2012 Examination for Japanese University Admission for International Students

Science (80min.)

【Physics, Chemistry, Biology】

※ Choose and answer two subjects.
※ Answer the questions using the front side of the answer sheet for one subject, and the reverse side for the other subject.

Ⅰ Rules of Examination

1. Do not leave the room without the proctor's permission.
2. Do not take this question booklet out of the room.

Ⅱ Rules and Information Concerning the Question Booklet

1. Do not open this question booklet until instructed.
2. After instruction, write your name and examination registration number in the space provided below, as printed on your examination voucher.
3. The pages of each subject are as in the following table.

Subject	Pages
Physics	1－21
Chemistry	23－34
Biology	35－48

4. If your question booklet is missing any pages, raise your hand.
5. You may write notes and calculations in the question booklet.

Ⅲ Rules and Information Concerning the Answer Sheet

1. You must mark your answers on the answer sheet with an HB pencil.
2. Each question is identified by one of the row numbers [1], [2], [3], ⋯. Follow the instruction in the question and completely black out your answer in the corresponding row of the answer sheet (mark-sheet).
3. Make sure also to read the instructions on the answer sheet.

※ Once you are informed to start the examination, fill in your examination registration number and name.

Examination registration number			*					*						
Name														

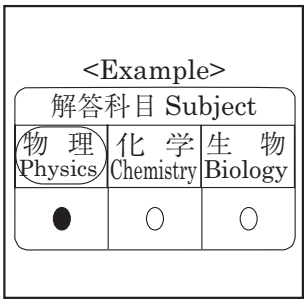
Physics

Marking your Choice of Subject on the Answer Sheet

Choose and answer two subjects from Physics, Chemistry, and Biology. Use the front side of the answer sheet for one subject, and the reverse side for the other subject.

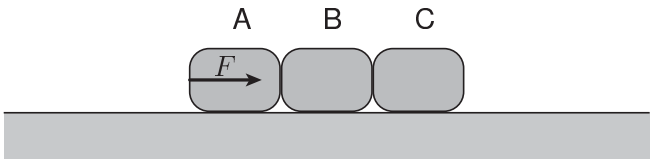
As shown in the example on the right, if you answer the Physics questions, circle "Physics" and completely fill in the oval under the subject name.

If you do not correctly fill in the appropriate oval, your answers will not be graded.



I Answer questions **A** (Q1), **B** (Q2), **C** (Q3), **D** (Q4), **E** (Q5), **F** (Q6), and **G** (Q7) below, where g denotes the magnitude of acceleration due to gravity, and air resistance is negligible.

A As shown in the figure below, objects A, B, and C are placed on a smooth horizontal surface. All three objects have the same mass. A force of magnitude F is applied continuously to A in the horizontal direction to the right, causing the three objects to move to the right, while remaining in contact with one another.



Q1 What is the magnitude of the force that C exerts on B to the left? From ①-④ below choose the correct answer. **1**

① $\frac{1}{3}F$　② $\frac{1}{2}F$　③ $\frac{2}{3}F$　④ F

B The magnitude of acceleration due to gravity at the surface of a certain planet is $\frac{g}{2}$ ($\frac{1}{2}$ of that of the earth). An object is launched from the planet's surface at a certain angle and a certain speed, causing the object to undergo parabolic motion.

Q2 What is the ratio of the horizontal distance traveled by the object (from point of launch to point of landing on the planet's surface), to the horizontal distance that it would travel if launched at the same angle and speed on the earth's surface? From ①-⑤ below choose the closest value. **2**

① $\frac{1}{4}$ ② $\frac{1}{2}$ ③ 1 ④ 2 ⑤ 4

C Object A (mass: m) and object B (mass: $\frac{5}{2}m$) are attached to opposite ends of a lightweight, inelastic string. As shown in the figures below, the two objects are placed on different surfaces, with the string passing over/under a pulley that rotates smoothly. There is no friction between A and the surfaces on which it is placed, but there is friction between B and the surfaces on which it is placed. In the cases of all three figures, both A and B are at rest, and the string is taut and parallel to the surfaces below it.

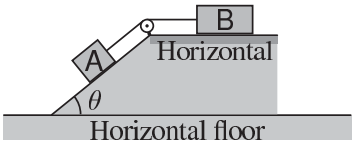


Figure 1

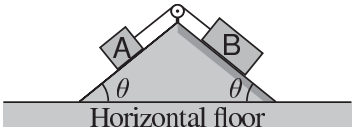


Figure 2

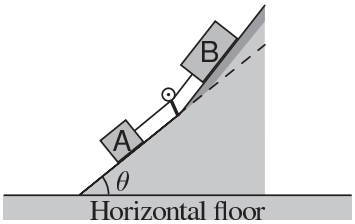


Figure 3

Q3 Let us define the magnitude of the frictional force acting on B in Figures 1, 2, and 3 as, respectively, F_1, F_2, and F_3. From ①-⑥ below choose the answer that correctly expresses the magnitude relationship of F_1, F_2, and F_3. **3**

① $F_1 < F_2 < F_3$　② $F_1 < F_3 < F_2$　③ $F_2 < F_1 < F_3$

④ $F_2 < F_3 < F_1$　⑤ $F_3 < F_1 < F_2$　⑥ $F_3 < F_2 < F_1$

D As shown in Figure 1 below, object A (mass: M) is placed on a smooth horizontal surface, and object B (mass: m, where $M > m$) is placed on top of A, which is also a smooth horizontal surface. B is moving on top of A and repeatedly collides elastically with both ends of A. The speed of B relative to A, denoted as v, remains constant during B's motion. A repeatedly alternates between moving distance L and remaining at rest for intervals of time $\frac{T}{2}$. Figure 2 below is a graph expressing the change over time in distance traveled by A.

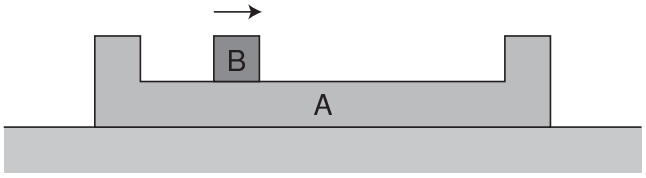


Figure 1

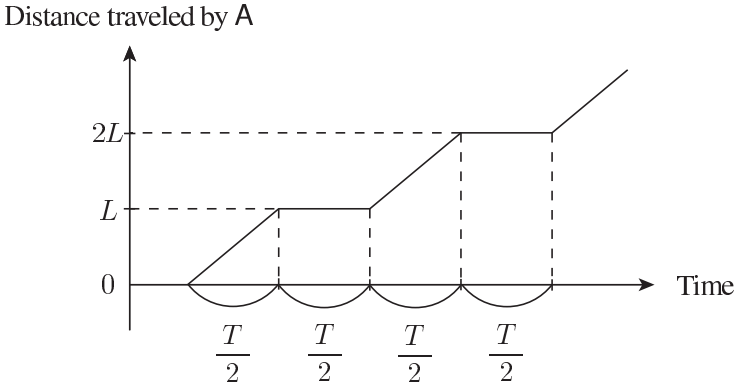


Figure 2

Q4 What is the magnitude of v? From ①-⑤ below choose the correct answer. **4**

① $\frac{2L}{T}$ ② $\frac{4M}{M+m} \cdot \frac{L}{T}$ ③ $\frac{4m}{M+m} \cdot \frac{L}{T}$

④ $\frac{M+m}{M} \cdot \frac{L}{T}$ ⑤ $\frac{M+m}{m} \cdot \frac{L}{T}$

E As shown in Figure 1 below, a small ball is attached to one end of a spring, the other end of which is fixed to a wall. The ball is made to undergo simple harmonic motion on a smooth horizontal surface of a floor. An x-axis is plotted along the spring, with the origin O, defined as the position of the ball when the spring is at its natural length. Figure 2 below is a graph expressing the change over time of the ball's position, x.

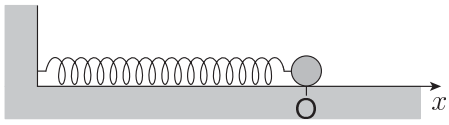


Figure 1

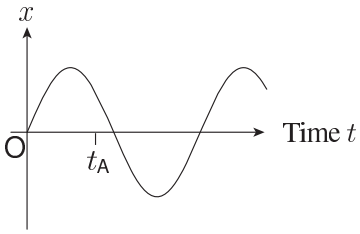
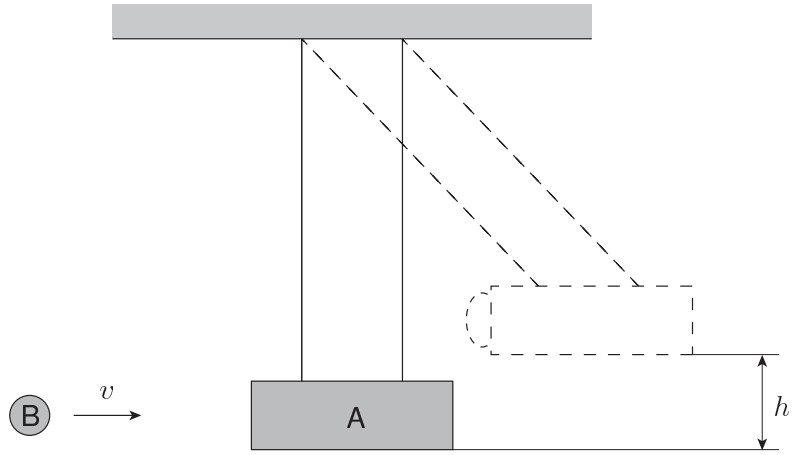


Figure 2

Q5 At time t_A in Figure 2, what is the direction of the ball's velocity in terms of the x-axis direction (positive or negative)? Also, at time t_A, what is the direction of the force exerted on the wall by the spring in terms of the x-axis direction (positive or negative)? From ①-④ below choose the correct combination. **5**

	Direction of ball's velocity	Direction of force exerted on wall by spring
①	positive direction of x-axis	positive direction of x-axis
②	positive direction of x-axis	negative direction of x-axis
③	negative direction of x-axis	positive direction of x-axis
④	negative direction of x-axis	negative direction of x-axis

F As shown in the figure below, object A (mass: M) is suspended from a ceiling by two strings of equal length and is initially at rest. A ball of clay, B (mass: m), travels horizontally from the left at speed v and instantaneously adheres to A. Then, A and B begin to move as a single body. A attains a maximum height of h from its initial position.

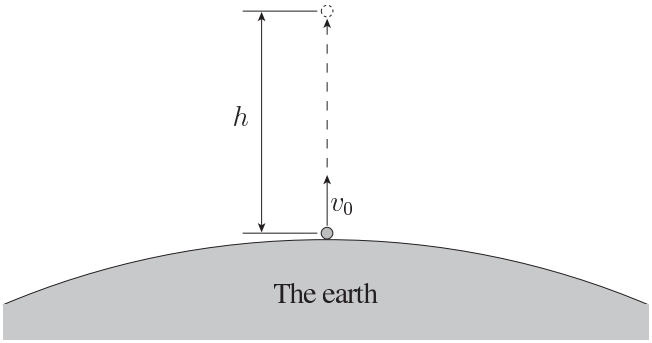


Q6 What is the magnitude of h? From ①-⑤ below choose the correct answer. **6**

① $\dfrac{m}{2(M+m)g}v^2$ ② $\dfrac{m^2}{2(M+m)^2g}v^2$ ③ $\dfrac{v^2}{2g}$

④ $\dfrac{M}{2(M+m)g}v^2$ ⑤ $\dfrac{M^2}{2(M+m)^2g}v^2$

G As shown in the figure below, an object is launched vertically upward from the earth's surface with speed v_0. After attaining a height of h from the earth's surface, the object begins falling. Let the earth's radius be denoted as R, and the magnitude of acceleration due to gravity at the earth's surface as g. The effect of the earth's rotation is negligible.



Q7 What is the magnitude of h? From ①-⑥ below choose the correct answer. **7**

① $\dfrac{{v_0}^2R}{gR+{v_0}^2}$　② $\dfrac{{v_0}^2R}{gR-{v_0}^2}$　③ $\dfrac{{v_0}^2R}{2gR+{v_0}^2}$

④ $\dfrac{{v_0}^2R}{2gR-{v_0}^2}$　⑤ $\dfrac{2{v_0}^2R}{2gR+{v_0}^2}$　⑥ $\dfrac{2{v_0}^2R}{2gR-{v_0}^2}$

II Answer questions **A** (Q1), **B** (Q2), and **C** (Q3) below.

A The table below lists the specific heat of five different substances. Consider a container that is made from one of these substances and has a mass of 150 g. One hundred (100) grams of water at 75°C is placed in the container, which was initially at 10°C. After sufficient time elapses, the temperature of the container and the water both becomes 60°C. The specific heat of water is 4.2 J/(g·K), and there is no exchange of heat between the container and its environment.

Substance	Silver	Copper	Iron	Glass	Aluminum
Specific heat (J/(g·K))	0.24	0.39	0.45	0.84	0.90

Q1 From what substance is the container made? From ①-⑤ below choose the best answer.

8

① Silver ② Copper ③ Iron ④ Glass ⑤ Aluminum

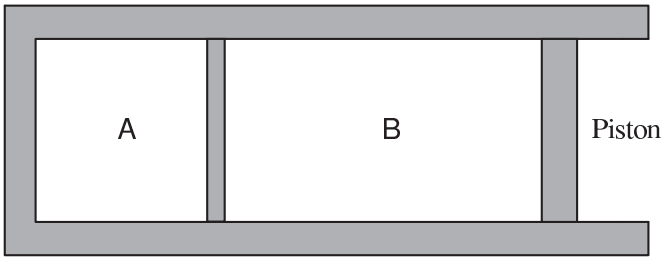
B Consider a container that holds 400 L of oxygen molecules at 27°C and 7.0×10^5 Pa. One mole (1.0 mol) of oxygen molecules occupies a volume of 22.4 L when at a temperature of 0.0°C and a pressure of 1.0×10^5 Pa. One mole (1.0 mol) of oxygen molecules has a mass of 32 g.

Q2 What is the total mass (in kg) of the oxygen molecules held in the container? From ①-⑥ below choose the best answer. **9** kg

① 0.11　② 0.36　③ 1.1

④ 3.6　⑤ 11　⑥ 36

C As shown in the figure below, a monatomic ideal gas is contained by a cylinder and a piston that are made of thermally insulating material. The interior of the cylinder is divided into two compartments (A and B) by a partition, which is fixed in place and is impermeable to gas. The volume of A is constant, while the volume of B changes with movement of the piston. The piston moves smoothly, and the pressure in B constantly maintained at atmospheric pressure. The amount of monatomic ideal gas in B (in terms of moles) is three times that of A. Initially, the absolute temperature of the gas in A is $2T_0$, while that of the gas in B is T_0. After sufficient time elapses, the gas in A and the gas in B both reach an absolute temperature of T_1. The partition is highly conductive of heat, and its heat capacity is negligible.

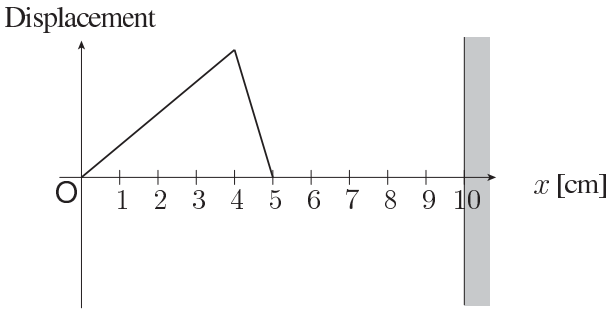


Q3 What is the magnitude of T_1? From ①-④ below choose the correct answer. **10**

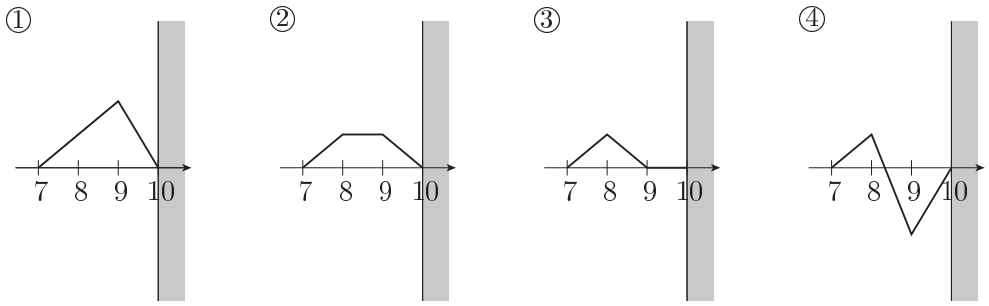
① $\frac{5}{4}T_0$ ② $\frac{7}{6}T_0$ ③ $\frac{11}{8}T_0$ ④ $\frac{7}{2}T_0$

III Answer questions **A** (Q1), **B** (Q2), and **C** (Q3) below.

A The following figure expresses the form of a wave, which travels at a speed of 10 cm/s along an x-axis in its positive direction, at time $t = 0$ s. A wall exists at $x = 10$ cm, where the wave undergoes fixed-end reflection.



Q1 From ①-④ below choose the figure that best expresses the waveform at $t = 0.70$ s. **11**



B A certain sound source is moving with constant speed along an x-axis, from the negative region of the x-axis toward the positive region. The sound waves emitted by the source are measured at the origin. Figures 1 and 2 below are graphs expressing how the change in air pressure, Δp, varies over time t, where time is in ms (10^{-3} s). Figure 1 shows the results for measurement when the sound source approaches the origin, and Figure 2 for measurement when the sound source moves away from the origin.

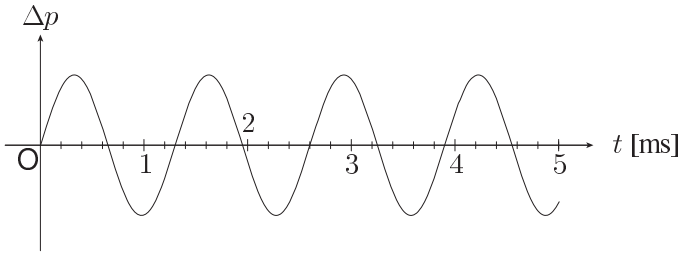


Figure 1

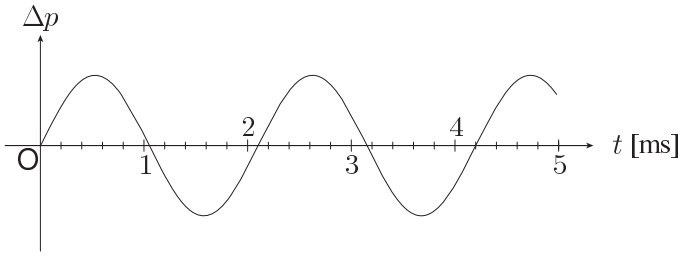


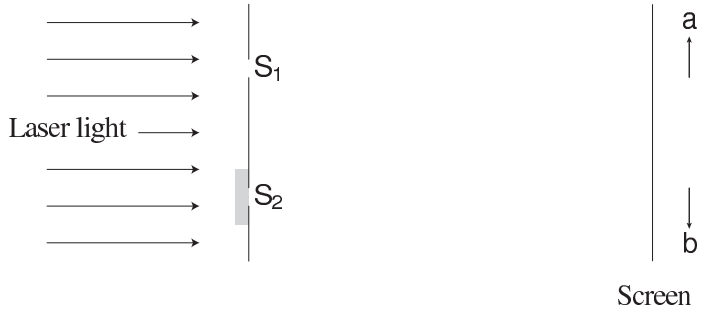
Figure 2

Q2 What is the frequency of the sound source? From ①-④ below choose the best answer.

12 Hz

① 290 ② 590 ③ 620 ④ 1200

C As shown in the figure below, parallel beams of monochromatic light emitted from a laser light source pass through two slits (S_1 and S_2) and create interference patterns on a sufficiently distant screen. A thin transparent plate with a variable refractive index is placed in front of slit S_2.

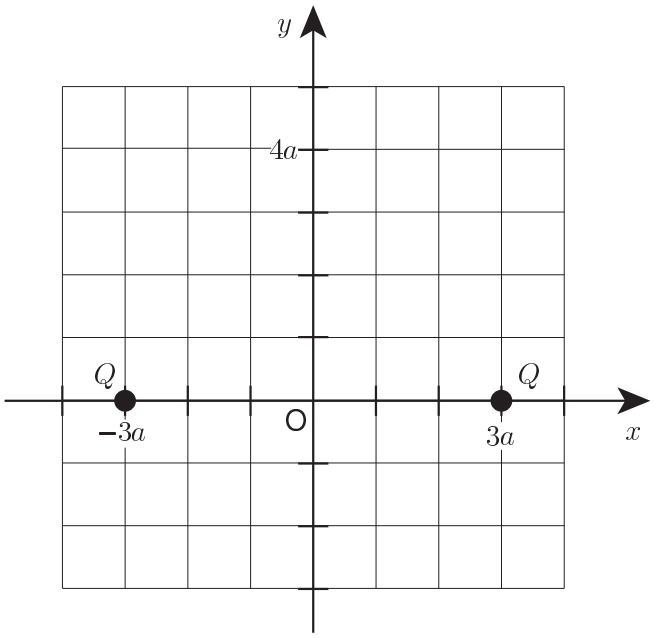


Q3 If the refractive index of the plate is gradually increased, will the dark bands near the center of the screen move in the direction of arrow a in the figure, or in the direction of arrow b? Also, how will the distance between neighboring dark bands behave? From ①-⑥ below choose the correct combination. **13**

	①	②	③	④	⑤	⑥
Direction of movement	a	a	a	b	b	b
Distance between dark bands	Becomes larger	Does not change	Becomes smaller	Becomes larger	Does not change	Becomes smaller

IV Answer questions **A** (Q1), **B** (Q2), **C** (Q3), **D** (Q4), **E** (Q5), and **F** (Q6) below.

A As shown in the figure below, two small balls, each carrying a charge of Q (> 0), are fixed in place in an xy plane at points $(3a, 0)$ and $(-3a, 0)$, where $a > 0$.



Q1 A third small ball, also carrying a charge of Q, is slowly moved from point $(0, 4a)$ to the origin $(0, 0)$. From ①-⑥ below choose the answer that best indicates the work done by the external force needed to move the third ball as described, where k denotes the proportionality constant of Coulomb's law. **14**

① $\dfrac{kQ^2}{12a}$ ② $\dfrac{2kQ^2}{15a}$ ③ $\dfrac{kQ^2}{6a}$

④ $\dfrac{kQ^2}{4a}$ ⑤ $\dfrac{4kQ^2}{15a}$ ⑥ $\dfrac{kQ^2}{2a}$

B As shown in Figure 1 below, a parallel plate capacitor whose plates are separated by distance d is charged by connecting it to a battery of electromotive force V. After the capacitor is fully charged, it is disconnected from the battery. Next, as shown in Figure 2, the distance between the plates is increased to $2d$ and a dielectric of thickness $2d$ and relative permittivity ε_r is inserted between the plates, completely filling the space between them.

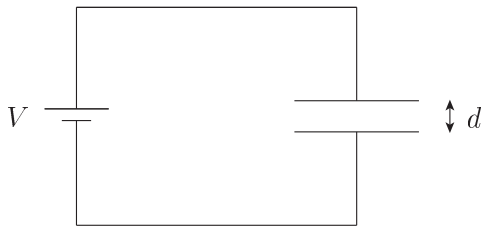


Figure 1

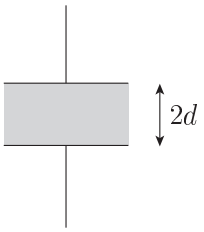


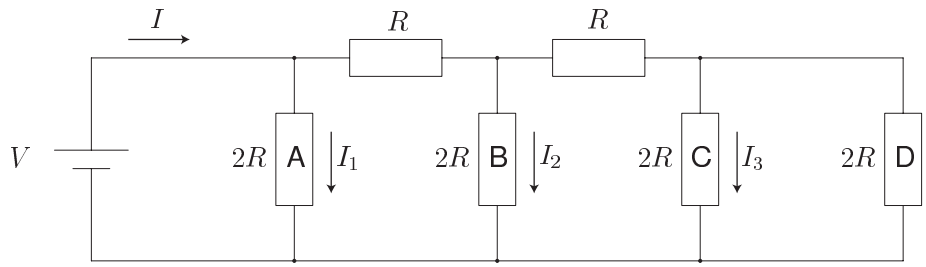
Figure 2

Q2 What is the ratio of the electrostatic energy stored in the capacitor in Figure 2 to the electrostatic energy stored in the capacitor in Figure 1? From ①-⑥ below choose the correct answer. **15**

① $\frac{\varepsilon_r}{2}$ ② ε_r ③ $2\varepsilon_r$

④ $\frac{1}{2\varepsilon_r}$ ⑤ $\frac{1}{\varepsilon_r}$ ⑥ $\frac{2}{\varepsilon_r}$

C Two resistors of resistance R, four resistors of resistance $2R$, and a battery of electromotive force V are connected together to form the circuit shown in the figure below. The $2R$ resistors are labeled A, B, C, and D as shown. Electrical current flowing through the battery is denoted as I, and the currents flowing through A, B, and C are defined as I_1, I_2, and I_3, respectively.

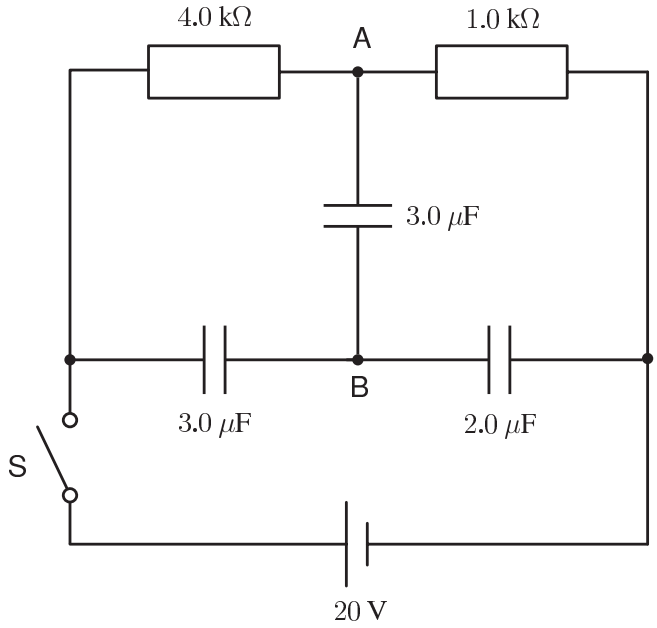


Q3 What is the magnitude of I_1, I_2, and I_3? From ①-⑤ below choose the correct combination.

16

	I_1	I_2	I_3
①	$\frac{1}{2}I$	$\frac{1}{4}I$	$\frac{1}{8}I$
②	$\frac{1}{2}I$	$\frac{1}{4}I$	$\frac{1}{6}I$
③	$\frac{1}{2}I$	$\frac{1}{4}I$	$\frac{1}{16}I$
④	$\frac{1}{2}I$	$\frac{1}{3}I$	$\frac{1}{4}I$
⑤	$\frac{1}{2}I$	$\frac{1}{9}I$	$\frac{1}{16}I$

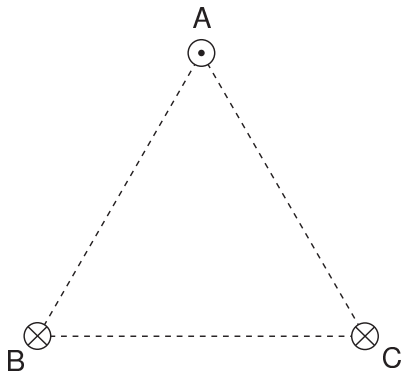
D As shown in the figure below, a circuit is formed from two resistors (resistance: 4.0 kΩ and 1.0 kΩ), a capacitor of capacitance 2.0 μF, two capacitors of capacitance 3.0 μF, a battery (electromotive force: 20 V), and a switch S. The battery's internal resistance is negligible, and the capacitors remain uncharged until S is closed.



Q4 What is the magnitude of the voltage between A and B in the figure after S is closed and sufficient time elapses? From ①-⑤ below choose the best answer. **17** V

① 4.0 ② 5.0 ③ 6.0 ④ 8.0 ⑤ 9.0

E As shown in the figure below, three conducting wires are arranged at vertices A, B, and C of an equilateral triangle (side length: 0.10 m), with each wire running perpendicular to the triangle's plane. An electrical current of 10 A is flowing through each wire. The direction of the current is from the back of the page to the front for the wire at A, and from the front to the back for the wires at B and C.

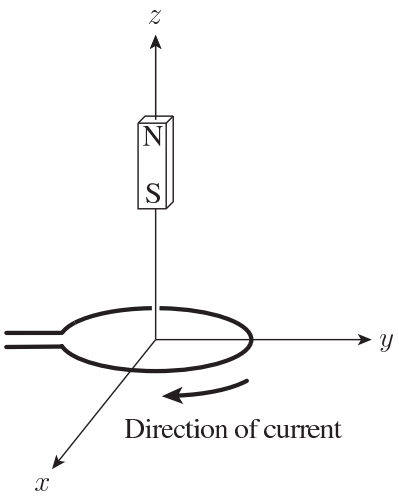


Q5 What is the magnitude of the magnetic field at the geometric center (centroid) of the triangle ABC? From ①-⑤ below choose the best answer. You may use $\pi = 3.1$ and $\sqrt{3} = 1.7$.

18 A/m

① 0 ② 37 ③ 55 ④ 75 ⑤ 83

F As shown in the figure below, an electrical current is flowing through a circular conducting wire located in an xy plane, and a bar magnet is placed longitudinally on the z-axis. The direction of the current is clockwise when viewed from the positive direction of the z-axis. The north pole of the magnet is pointed in the positive direction of the z-axis.



Q6 In terms of the z-axis direction (positive or negative), what is the direction of the force exerted on the magnet by the magnetic field generated by the current? Also, in terms of the z-axis direction, what is the direction of the force exerted on the circular wire by the magnetic field generated by the magnet? From ①-④ below choose the correct combination.

19

	Direction of force exerted on magnet	Direction of force exerted on circular wire
①	positive direction of z-axis	positive direction of z-axis
②	positive direction of z-axis	negative direction of z-axis
③	negative direction of z-axis	positive direction of z-axis
④	negative direction of z-axis	negative direction of z-axis

End of Physics questions. Leave the answer spaces 20 ~ 75 blank. Please check once more that you have properly marked the name of your subject as "Physics" on your answer sheet.

Do not take this question booklet out of the room.

Chemistry

Marking Your Choice of Subject on the Answer Sheet

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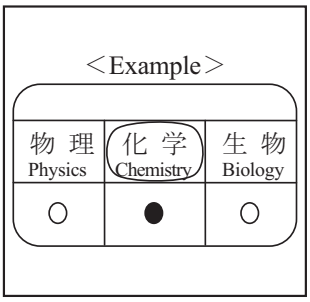
As shown in the example on the right, if you answer the Chemistry questions, circle "Chemistry" and completely fill in the oval under the subject name.

If you do not correctly fill in the appropriate oval, your answers will not be graded.



Use the following values for calculation. "L" indicates liters.

Standard state: 0 ℃, 1.0×10^5 Pa (= 1.0 atm)

The molar volume of an ideal gas at the standard state: 22.4 L/mol

Gas constant: $R = 8.31 \times 10^3$ Pa·L/(K·mol)

Avogadro constant: $N_A = 6.02 \times 10^{23}$ /mol

Faraday constant: $F = 9.65 \times 10^4$ C/mol

Atomic weight: H : 1.0 C : 12 N : 14 O : 16 Na : 23 Mg : 24 S : 32 Ca : 40
Fe : 56 Zn : 65 Pb : 207

Q1 From ①-⑤ below choose the one in which all of the three elements given belong to the same group of the periodic table. **1**

① Al, B, S ② Be, Ca, Mg ③ Br, O, S
④ Ca, K, Li ⑤ Cl, F, Ne

Q2 From the following molecules ①-⑤ choose the one that has the largest number of valence electrons involved in covalent bonds. **2**

① ethane ② ethylene (ethene) ③ nitrogen
④ carbon dioxide ⑤ water

Q3 How many unshared electron pairs do CH_4, H_2O, and NH_3 possess, respectively? From ①-⑥ in the table below choose the correct combination of numbers. **3**

	CH_4	H_2O	NH_3
①	0	0	2
②	0	1	0
③	0	2	1
④	1	0	2
⑤	1	1	0
⑥	1	2	1

Q4 From the following statements ①-⑤ on the elements starting from H to Ar in the periodic table, choose the one that is **not** correct. **4**

① Group 1 elements readily turn into monovalent cations.

② The first ionization energy of Group 18 elements is larger than those of other elements belonging to the same period.

③ Except for the period starting from H, main group elements belonging to the same group have very similar chemical properties.

④ Except for the period starting from H, metallic elements locate at the left side of the periodic table.

⑤ Transition elements are also included in the period starting from Na.

Q5 The masses of the element **X** contained in 1.0 mol each of three compounds **A**, **B**, and **C** are 38 g, 57 g, and 76 g, respectively. From the following ①-⑥ choose the value closest to the atomic weight of the element **X**. **5**

① 19　② 38　③ 57　④ 76　⑤ 95　⑥ 114

Q6 Suppose that 1.0 g each of the following substances is present as an ideal gas in containers with the same volume at the same temperature. From the following ①-⑤ choose the one whose inner pressure is the lowest. **6**

① CO_2　② O_2　③ N_2　④ $CH_3CH{=}CH_2$　⑤ CH_3CH_2OH

Q7 The heats of combustion of carbon (C) and carbon monoxide (CO) are 394 kJ/mol and 283 kJ/mol, respectively. A 1.00 mol sample of carbon was combusted to generate 0.500 mol of carbon monoxide and 0.500 mol of carbon dioxide (CO_2). How many kJ of heat were generated? From the following ①-⑥ choose the closest value. **7** kJ

① 111　② 253　③ 299　④ 323　⑤ 338　⑥ 677

Q8 From the following ①-⑥ choose the one in which the molar concentration of each ion existing in 0.10 mol/L aqueous sodium acetate (CH_3COONa (*aq*)) is arranged in decreasing order. **8**

① $CH_3COO^- > Na^+ > OH^- > H^+$

② $CH_3COO^- > OH^- > Na^+ > H^+$

③ $Na^+ > CH_3COO^- > OH^- > H^+$

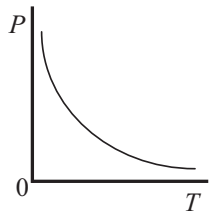
④ $Na^+ > OH^- > CH_3COO^- > H^+$

⑤ $Na^+ > OH^- > H^+ > CH_3COO^-$

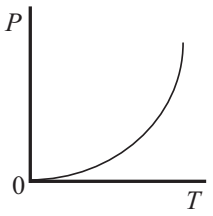
⑥ $OH^- > H^+ > Na^+ > CH_3COO^-$

Q9 From the following ①-⑤ choose the graph that is the most appropiate representation of the relation between the temperature T (K) and the pressure P (Pa) of an ideal gas confined in a container with a fixed volume. **9**

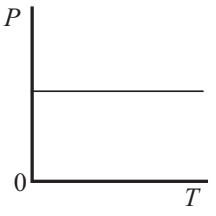
①



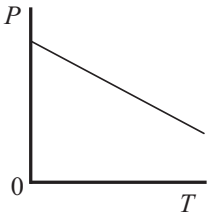
②



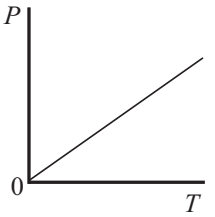
③



④



⑤



Q10 The reactions that take place at the anode and the cathode when a lead storage battery is discharged are represented below.

(anode) $Pb + SO_4^{2-} \longrightarrow PbSO_4 + 2e^-$

(cathode) $PbO_2 + SO_4^{2-} + 4H^+ + 2e^- \longrightarrow PbSO_4 + 2H_2O$

How many grams did the masses of the anode and the cathode increase, respectively, when 10.0 A of electricity flowed for 965 seconds by the discharge? From ①-⑥ in the following table, choose the correct combination. Assume that all the $PbSO_4$ formed was deposited on the surface of the electrodes. **10**

	Anode (g)	Cathode (g)
①	4.80	3.20
②	4.80	6.40
③	9.60	6.40
④	9.60	15.2
⑤	15.2	3.20
⑥	15.2	15.2

Q11 From the following compounds ①-⑥ choose the one in which the oxidation number of the nitrogen atom (N) is the lowest. **11**

① HNO_2 ② HNO_3 ③ NH_3 ④ NO ⑤ NO_2 ⑥ N_2O_4

Q12 Among the following reactions ①-⑤, which one generates the largest volume of hydrogen (H_2) at the same pressure and temperature when 1.0 g of the metal is reacted with a sufficient amount of either water or hydrochloric acid (HCl (*aq*))? From ①-⑤ below choose the one that is correct. **12**

① $Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2$

② $Fe + 2HCl \longrightarrow FeCl_2 + H_2$

③ $Mg + 2HCl \longrightarrow MgCl_2 + H_2$

④ $2Na + 2H_2O \longrightarrow 2NaOH + H_2$

⑤ $Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

Q13 From the following statements ①-⑤ on hydrogen, choose the one that is **not** correct. **13**

① Among all gases, hydrogen is the lightest.

② Hydrogen is hardly soluble in water.

③ Hydrogen acts as a reducing agent upon metallic oxides at high temperature.

④ Hydrogen is generated from the anode when water is electrolyzed.

⑤ Hydrogen is employed in a fuel cell.

Q14 From the following statements ①-⑤ regarding alkali metals choose the most appropriate one.

14

① Sodium (Na) is obtained by the electrolysis of aqueous sodium chloride (NaCl (*aq*)).

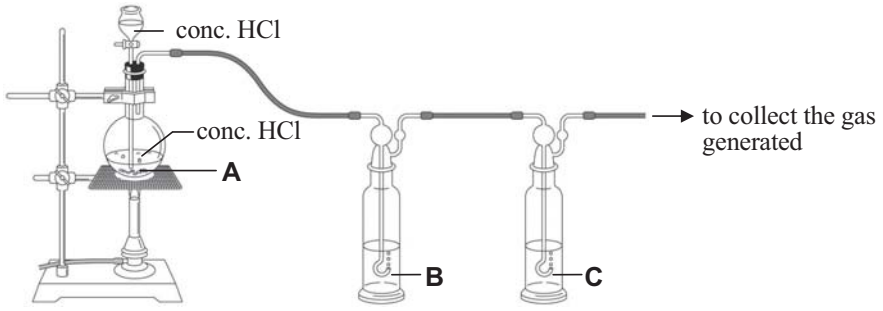
② Sodium does not react with ethanol (ethyl alcohol).

③ Alkali metals tend to become divalent cations.

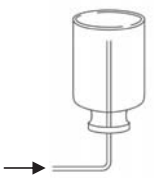
④ Atoms of alkali metals have one valence electron.

⑤ The larger the atomic number of an alkali metal, the larger its first ionization energy.

Q15 Suppose dry chlorine (Cl_2) is to be generated from the compound **A** and concentrated hydrochloric acid (conc. HCl) using the apparatus shown in the following figure. What is the compound **A**? What materials are placed in **B** and **C** in the figure, respectively? Which method is better, (i) or (ii) shown below, as the method to collect the gas generated? From ①-⑥ in the table below choose the most appropriate combination. **15**



(i) upward delivery



(ii) downward delivery

	A	B	C	Method to collect gas
①	CuO	conc. H_2SO_4	H_2O	i
②	CuO	conc. H_2SO_4	H_2O	ii
③	CuO	H_2O	conc. H_2SO_4	ii
④	MnO_2	conc. H_2SO_4	H_2O	i
⑤	MnO_2	H_2O	conc. H_2SO_4	i
⑥	MnO_2	H_2O	conc. H_2SO_4	ii

conc. H_2SO_4; concentrated sulfuric acid

Q16 From the following statements ①-⑤ on the reactions of alkenes, choose the one that is **not** correct. **16**

① When ethylene (ethene) is passed through bromine water, the bromine water is decolorized.

② When ethylene is reacted with hydrogen in the presence of a catalyst, ethane is produced.

③ Benzene is formed from ethylene by addition polymerization.

④ Cumene (isopropylbenzene) is synthesized from propylene (propene) and benzene.

⑤ No stereoisomer is formed from the reaction between 2-methylpropene and bromine.

Q17 From the following reactions ①-⑤ choose the one that can distinguish between 1-propanol (propyl alcohol) and 2-propanol (isopropyl alcohol) . **17**

① dehydration reaction by means of concentrated sulfuric acid (conc. H_2SO_4)

② silver mirror test

③ color reaction by iron(III) chloride ($FeCl_3$)

④ reducing reaction by Fehling's solution

⑤ iodoform reaction

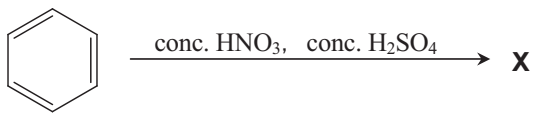
Q18 How many liters (L) of oxygen at the standard state are required to combust completely 2.3 g of ethanol (ethyl alcohol)? From the following ①-⑥ choose the closest value.

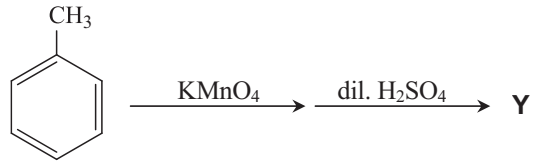
18 L

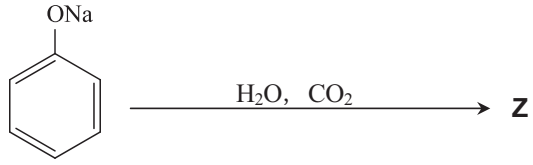
① 1.1 ② 3.4 ③ 6.8 ④ 11 ⑤ 34 ⑥ 68

Q19 Choose from ①-⑥ below the most appropriate one in which the acidities of compounds **X**, **Y**, and **Z** generated from the following reactions (**a**)-(**c**) are arranged in decreasing order.

19

(**a**) 

(**b**) 

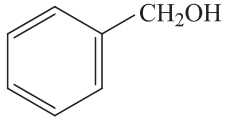
(**c**) 

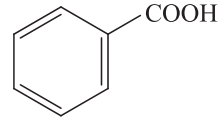
① **X** > **Y** > **Z** ② **X** > **Z** > **Y** ③ **Y** > **X** > **Z**

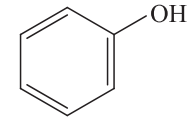
④ **Y** > **Z** > **X** ⑤ **Z** > **X** > **Y** ⑥ **Z** > **Y** > **X**

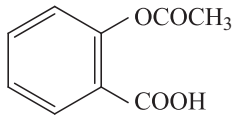
Q20 Two among the following aromatic compounds (**a**)-(**e**) exhibit the blue-purple color reaction with aqueous iron(III) chloride ($FeCl_3$ (*aq*)). From ①-⑥ below choose the correct combination.

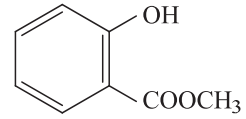
20

(**a**) 

(**b**) 

(**c**) 

(**d**) 

(**e**) 

① **a**, **c**　② **a**, **d**　③ **b**, **c**　④ **b**, **e**　⑤ **c**, **d**　⑥ **c**, **e**

End of Chemistry questions. Leave the answer spaces **21** ～ **75** blank.
Please check once more that you have properly marked the name of your subject as "Chemistry" on your answer sheet.

Do not take this question booklet out of the room.

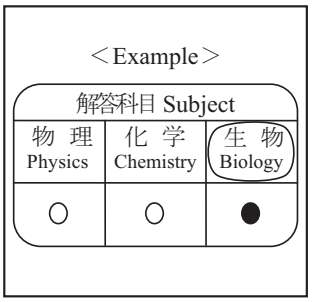
Biology

Marking Your Choice of Subject on the Answer Sheet

Choose and answer two subjects from Physics, Chemistry, and Biology. Use the front side of the answer sheet for one subject, and the reverse side for the other subject.

As shown in the example on the right, if you answer the Biology questions, circle "Biology" and completely fill in the oval under the subject name.

If you do not correctly fill in the appropriate oval, your answers will not be graded.



Q1 From ①–⑥ below choose the combination that correctly classifies the following organisms, (A)–(D), as a prokaryote, a single-celled eukaryote, or a chloroplast-containing eukaryote.

1

(A) Yeast (B) Lactobacillus (C) Amoeba (D) Euglena

	Prokaryote	Single-celled eukaryote	Chloroplast-containing eukaryote
①	A	B, C	D
②	B	A, C, D	D
③	B	A, C, D	A, D
④	A, B	C, D	—
⑤	A, B	C	D
⑥	C	A, B, D	—

Q2 Statements (a)–(e) below describe functions of cell organelles. From ①–⑨ below choose the combination correctly indicating the statement that applies to Golgi bodies and the statement that applies to centrosomes. **2**

(a) They store waste products and nutrients.

(b) They are involved in the secretion of substances synthesized by the cell to outside of the cell.

(c) They are the starting points of spindle fiber formation during cell division.

(d) They synthesize organic compounds.

(e) They produce energy.

	Golgi bodies	Centrosomes
①	a	b
②	a	c
③	b	a
④	b	c
⑤	c	a
⑥	c	b
⑦	d	b
⑧	d	e
⑨	e	a

Q3 A plant cell was immersed in a hypotonic solution. The cell absorbed water, causing its volume to expand. After a while, the cell volume stopped increasing and thereafter remained unchanged. At this point, which two pressure relationships in (a)–(f) below apply to the cell? From ①–⑥ below choose the correct combination. **3**

(a) Cellular osmotic pressure > External osmotic pressure

(b) Cellular osmotic pressure = External osmotic pressure

(c) Cellular osmotic pressure < External osmotic pressure

(d) Suction force < Turgor pressure

(e) Suction force > Turgor pressure

(f) Suction force = Turgor pressure

① a, d ② a, f ③ b, d ④ b, e ⑤ c, e ⑥ c, f

Q4 Statements (a)–(e) below describe the process of fertilization in the sea urchin. From ①–⑤ below choose the answer that correctly arranges (a)–(e) in chronological order. **4**

(a) The sperm reaches the cell membrane of the egg.

(b) The sperm reaches the jelly layer of the egg.

(c) The sperm's nucleus and the egg's nucleus approach each other.

(d) A change occurs in the tip (acrosome) of the sperm.

(e) The fertilization membrane is formed.

① a → b → d → c → e ② b → a → d → e → c

③ b → d → a → e → c ④ d → b → a → e → c

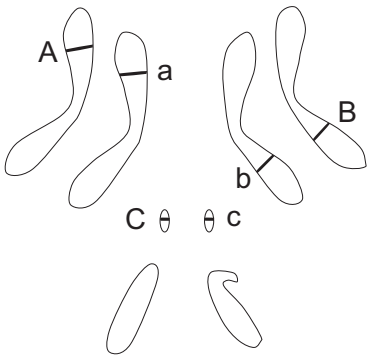
⑤ d → b → e → a → c

Q5 Genetically diverse gametes are produced as a result of sexual reproduction. Answer questions (1) and (2) below concerning this.

(1) In general, crossing-over occurs between parts of homologous chromosomes during meiosis, resulting in new combinations of genes. From ①–⑥ below choose the answer that correctly indicates the phase during which crossing-over occurs. **5**

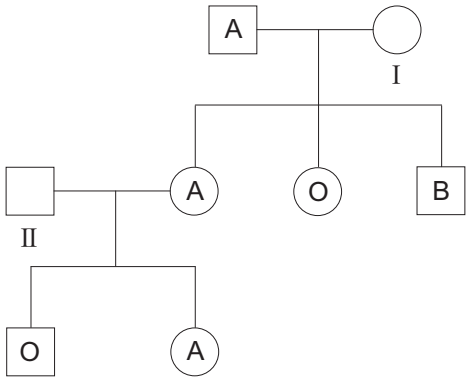
① Prophase of meiosis Ⅰ　② Anaphase of meiosis Ⅰ
③ Telophase of meiosis Ⅰ　④ Prophase of meiosis Ⅱ
⑤ Metaphase of meiosis Ⅱ　⑥ Anaphase of meiosis Ⅱ

(2) The figure below represents the chromosomal constitution of a somatic cell in a male *Drosophila melanogaster*, and the locations of three pairs of alleles (A/a, B/b, C/c) on autosomes. Considering these genes only, what is the maximum number of different genotypes theoretically possible for sperm from an individual male? From ①–⑤ below choose the correct answer. **6**



① 1　② 2　③ 4　④ 8　⑤ 16

Q6 The figure below shows a human family line. Circles represent females, and squares represent males. The letters indicate the ABO blood type of each individual. What is the genotype of the female represented by Ⅰ in the figure? What phenotypes are possible for the male represented by Ⅱ? From ①–⑧ below choose the combination that correctly answers both questions. **7**



	Genotype of Ⅰ	Phenotypes of Ⅱ
①	*AB*	Type A or O
②	*AB*	Type A, B, or O
③	*BB*	Type A or B
④	*BB*	Type A, B, or AB
⑤	*BO*	Type A or O
⑥	*BO*	Type A, B, or O
⑦	*OO*	Type A or B
⑧	*OO*	Type A, B, or AB

Q7 From ①–⑤ below choose the statement that does **not** correctly describe the structure or function of the human kidneys. **8**

① The kidneys are located at the rear of the abdomen, with one on the left and the other on the right; they contain structures called “nephrons” (also known as “kidney units”).

② A nephron is made up of a renal corpuscle (Malpighian corpuscle) and a kidney tubule (uriniferous tubule), which is surrounded by capillaries.

③ In a renal corpuscle, blood plasma constituents other than glucose are filtered into Bowman’s capsule from the glomerulus.

④ The filtrate entering Bowman’s capsule from the glomerulus is called “primitive urine”; as primitive urine passes through a kidney tubule, various constituents are reabsorbed by the surrounding capillaries.

⑤ In some cases, reabsorption of the various constituents at the kidney tubule involves active transport, which regulates the blood’s osmotic pressure to keep it at a constant level.

Q8 Homeostasis of the body is maintained by the antagonistic action of the two types of autonomic nerves. Which three actions in (a)–(f) below are functions of the sympathetic nerves? From ①–⑧ below choose the correct combination. **9**

(a) Dilation of the pupils
(b) Contraction of the pupils
(c) Dilation of skin blood vessels
(d) Contraction of skin blood vessels
(e) Inhibition of heart pulsation
(f) Stimulation of heart pulsation

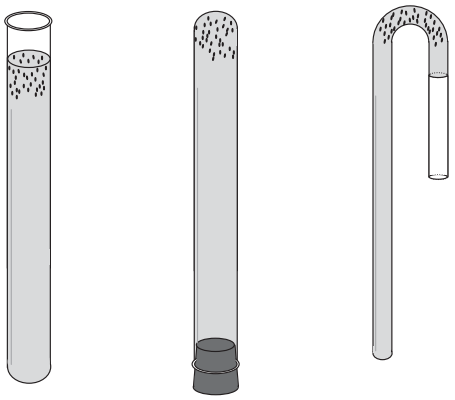
① a, c, e ② a, c, f ③ a, d, e ④ a, d, f ⑤ b, c, e
⑥ b, c, f ⑦ b, d, e ⑧ b, d, f

Q9 Statements (a)–(e) below describe the patellar tendon reflex in humans. From ①–⑨ below choose the combination indicating the two statements that are correct. **10**

(a) The patellar reflex is a set reaction that occurs quickly and consciously.
(b) The patellar tendon and the connected muscle stretch when struck, resulting in excitation of the muscle spindles, which are effectors within the muscle.
(c) The reflex center is located in the spinal cord; the excitation is transmitted to the motor nerve via a single synapse in the spinal cord.
(d) The motor nerve emerges from the dorsal root of the spinal cord, and causes the thigh muscles to relax, resulting in the upward movement of the lower leg.
(e) The pathway through which the excitation is transmitted during the reflex is called a "reflex arc."

① a, b ② a, c ③ a, d ④ a, e ⑤ b, c ⑥ b, d
⑦ b, e ⑧ c, d ⑨ c, e

Q10 Culture containing paramecia was placed in the three containers depicted in the figure below. As shown, the paramecia congregated near the top of each container. From ①–⑥ below choose the combination indicating the two statements in (a)–(e) below that correctly describe the behavior observed in this experiment. Assume that the intensity of the light incident on the containers is uniform across each container, and is the same for all three. **11**



(a) The paramecia congregated near the top in response to their sensation of gravity.

(b) The paramecia congregated near the top in response to their sensation of air.

(c) The paramecia congregated near the top in response to their sensation of gravity and air.

(d) This behavior is an example of positive taxis.

(e) This behavior is an example of negative taxis.

① a, d　② a, e　③ b, d　④ b, e　⑤ c, d　⑥ c, e

Q11 Types of human digestive enzymes include amylase in saliva, pepsin in gastric juice, and trypsin in pancreatic juice. Let us define the pH level where amylase is most active as X. From ①–⑦ below choose the combination that best indicates the pH level (in terms of X) where pepsin and trypsin would comparably be most active. Assume that all other enzymatic reaction conditions are optimal. **12**

	Pepsin	Trypsin
①	X	X－5
②	X	X＋1
③	X＋1	X－5
④	X＋1	X
⑤	X＋1	X＋1
⑥	X－5	X－5
⑦	X－5	X＋1

Q12 Lettuce seeds that had absorbed sufficient moisture were exposed to red light (R; wavelength of approx. 660 nm) and/or far-red light (FR; wavelength of approx. 730 nm) for five minutes each time in the manner indicated in the table below. The seeds were then placed in a dark room at 25°C for three days. After this, the germination rate of each seed group was examined, the results of which are listed in the table.

Referring to this table, answer questions (1) and (2) below concerning lettuce seed germination.

Light processing	Germination rate (%)
Dark room	4
R → dark room	98
FR → dark room	3
R → FR → dark room	2
R → FR → R → dark room	97
R → FR → R → FR → dark room	0
R → FR → R → FR → R → dark room	95

(1) What germination rate would be expected if the same experiment were performed with the light processing pattern [FR → R → dark room]? From ①–④ below choose the correct answer. **13**

① The germination rate would be near 0%.

② The germination rate would be near 100%.

③ The germination rate would be around 50%.

④ The germination rate would be around 25%.

(2) Plant hormone X was applied to lettuce seeds that were kept in a dark room without any exposure to light. The germination rate of these seeds was near 100%. If X were applied to seeds undergoing the light processing pattern [R → FR → R → FR → dark room], what germination rate would be expected? From ①–④ below choose the statement that best indicates the name of X and the expected germination rate. **14**

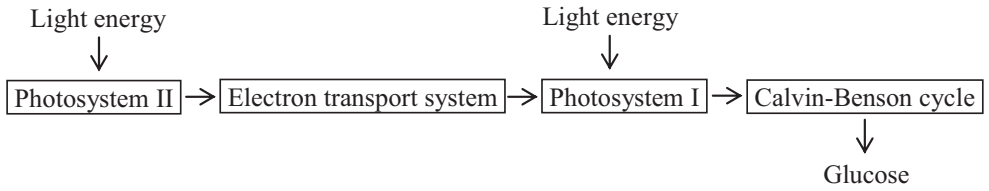
① X is abscisic acid; the germination rate would be near 100%.

② X is abscisic acid; the germination rate would be near 0%.

③ X is gibberellin; the germination rate would be near 100%.

④ X is gibberellin; the germination rate would be near 0%.

Q13 Photosynthesis in chloroplasts is generally described in terms of the following four processes. Answer questions (1) and (2) below concerning these processes.



(1) From ①–⑥ below choose the answer that correctly indicates all processes (of the four) in which ATP is synthesized as the reaction progresses. **15**

① Photosystem Ⅱ

② Electron transport system

③ Photosystem Ⅰ

④ Calvin-Benson cycle

⑤ Photosystem Ⅱ , photosystem Ⅰ

⑥ Electron transport system, Calvin-Benson cycle

(2) From ①–⑥ below choose the answer that correctly indicates all processes (of the four) that take place in thylakoids. **16**

① Photosystem Ⅱ

② Photosystem Ⅱ , electron transport system

③ Photosystem Ⅱ , electron transport system, photosystem Ⅰ

④ Calvin-Benson cycle

⑤ Photosystem Ⅰ , Calvin-Benson cycle

⑥ Electron transport system, photosystem Ⅰ , Calvin-Benson cycle

Q14 Prolonged contraction of human skeletal muscles depletes the readily available supply of oxygen, resulting in a buildup of lactic acid within the muscles. The amount of ATP in the muscles does not change much, but the amount of phosphocreatine decreases. From ①–④ below choose the statement that correctly describes how ATP and phosphocreatine are used in muscle contraction. **17**

① ATP is consumed as a direct energy source for muscle contraction. Phosphocreatine is used to re-synthesize the ATP consumed.

② ATP is consumed as a direct energy source for muscle contraction, and is immediately re-synthesized by glycolysis. Phosphocreatine is used in the process where lactic acid is produced by glycolysis.

③ Phosphocreatine is consumed as a direct energy source for muscle contraction. ATP is used to re-synthesize the phosphocreatine consumed, and is immediately re-synthesized by glycolysis.

④ Phosphocreatine is consumed as a direct energy source for muscle contraction. ATP is produced by glycolysis, and is used to synthesize glycogen from lactic acid.

Q15 From ①–⑧ below choose the combination of terms that correctly fills blanks [W]–[Z] in the following paragraph concerning eukaryotic chromosomes and DNA. **18**

Chromosomes are composed mainly of DNA and [W]. DNA is the substance of genes, and is made from the bonding together of many nucleotides, which are its basic structural units. Each nucleotide is made up of phosphate, [X], and a base. There are four types of DNA bases, whose names are abbreviated as A, T, G, and C, and the sequence of these bases encodes the genetic information. The formation of the double helix structure of DNA involves bonding between A and [Y], and between G and [Z].

	W	X	Y	Z
①	lipids	sugar	T	C
②	lipids	sugar	C	T
③	lipids	amino acid	T	C
④	lipids	amino acid	C	T
⑤	proteins	sugar	T	C
⑥	proteins	sugar	C	T
⑦	proteins	amino acid	T	C
⑧	proteins	amino acid	C	T

End of Biology questions. Leave the answer spaces **19** ～ **75** blank.
Please check once more that you have properly marked the name of your subject as “Biology” on your answer sheet.

Do not take this question booklet out of the room.

2012 Examination for Japanese University Admission
for International Students

Japan and the World

(80min.)

I Rules of Examination

1. Do not leave the room without the proctor's permission.
2. Do not take this question booklet out of the room.

II Rules and Information Concerning the Question Booklet

1. Do not open this question booklet until instructed.
2. After instruction, write your name and examination registration number in the space provided below, as printed on your examination voucher.
3. This question booklet has 26 pages.
4. If your question booklet is missing any pages, raise your hand.
5. You may write notes and calculations in the question booklet.

III Rules and Information Concerning the Answer Sheet

1. You must mark your answers on the answer sheet with an HB pencil.
2. Each question is identified by one of the row numbers 1 , 2 , 3 , ···. Follow the instruction in the question and completely fill in your answer in the corresponding row of the answer sheet (mark-sheet).
3. Make sure also to read the instructions on the answer sheet.

※ Once you are informed to start the examination, fill in your examination registration number and name.

Examination registration number			*					*						
Name														

Q1 Read the following passage and answer questions (1)–(4) below.

In Japan now, there is debate over fiscal policy between those who advocate austerity measures and those who advocate expansionary fiscal policies.

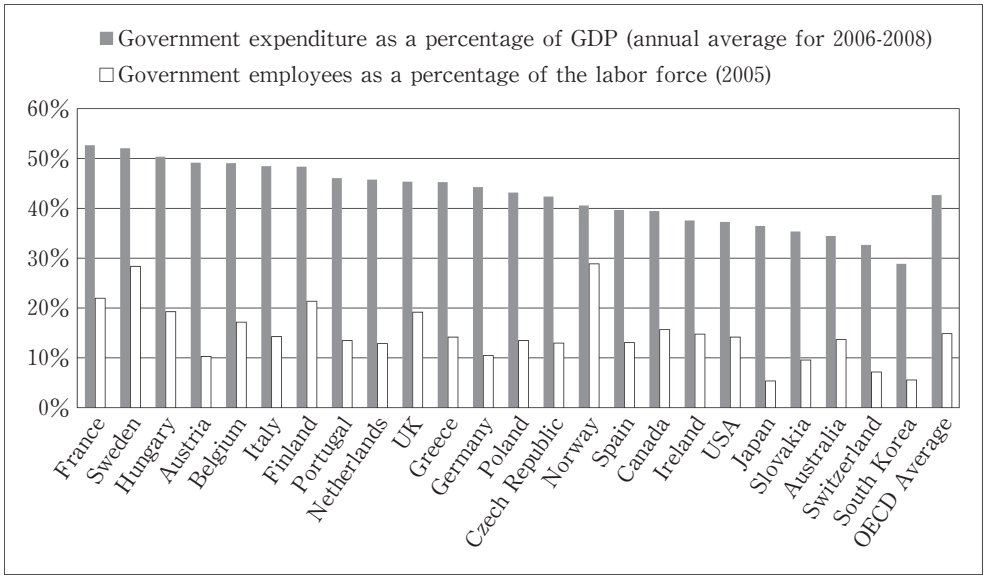
Since Japan's national debt from bond issues and borrowings exceeded 900 trillion yen as of the end of 2011, the advocates of fiscal austerity say that it is necessary to immediately [a] taxes, even though this action clearly runs the risk of harming [b] . Also, [1] they claim that it is necessary to reduce government spending by cutting back public works projects and decreasing the number of government employees.

On the other hand, the fiscal expansionists say that since [2] there is very little likelihood that Japan will financially collapse, [3] the government needs to create demand by actively implementing public works projects, even if this means issuing bonds. They argue that this will help [b] to recover while increasing [c] , and thus reduce the amount of government bond issuance over the medium to long run.

(1) From ①–④ below choose the combination of terms that best fills blanks [a] – [c] in the paragraphs above. **1**

	a	b	c
①	raise	public order	savings
②	raise	the economy	tax revenues
③	lower	public order	savings
④	lower	the economy	tax revenues

(2) With reference to underlined item **1**, from ①–④ below choose the statement that best indicates what can be inferred from the following graph comparing OECD countries (including Japan). **2**



Compiled from the website of the OECD

① Japan can be considered a small-government country.

② The Nordic countries can be considered small-government countries.

③ Countries with larger populations tend to practice big government.

④ Countries with larger GDPs tend to practice big government.

(3) From ①–④ below choose the statement that best supports the claim made in underlined item **2**. **3**

① Most of Japan's government bonds are yen-based and are held by financial institutions and individuals in Japan.

② Owing to the stronger yen, the Japanese government has accrued unrealized gains on its foreign currency assets.

③ While Japan's current account balance is in deficit, its capital account balance is in surplus.

④ Real government debt decreases when the economy is in deflation, where the value of the currency falls.

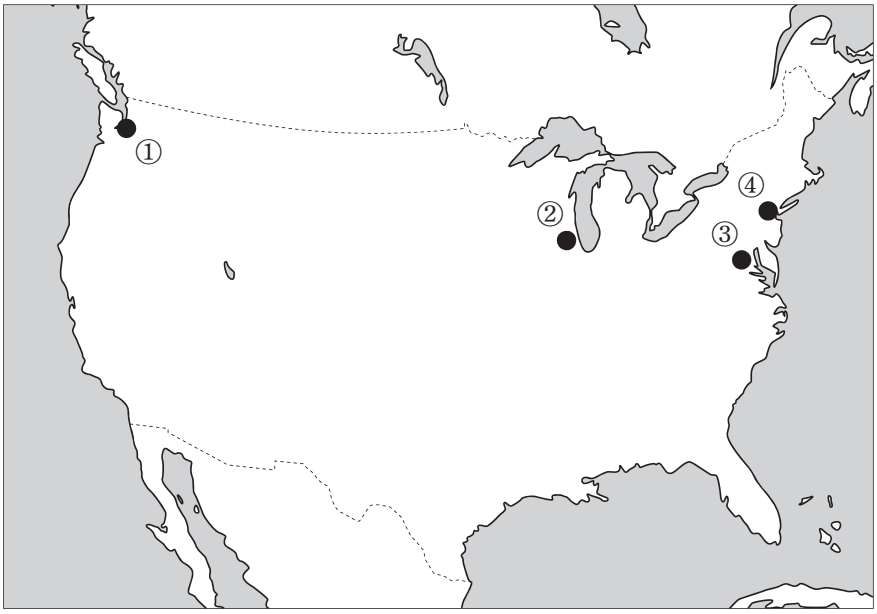
(4) With reference to underlined item **3**, from ①–④ below choose the combination that correctly indicates: (1) an economist who advocated the importance of government measures to create demand through active implementation of public works projects, and (2) a government policy based on that thinking. **4**

	Economist	Government policy
①	Adam Smith	laissez-faire policy
②	John Maynard Keynes	The New Deal
③	Friedrich von Hayek	Thatcherism
④	Milton Friedman	Reaganomics

Q2 Read the following paragraph and answer questions (1)–(4) below.

[1]Washington, D.C., in the USA, is situated in a region with a [2]temperate, rainy climate. It is the seat of the Executive Office of the President and the [3]US Congress, and is the location of the [4]International Monetary Fund (IMF) headquarters, making it an important city both domestically and internationally.

(1) With reference to underlined item **1**, from ①–④ on the map below choose the answer that correctly indicates the location of Washington, D.C. **5**



(2) With reference to underlined item **2**, a temperate, rainy climate is characterized by distinct seasonal changes and a hot, rainy summer. From ①–④ below choose the answer that best represents a city with a temperate, rainy climate. **6**

① Tokyo
② Rome
③ Moscow
④ Singapore

(3) With reference to underlined item **3**, seats in the House of Representatives are allocated to each state in a number proportional to the size of its population. From ①–④ below choose the state with the largest number of seats in the House of Representatives. **7**

① Washington
② Florida
③ Texas
④ California

(4) With reference to underlined item **4**, from ①–④ below choose the answer that does **not** indicate a key role of the IMF. **8**

① Promoting cooperation on international monetary problems
② Promoting stabilization of foreign currency exchange rates
③ Making foreign currency loans to member countries
④ Lending developmental investment funds to developing countries

Q3 Read the following paragraph and answer questions (1) and (2) below.

The [a] that began in the UK in the latter half of the 18th century marked the emergence of the capitalist economy, which then gradually spread to other countries around the world. These capitalist economies, which continued to grow as they underwent cyclical recessions, powered the rise of the heavy and chemical industries in the late 19th and early 20th centuries. Technological innovation enabled mass production, and large businesses with heavy investments in production equipment began to emerge. The [b] system developed as a means of raising money from many parts of society to finance the growth of such businesses.

(1) From ①–④ below choose the term that best fills blank [a] in the paragraph above. **9**

① Bourgeois Revolution
② IT Revolution
③ Industrial Revolution
④ Agricultural Revolution

(2) From ①–④ below choose the term that best fills blank [b] in the paragraph above. **10**

① central bank
② joint-stock company
③ holding company
④ managed currency

Q4 Read the following paragraph and from ①–④ below choose the combination of terms that correctly fills blanks [a] – [f] in the paragraph. **11**

In a market economy, imbalances in supply and demand are corrected by the rise and fall of the prices of goods. For example, if a newly developed product generates heavy demand among consumers, the supply will not be adequate to satisfy demand, and consequently the product's price will [a] and the industry's profit on it will [b]. This will lead to an [c] of capital from other sectors, causing the industry to grow rapidly. As another example, when demand decreases for the products of a declining industry, the prices of those products will [d] and the industry's profits will [e], prompting an [f] of capital. As these examples show, the allocation of resources is automatically achieved by the market's self-adjustment mechanism.

	a	b	c	d	e	f
①	rise	increase	exit	rise	increase	exit
②	fall	decrease	exit	rise	increase	entry
③	rise	increase	entry	fall	decrease	exit
④	fall	decrease	entry	fall	decrease	entry

Q5 From ①–④ below choose the statement that does **not** correctly describe economic policies of today's developed countries. **12**

① In response to increased globalization of the economy, developed countries have adopted a floating exchange rate system and never intervene in the foreign exchange market.

② The government seeks to encourage business competition and flexible prices by controlling oligopolistic and monopolistic practices through anti-monopoly laws.

③ The government implements fiscal policies to minimize economic fluctuations, such as implementing tax cuts and public investment during recessions, and raising taxes during economic booms.

④ In monetary policy, measures are taken to maintain the stability of prices and the financial system, mainly through the central bank's adjustment of the money supply and interest rates.

Q6 From ①–④ below choose the statement that best describes appreciation/depreciation of the Japanese yen. **13**

① When the Japanese economy is booming, the yen depreciates due to the resulting increase in foreign investment in Japan.

② When Japanese exports increase, the yen appreciates due to the resulting increase in demand for yen.

③ When interest rates are lower in Japan than in other countries, the yen depreciates due to the resulting capital inflow to Japan from other countries.

④ The term "strong yen" means that the yen has fallen in value against other currencies in the foreign exchange market.

Q7 Statements A–F below describe the four phases of the business cycle: boom, downturn, slump, and recovery. From ①–④ below choose the combination indicating the two statements that best describe the boom phase. **14**

A: Prices and employment decrease.

B: Prices and interest rates are high.

C: Prices are low, and many businesses go bankrupt.

D: Wages and stock prices are high.

E: Economic activity grows, and wages start to rise.

F: Employment and wages are low.

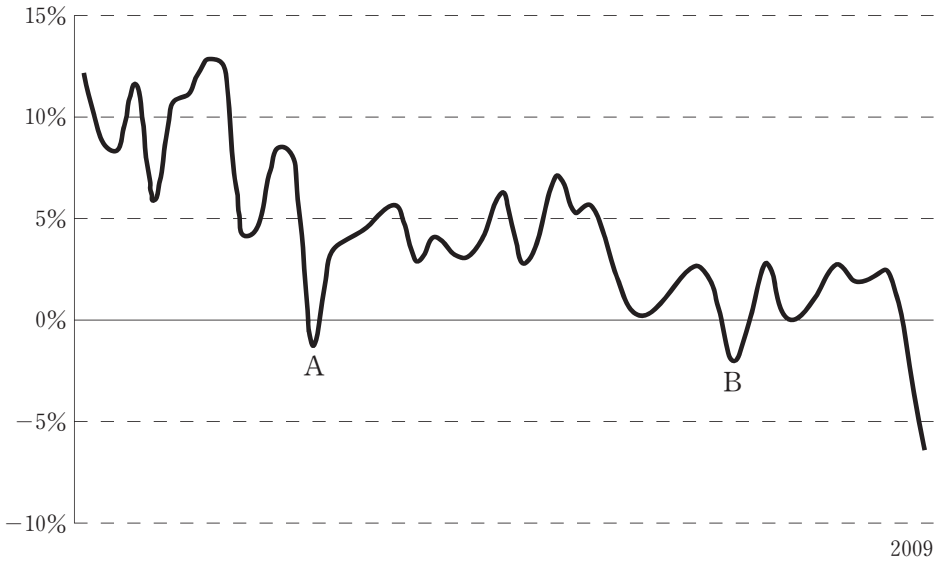
① A, E

② B, C

③ B, D

④ E, F

Q8 The following graph shows changes in Japan's economic growth rate from a certain time in the 20th century up to 2009. From ①–④ below choose the combination that correctly indicates the periods represented by A and B on the graph. **15**



Compiled from the website of the World Bank

	A	B
①	around 1945	around 1987
②	around 1965	around 1994
③	around 1974	around 1998
④	around 1992	around 2003

Q9 An economic partnership agreement (EPA) is an international agreement between countries or regions for purposes such as removing import tariffs, deregulating service industries, improving the investment environment, and strengthening intellectual property rights. From ①–④ below choose the answer that correctly indicates the partner in the first EPA established by Japan. **16**

① Russia

② Singapore

③ USA

④ Australia

Q10 The following table lists the top three source countries for major imports to Japan in 2010, and each country's proportion of the import total. From ①–④ below choose the combination that correctly identifies each country as represented by A–D in the table. **17**

Unit: %

Rank	Meat		Seafood		Fruit		Alcoholic beverages	
1	USA	26.0	China	18.2	USA	24.3	D	39.5
2	A	16.5	B	8.8	C	23.6	South Korea	12.1
3	Canada	11.0	USA	8.6	China	16.1	USA	8.6

Compiled from *Nihon Kokusei-zue 2011-12*

	A	B	C	D
①	Australia	Thailand	Philippines	France
②	Thailand	Philippines	France	Australia
③	Philippines	France	Australia	Thailand
④	France	Australia	Thailand	Philippines

Q11 The following table lists the volume of railway passenger transport (passenger-kilometers) for Japan, the USA, China, and Russia in 2009. From ①–④ below choose the combination that correctly identifies each country as represented by A–D in the table. **18**

Unit: 100 million pkm

Country	Passenger transport volume
A	7,879
B	3,939
C	1,536
D	95

Compiled from *Sekai Kokusei-zue 2011-12*

Note: 1 passenger-kilometer (pkm) is 1 kilometer traveled by 1 passenger, as a unit of traffic.

	A	B	C	D
①	China	Japan	Russia	USA
②	Japan	Russia	USA	China
③	Russia	USA	China	Japan
④	USA	China	Japan	Russia

Q12 The following table lists the population estimates for Africa, Asia, Europe, North America, Oceania, and South America for every 20 years from 1970 to 2050. From ①–④ below choose the combination that correctly identifies each region as represented by A–C in the table. **19**

Unit: million

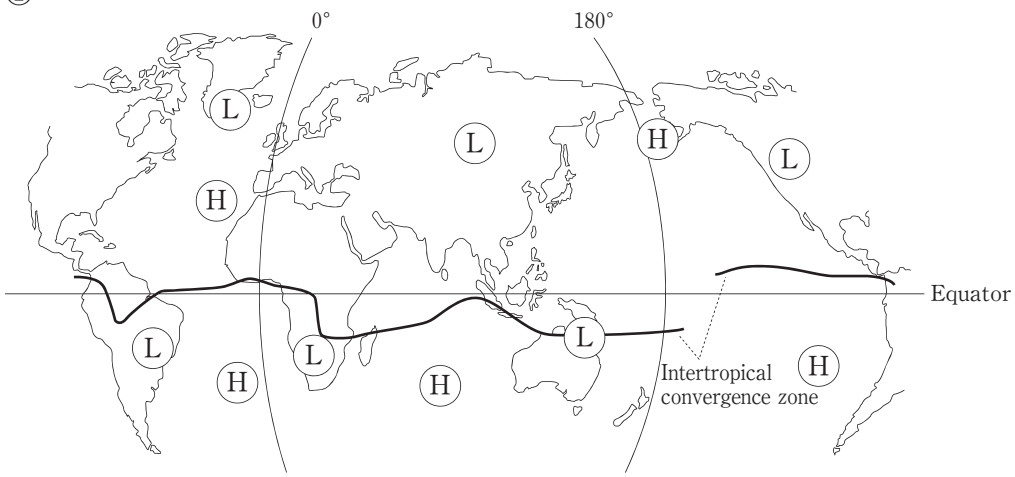
	1970	1990	2010	2030	2050
A	2,125	3,179	4,167	4,917	5,231
B	656	721	733	723	691
C	367	639	1,033	1,524	1,998
D	326	429	547	642	695
E	191	296	393	458	483
F	20	27	36	45	51

Compiled from *Sekai no Toukei 2011*

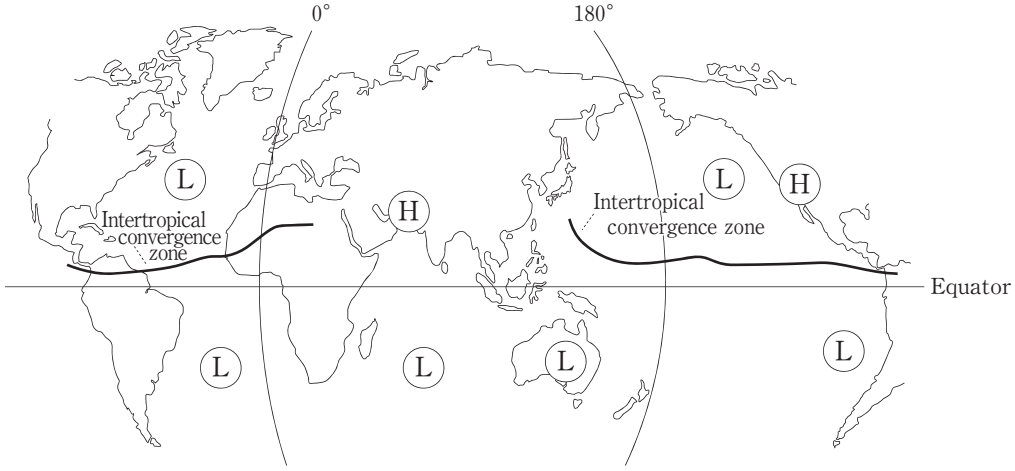
	A	B	C
①	Africa	Europe	Asia
②	Asia	North America	South America
③	Asia	Europe	Africa
④	Africa	North America	South America

Q13 The following four maps represent models of the global atmospheric pressure patterns (H: high pressure; L: low pressure) and the intertropical convergence zone (bold lines). From ①–④ below choose the map that best depicts the state of these patterns and this zone in July. **20**

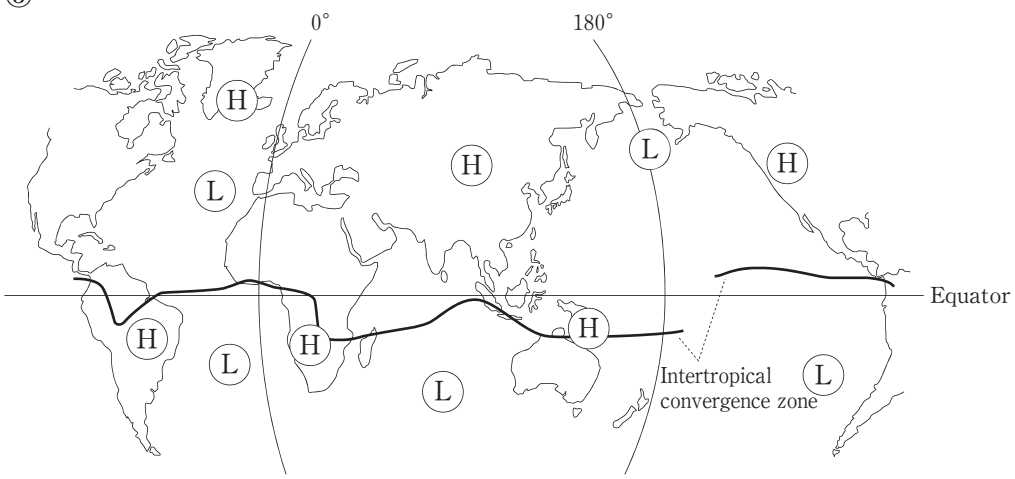
①



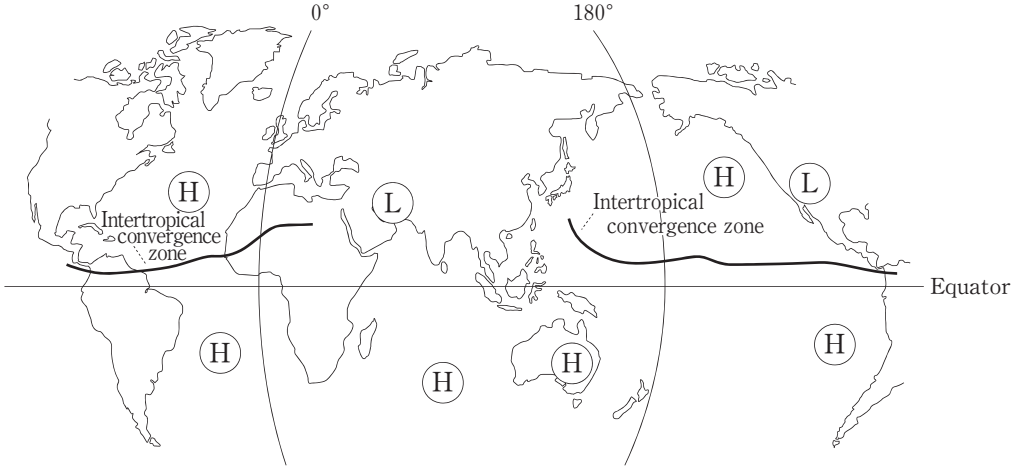
②



③



④



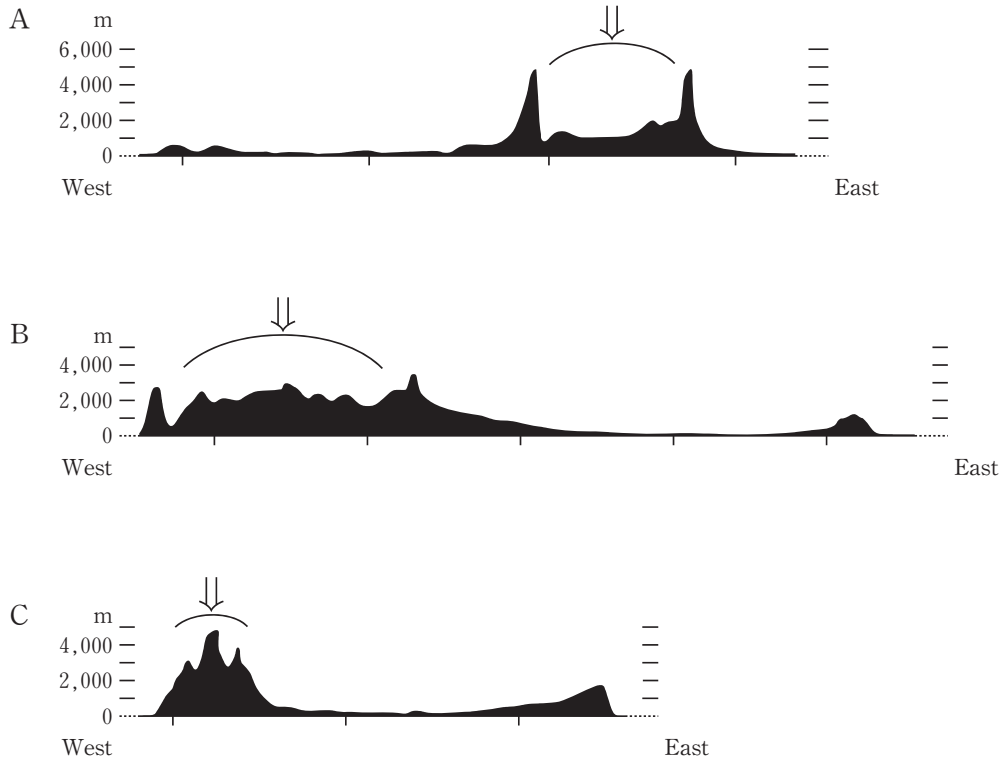
Q14 Figures A–C below are topographical cross-sections of the earth's surface along specific latitudes in three continents:

North America (cross-sectioned at latitude 40° north)

South America (cross-sectioned at the Tropic of Capricorn)

Africa (cross-sectioned at the equator)

Note that east-west distances are not uniform for the three figures, but the graduations on the horizontal axis are separated by 10 longitudinal degrees. Answer questions (1) and (2) below concerning these figures.



(1) From ①-④ below choose the combination that correctly identifies each continent as represented by figures A-C. **21**

	A	B	C
①	Africa	South America	North America
②	Africa	North America	South America
③	South America	North America	Africa
④	North America	Africa	South America

(2) In each figure, the section indicated with an arrow (⇓) represents a region of mountains or highlands. From ①-④ below choose the combination that correctly identifies the figures whose arrowed region is a young orogenic belt. **22**

① A, B, C

② A, B

③ A, C

④ B, C

Q15 Statements A and B below concern Japan's capital, Tokyo (latitude 35.4° north, longitude 139.5° east), and Australia's capital, Canberra (latitude 35.2° south, longitude 149.1° east). From ①–④ below choose the combination that correctly indicates whether these two statements are true or false. **23**

A: The time in Canberra is one hour behind the time in Tokyo as their local times are based on two different standard meridians (ignore the effect of daylight saving time).

B: If we suppose the circumference of the earth passing through Tokyo and Canberra to be 40,000 km, the distance between the two cities would be nearly 6,600 km.

	A	B
①	True	True
②	True	False
③	False	True
④	False	False

Q16 The following table lists the top five exports of three South American countries (A–C) in 2009. From ①–④ below choose the combination that best identifies the countries represented by A–C in the table. **24**

Rank	A	B	C
1	machinery	copper	crude oil
2	iron ore	copper ore	petroleum products
3	meat	vegetables, fruit	steel
4	soybeans	seafood	aluminum
5	crude oil	pulp & recycled paper	iron ore

Compiled from *Sekai Kokusei-zue 2011-12*

	A	B	C
①	Brazil	Chile	Venezuela
②	Argentina	Chile	Brazil
③	Venezuela	Brazil	Argentina
④	Chile	Argentina	Venezuela

Q17 In 1863, a ceremony was held to dedicate a national cemetery in Gettysburg (USA), the site of a fierce battle during the American Civil War. In the ceremony, the US President gave a speech in which he spoke about "government of the people, by the people, for the people." From ①–④ below choose the answer that correctly identifies that president. **25**

① George Washington
② Thomas Jefferson
③ Abraham Lincoln
④ Theodore Roosevelt

Q18 A semi-presidential system is a form of government that combines certain elements of parliamentary cabinet systems with those of presidential systems. From ①–④ below choose the answer that best indicates a country that uses a semi-presidential system. **26**

① Japan
② France
③ UK
④ USA

Q19 Read the following conversation and answer questions (1) and (2) below.

Yoshiko: In recent years, the swing of public opinion in Japan has grown larger, I think. For example, the Liberal Democratic Party won a landslide victory in the 2005 general election with a [1] neoliberal set of policies. But then...

Teacher: But then in the next general election the Democratic Party of Japan scored a big victory with its pledge to provide various welfare benefits, including a child allowance.

Yoshiko: Why does public opinion shift so much?

Teacher: The reason might be that citizens lack a long-range perspective on things. We should keep in mind the famous words of a philosopher who spoke about "[2] a partnership not only between those who are living, but between those who are living, those who are dead, and those who are to be born."※ In other words, we should take a very far-reaching perspective that thinks about the present with due consideration to continuity with the traditions of the past, and that serves the happiness of future generations.

※ Quoted from *Reflections on the Revolution in France*

(1) With reference to underlined item **1**, from ①–④ below choose the answer that best represents an example of neoliberal policy. **27**

① A policy to enhance the quality of education by increasing public spending on education

② A policy to reduce economic disparities by raising taxes on the wealthy

③ A policy to add stability to society by taking measures to help the unemployed

④ A policy to extend freedom of activity for businesses by deregulating markets

(2) The words in underlined item **2** were written by a British conservative thinker. From ①–④ below choose the answer that correctly identifies that thinker. **28**

① Edmund Burke

② Karl Marx

③ John Locke

④ Jean-Jacques Rousseau

Q20 The following table lists, for four countries, the years in which universal suffrage was granted to men and to women. From ①-④ below choose the combination that best identifies the countries represented by A-C in the table.

29

	A	B	C	Japan
Men	1848	1918	1870	1925
Women	1944	1928	1920	1945

	A	B	C
①	UK	France	USA
②	France	UK	USA
③	France	USA	UK
④	USA	France	UK

Q21 From ①–④ below choose the statement that best describes the Japanese Constitution. **30**

① It requires the Emperor and public officials to respect and defend it.

② It is considered a flexible constitution that can be easily amended.

③ It starts with an article that renounces war.

④ It states that laws conflicting with it must have approval by at least a two-thirds majority of the Diet in order to be enacted.

Q22 Indian scholar Sugata Dasgupta argued that the traditional dichotomy of "war and peace" should be avoided, and instead proposed that the antithesis to peace should be called "peacelessness." He reasoned that the absence of war in developed countries may be referred to as "peace," but the absence of war in developing countries does not equate with peace. In this context, from ①–④ below choose the statement that does **not** indicate an appropriate example of the conditions in developing countries. **31**

① Inequalities and large economic disparities stemming from structural causes exist in many corners of society.

② Many people are unable to receive proper education and medical care.

③ The economy is quite vulnerable because it is heavily dependent on the production of certain primary commodities.

④ Only economic growth and material wealth are pursued, while the need for emotional well-being is neglected.

Q23 The right of individual or collective self-defense is internationally recognized as an inherent right of states. From ①–④ below choose the answer that best indicates the first international agreement to include this right in its text. **32**

① Covenant of the League of Nations (1919)

② Treaty for the Renunciation of War (Kellogg-Briand Pact) (1928)

③ Charter of the United Nations (1945)

④ Universal Declaration of Human Rights (1948)

Q24 From ①–④ below choose the statement that best describes international relations in the 20th century. **33**

① Following World War I, the principle of self-determination that was advocated by the League of Nations spread all over the world.

② Following World War II, the USA adopted the Monroe Doctrine as a policy for intervening against the spread of communism in third-world countries.

③ The Cold War came to a close with the end of the Vietnam War, which had been called a proxy war between the USA and the USSR.

④ After the end of the Cold War, NATO, acting without UN approval, launched air strikes against Serbia in order to stop its campaign of ethnic cleansing.

Q25 From ①–④ below choose the answer that best indicates an action taken by Napoleon I following the French Revolution. **34**

① He successfully invaded Moscow and deposed the Romanovs.

② He issued the Continental System (Blockade) order, which prohibited continental European states from engaging in trade with the UK.

③ He executed Louis XVI and established a revolutionary government.

④ He convened the Congress of Vienna, which redrew the boundaries of European states.

Q26 From ①–④ below choose the statement that best describes the situation in Asia following the First Sino-Japanese War. **35**

① The USA demanded the opening up of Korea and established an unequal treaty with its government.

② The UK obtained a lease on Hong Kong from China.

③ France demanded that the territorial integrity of, and equal opportunities in, China be guaranteed.

④ Russia acquired a lease on territory in Manchuria and the right to build a railroad there.

Q27 From ①–④ below choose the statement that best describes Germany following World War I. **36**

① Under the leadership of the Social Democratic Party, the German economy was rebuilt as a socialist state.

② Germany was placed under the administration of the League of Nations, with various restrictions on its sovereignty.

③ Germany was partitioned into eastern and western halves controlled separately by the USSR and the USA.

④ A democratic system of government was built up under the Weimar Constitution.

Q28 Read the following paragraph and from ①–④ below choose the combination of terms that correctly fills blanks [a] and [b] in the paragraph. **37**

In the years immediately following World War II, Japan was placed under a form of indirect rule, in which the Japanese government carried out directives and recommendations issued by GHQ/SCAP (General Headquarters/Supreme Commander for the Allied Powers), the occupation authorities led mainly by the [a] . The initial aim of this ruling was to [b] and democratize Japan.

	a	b
①	USSR	demilitarize
②	USA	demilitarize
③	USSR	socialize
④	USA	socialize

Q29 Agricultural land reforms were implemented in Japan as part of economic reforms carried out following World War II. From ①–④ below choose the statement that best describes those land reforms. **38**

① The government promoted cultivation of commercial crops in order to acquire foreign currency through the export of those crops.

② The government implemented a policy for reducing rice acreage that encouraged farmers to switch from paddy rice cultivation to growing other crops.

③ In order to increase owner farmers, the government forcibly purchased land from landowners and sold it to the tenants at low prices.

④ The government attempted to spread large-scale agriculture in Japan by promoting a switch from family farming to corporate farming.

The end of the questions for Japan and the World. Leave answer spaces **39** — **60** blank.

Do not take this question booklet out of the room.