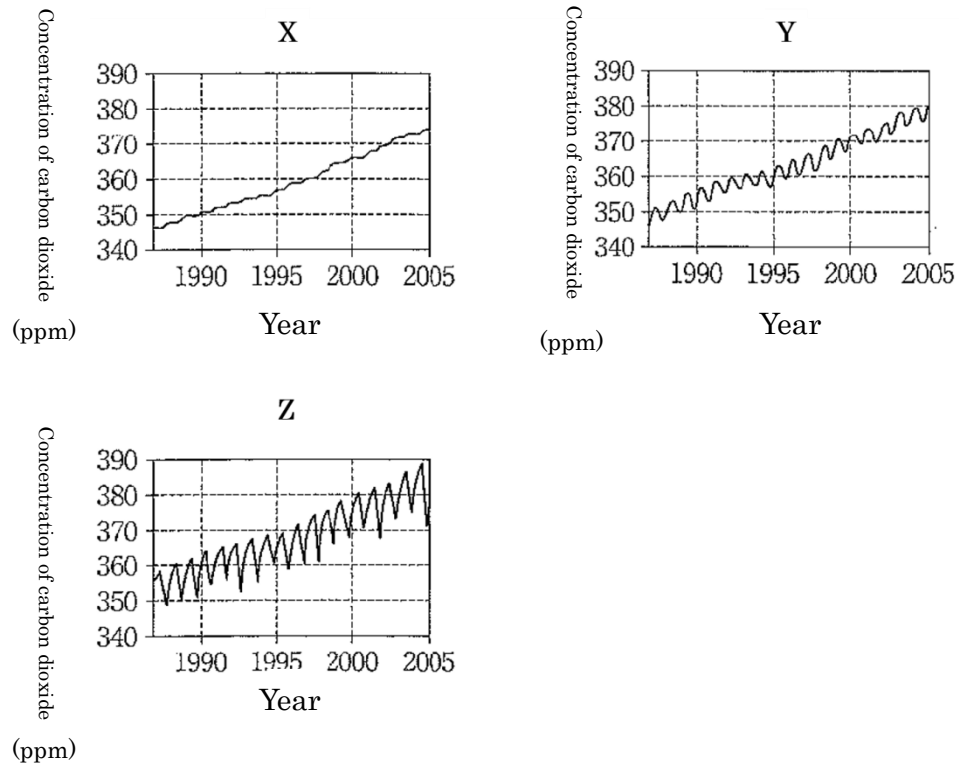

Fig.1

Question 1. The description with underline is about the greenhouse effect, please choose the best one from①～④.

① The greenhouse gases absorb the sun heat before it being transmitted to the ground.
② The greenhouse gases enlarge the sun heat and then transmit to the ground.
③ The greenhouse gases enlarge the heat liberated from the ground.
④ The greenhouse gases absorb the heat liberated from the ground and then liberate to the ground.

Question 2. Fig.1 is to describe the carbon dioxide concentration of each observation point. Within 1 year period, the concentration change continually, but the trend is rising. For the change reasons of carbon dioxide concentration, please choose the wrong one from①～④. The phenomenon that the carbon dioxide concentration raises in winter and declines in summer is observed.

① For the concentration change of carbon dioxide within 1 year, the main reason is the change of plants respiratory capacity.
② For the concentration change of carbon dioxide within 1 year, the main reason is the change of plants photosynthesis volume.
③ One reason of carbon dioxide concentration long-term rising is the increasing of fossil fuel burning.
④ One reason of carbon dioxide concentration long-term rising is the increasing forest harvesting.

Question 3. X-Z in Fig.1 is the data measured in each observation places. For the combinations, please choose the best one from ①～⑥.

	X	Y	Z
①	Hawaii	Japan	The South Pole
②	Hawaii	The South Pole	Japan
③	Japan	Hawaii	The South Pole
④	Japan	The South Pole	Hawaii
⑤	The South Pole	Hawaii	Japan
⑥	The South Pole	Japan	Hawaii

Question 5. Please answer the questions 1-4.

In form 1 below, the amino acid sequence in hemoglobin α chain is compared among mammalia a-c, carp and human and different amino acid quantity among them is also shown in the form. The result shows that the hemoglobin α chain owned by their common ancestors has changed in long time, generating different amino acid sequence. (1)Generally, if the protein is the same, then it's determined that the changing speed of amino acid (replacement speed) is basically fixed without relationship with the species, molecular tree can be described based on the replacement times of amino acid.

Form 1

	Mammalia a	Mammalia b	Mammalia c	Carp	Human
Mammalia a	–	(2)	26	65	17
Mammalia b		–	49	75	37
Mammalia c			–	(3)	27
Carp				–	68

Question 1. The molecular evolution tree about mammalia a-c and human is shown as Fig.1. Please choose the best one from the combination ①～⑥ that meet mammalia a-c.

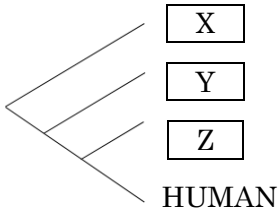

Fig.1

	X	Y	Z
①	Mammalia a	Mammalia b	Mammalia c
②	Mammalia a	Mammalia c	Mammalia b
③	Mammalia b	Mammalia a	Mammalia c
④	Mammalia b	Mammalia c	Mammalia a
⑤	Mammalia c	Mammalia a	Mammalia b
⑥	Mammalia c	Mammalia b	Mammalia a

Question 2. Numbers are filled in the (2), (3) column, please choose the right one from①～④.

	(2)	(3)
①	21	48
②	21	69
③	43	48
④	43	69

Question 3. From the evidence of fossil, etc. it can be determined that mammalia a and human were differentiated 65 million years ago, which can be deduced how long (year) an amino acid in the hemoglobin α chain can change, please choose the best one from ①～④. Please note that the quantity of different amino acid within 2 cycles is the sum of amino acid replacement times that these two creatures' ancestor evolving to their respective descendants.

① 3.8 million years ② 7.6 million years
③ 11.4 million years ④ 15.2 million years

Question 4. Regarding the underline part (1), actually the replacement speed of some creatures' specific protein has great different with other species. As a kind of rat, the eyes of mole rat degenerate due to underground living conditions. For mole rat and other 3 kinds of rats, the protein contained in the crystalline lens and the amino acid sequence of crystal protein is compared here. The following options are the descriptions of the result, please choose the best one.

① For this species, they don't have the protein with important functions, because the replacement speed of amino acid is fast, the replaced quantity of amino acid for mole rat is much.
② For this species, they don't have the protein with important functions, because the replacement speed of amino acid is fast, the replaced quantity of amino acid for mole rat is very small.
③ For this species, they don't have the protein with important functions, because the replacement speed of amino acid is slow, the replaced quantity of amino acid for mole rat is much.
④ For this species, they don't have the protein with important functions, because the replacement speed of amino acid is slow, the replaced quantity of amino acid for mole rat is very small.