

平成31年度 入学試験問題

医学部 (Ⅱ期)

英語・数学

注意事項

1. 試験時間 平成31年3月2日、午前9時30分から11時50分まで
2. 配付した試験問題(冊子)、解答用紙の種類はつぎのとおりです。
 - (1) 試験問題(冊子、左折り)(表紙・下書き用紙付)
英語
数学(その1, その2)
 - (2) 解答用紙
英語 1枚(上端黄色)(右肩落し)
数学(その1) 1枚(上端茶色)(右肩落し)
" (その2) 1枚(上端茶色)(左肩落し)
3. 下書きが下書き用紙で足りなかったときは、試験問題(冊子)の余白を使用して下さい。
4. 試験開始2時間以降は退場を許可します。但し、試験終了10分前からの退場は許可しません。
5. 受験中にやむなく途中退室(手洗い等)を望むものは挙手し、監督者の指示に従って下さい。
6. 休憩のための途中退室は認めません。
7. 退場の際は、この試験問題(冊子)を一番上へのせ、挙手し、監督者の許可を得てから、試験問題(冊子)、受験票、下書き用紙および所持品を携行の上、退場して下さい。
8. 試験終了のチャイムが鳴ったら、直ちに筆記をやめ、おもてのまま上から解答用紙[英語、数学(その1)、数学(その2)]、試験問題(冊子)の順にそろえて確認して下さい。確認が終っても、指示があるまでは席を立たないで下さい。
9. 試験問題(冊子)はお持ち帰り下さい。
10. 監督者退場後、試験場で昼食をとることは差支えありません。ゴミ入れは場外に設置してあります。
11. 午後の集合は1時です。

英 語

- 1 次の各組の単語について1. ~ 2. は一番強いアクセントの位置が他と異なるものを, 3. ~ 5. は下線部の発音が他と異なるものを, それぞれ1つ選び, 記号で答えなさい。

1. A. al-ter-na-tive B. del-i-ca-cy C. e-con-o-mist
 D. ha-bit-u-al E. me-trop-o-lis
2. A. fac-ul-ty B. pho-to-graph C. man-ag-er
 D. con-cen-trate E. pi-o-neer
3. A. allow B. crow C. brow D. crowd E. owl
4. A. smooth B. bathe C. mouths D. breathe E. worth
5. A. hose B. resolve C. chase D. oppose E. lose

- 2 次の各文の()に入れるのに最も適切な表現を1つ選び, 記号で答えなさい。

1. The tennis player was dressed so gorgeously that people wouldn't have noticed him () holding a tennis racket.
A. not had he been B. not has he been C. he had been not
D. had he not been E. he had not been
2. It was () by the students that the teacher felt like hugging every one of them.
A. so good done B. so nicely done C. such best one
D. such lovely one E. such finely one
3. The children need a bigger room ().
A. where to play B. when to play C. in that they play
D. in which to play E. how to play
4. Who () was in front of my house?
A. you thought B. you think C. did you think that
D. did you think E. thought you
5. He is not interested in playing baseball, () in watching it.
A. still less B. still more C. much more
D. less than E. more than

6. The ecology of plants brought () to us the full wonder of nature.
A. home B. idea C. heart D. back E. place
7. The teacher recognized her face, but her name () him.
A. missed B. failed C. escaped D. left E. fell
8. Because Tom wasn't invited to the concert, he walked around with a long ().
A. ear B. hand C. feet D. face E. head
9. () the end of the vacation coming on, I had to study hard to get my homework done.
A. Since B. By C. Till D. Of E. With
10. The () amount of money Tom inherited allowed him to buy a big house.
A. much B. lot C. many D. large E. numerous

3

次の各日本文に一致するように語句を並べ替えたときに、(1)~(10)に入る語の記号をそれぞれ答えなさい。

1. あなたの考えが適用可能かどうかだけが、私達にとって重要だった。

Whether your idea was () () (1) () () (2) () () us.

ア. mattered イ. applicable ウ. that エ. was
オ. to カ. or キ. not ク. all

2. 物価の突然の上昇が、インフレの懸念を引き起こした。

The sudden () () () () (3) () (4) () inflation.

ア. concern イ. rise ウ. prices エ. about
オ. in カ. has given キ. to ク. increase

3. 彼女の新たなパフォーマンスは、並外れた才能の証明となるだろう。

Her new performance () (5) () (6) () () () .

ア. bear イ. her ウ. to エ. unusual
オ. will カ. talent キ. witness

4. この映画は、日本史が好きな人には興味深い。

This movie () (7) () () (8) () () () .

ア. who イ. to ウ. interest
エ. like オ. of カ. those
キ. Japanese history ク. is

5. どんなに頭がよい学生でも、2か月でドイツ語をマスターすることができないのは、疑いの余地がない。

It is () (9) () (10) () () () () in two months.

ア. the smartest student イ. German ウ. doubt
エ. master オ. that カ. beyond
キ. even ク. cannot

4 次の各文の下線部には誤りが1つあります。その箇所を番号で指摘し、訂正しなさい。

1. Mary and I are so likewise that the teacher often mistakes me for my twin sister.
(1) (2) (3) (4)

2. Your girlfriend got hurt by what you said yesterday. It would have been better for you to leave it unsaid.
(1) (2) (3) (4)

3. Today we hear it saying on all sides that the economy is tending to overheat.
(1) (2) (3) (4)

4. We have to be respective of each other's opinions, no matter how much we disagree.
(1) (2) (3) (4)

5. When I returned from my trip to Canada, I had such a lot of luggages that I had to pay extra at the airport.
(1) (2) (3) (4)

5

次の各対話中の(あ)～(お)に入る表現として最も適切なものをそれぞれ選択肢から1つ選び、記号で答えなさい。

[対話 1]

Waitress: Good evening, madam. Are you ready to order?

Customer: Yes, I'll have steak.

Waitress: How would you like your steak?

Customer: (あ)

Waitress: Anything else?

Customer: Well, (い)

Waitress: Salad, soup, bread, and coffee.

Customer: Sounds good. I'd like that, please.

(あ)の選択肢

- A. I like steak very much.
- B. After salad.
- C. So much the better.
- D. I'd like it medium.
- E. Well-burned, please.

(い)の選択肢

- A. no, thank you.
- B. what comes with it?
- C. when will it come?
- D. yes, thanks.
- E. can I have some more?

[対話 2]

Man 1: I thought you were going to the evening performance today.

Man 2: I wanted to, but I couldn't catch the train.

Man 1: (う)

Man 2: That'll be very kind of you.

< at the theater >

Man 1: How much is a ticket for the evening performance today?

Man 3: (え)

Man 1: OK. I'll take it.

(う)の選択肢

- A. I can drive you as far as the theater.
- B. I'll show you around the theater.
- C. There's another train coming soon.
- D. I'll walk you there.
- E. You don't have to be worried about.

(え)の選択肢

- A. Sorry, we don't have any ticket available.
- B. We don't have any performance today.
- C. You can buy the evening ticket at another counter.
- D. The same as for the afternoon performance.
- E. We only accept cash.

[対話 3]

Man 1: What do you think of my collection of stationery sets?

Man 2: Wonderful! But I didn't know you collected them.

Man 1: I've been collecting them since I was in the elementary school.

Man 2: (お)

(お)の選択肢

- A. Why don't you start to collect them again?
- B. You've stopped collecting them now, haven't you?
- C. You shouldn't have collected them when you were young.
- D. Oh, that many years! What made you start?
- E. You seemed to have taken too much time with many things.

- [1] Kaiba Gionfriddo was six weeks old when he suddenly stopped breathing and turned blue at a restaurant. Kaiba's parents quickly rushed him to the hospital where they learned that his left bronchial* tube had collapsed because of a previously undetected birth defect*. During the next few weeks the life-threatening attacks recurred, increasing in number until they became everyday events. Physicians and researchers, however, used some of the most sophisticated bioengineering techniques available to 3-D print a synthetic* tube to hold the baby's airway open. Kaiba had the surgery in January 2012 and hasn't suffered an airway collapse since.
- [2] The trachea*, or windpipe*, is essentially constructed much like a vacuum cleaner hose, says Glenn Green, an ear nose and throat specialist (otolaryngologist*) at the University of Michigan, who helped to develop the device. The human trachea comprises 20 rings of cartilage* (1) by muscle and connective tissue* that extends from the Adam's apple* down behind the breastbone. It then branches into two tubes called bronchi* that each connect to a lung. With each inhalation, the lungs fill and expand; likewise, the strong but flexible airway tubes widen and lengthen.
- [3] In most cases after a child is born, the cartilage in the trachea keeps the airway open. But in about one out of 2,100 live births*, for some reason, a portion of the airway is floppy* and collapses, (2) outside air from reaching one or both lungs.
- [4] Kaiba's doctors contacted Green and his colleagues who were working on a new device that could help. The researchers had been searching for a way to help infants with collapsing airways. They designed a tube that could wrap around the floppy portion of a trachea or bronchus and hold the airway open. Each individual's airway, however, is unique, and there is no one-size-fits-all solution. Instead Green and his colleagues would create custom-designed devices using technology called three-dimensional printing.
- [5] A 3-D printer works like an inkjet printer, but instead of laying down layers of ink it deposits a structural material. The printer head adds each layer according to a digital pattern to create a 3-D structure. 3-D printers in manufacturing have built prototypes and parts for machines. In research settings bioengineers have created artificial ears, and lab rats have received printed spinal disks* and bones. Printing fully functioning organs and tissues for humans poses some challenges. A kidney, for example, needs working blood vessels* and tubes to collect urine*.

- [6] Problems with the trachea, however, lend themselves to 3-D printed solutions because the organ's ridged tubelike structure is simple. After testing their idea in piglets*, Green and his colleagues were confident a printed device would work. Scott Hollister, a professor of biomedical engineering at Michigan was in charge of designing sleeve* that would wrap around the outside of the floppy airway. The sleeve's structure allows it to expand as the airway grows and develops while simultaneously resisting spasms* that pull inward, thereby collapsing the airway.
- [7] The team first used a computed tomography (CT) scan to sketch out Kaiba's airways. From those images, they then sculpted a three-dimensional printed cast that had the same shape as Kaiba's collapsed bronchus. (3) that cast they created the sleeve or splint* that would wrap around the bronchus. It took several tries but the researchers were eventually able to create a perfect fit. The next step was to sew the tissue of Kaiba's bronchus to the inside of the sleeve. The team needed to obtain an emergency-use approval from the U.S. Food and Drug Administration* before they could implant the device. "When we put the splint on, we saw his (4) moving for the first time," Green says. As Kaiba grows, the device should expand with him.
- [8] The tube itself was printed in layers of a biocompatible* plastic called polycaprolactone*. The 3-D printer heats up a powdered form of the plastic until it melts and can be extruded* in a paste. After a few years inside a body the tube will dissolve — it is made of the same material used for sutures*— and by that time his bronchus should have grown strong enough to function normally.
- [9] Kaiba's tube is the first time a 3-D printed device has been implanted in a patient to aid tissue reconstruction. The research team reported the case on May 22 in *The New England Journal of Medicine*.
- [10] The critical next steps to making the technology more available are clinical trials, along with tracking patients over a longer period of time to see (5) they fare with 3-D printed parts.
- [11] The use of 3-D printed devices and body parts is still in its infancy. Cartilage and bone will be the first solutions to reach wide use, Green says, adding there is a "gigantic potential," for the future.

(Marissa Fessenden, "3-D Printed Windpipe Gives Infant Breath of Life", 28 May 2013, ©Macmillan Publishers Limited(一部改編))

4. [11]の下線部(え)で、「軟骨と骨が、広く使われるようになるための最初の解決法である」と述べている理由を、50字以内の日本語で説明しなさい。

5. 次の中から本文の内容に合っているものを3つ選び、記号で答えなさい。

- A. The probability of live births having their airways partly collapsed is about 0.0005.
- B. A 3-D printer has not been tested for creating organs and tissues yet.
- C. Green and his colleagues designed the sleeve, which would wrap around the outside of the floppy airway.
- D. It is almost impossible to check how the transplanted device is functioning.
- E. Kaiba's bronchus will have fully grown and will function normally by the time the tube dissolves inside Kaiba's body.
- F. The 3-D printing technology should not be used more in clinical trials.
- G. Green says that the use of 3-D printed devices and body parts is still in its infancy and there is no future in it.
- H. Kaiba's physicians saved him after they found his left bronchial tube collapsed by using a 3-D printed synthetic tube.

数 学 (その1)

1 次の各問いに答えよ。ただし、答えは結果のみを解答欄に記入せよ。

複素数平面上で、複素数 z の表す点が原点を中心とする半径 1 の円周上を動く。このとき、次の問いに答えよ。ただし i は虚数単位とする。

- (1) 方程式 $z^{12} = 1$ を満たす z の値をすべて求めよ。
- (2) 単位円の円周上を動き、虚部を正とする複素数 α に対し、 $w = (1 - \sqrt{3}i)\alpha - (1 + i)$ で表される点の軌跡を複素数平面上に図示せよ。
- (3) (2)で求めた軌跡上の点のうち、 $\left(\frac{w + 1 + i}{2}\right)^{12} = 1$ を満たすものをすべて答えよ。また、それらの点を(2)で描いた図中に示せ。

2 次の各問いに答えよ。ただし、答えは結果のみを解答欄に記入せよ。

(1) 次のような数列

$$\frac{2}{1}, \frac{2}{3}, \frac{4}{3}, \frac{2}{5}, \frac{4}{5}, \frac{6}{5}, \frac{8}{5}, \frac{2}{7}, \frac{4}{7}, \frac{6}{7}, \frac{8}{7}, \frac{10}{7}, \frac{12}{7}, \frac{2}{9}, \dots$$

を考える。このとき、分母の値が等しいものを一つの群とする。 $n \geq 2$ のとき、 n 群に含まれる数列の項数を a_n とすると、 a_n は等差数列をなす。

(1-1) 第 n 群の末項は初項から数えて何項目か。

(1-2) 初項から第 31 群の最後の項までの総和を求めよ。

(1-3) 初項からの和が最初に 2019 を超えるのは第何群の何項目か。

(2) 座標空間において、点 $A(0, 1, 2)$, $B\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 4\right)$, $C\left(\frac{\sqrt{3}}{2}, 4, \frac{1}{2}\right)$ とする。このとき、次の問いに答えよ。

(2-1) 点 P が zx 平面上を動くとき、 $AP + PB$ の最小値を求めよ。また、直線 AP の方程式を求めよ。

(2-2) 点 Q が y 軸上を、また点 R が z 軸上を動くとき、 $AQ + QC + AR + RB$ の最小値を求めよ。また、直線 QR の方程式を求めよ。

数 学 (その2)

3 次の各問いに答えよ。ただし、答えは結果のみを解答欄に記入せよ。

(1) $\log_2 5 < \frac{n}{3}$ を満たす最小の自然数 n を求めよ。

(2) ある円に内接する正六角形の面積を S_1 、外接する正六角形の面積を S_2 とするとき、 $\frac{S_1}{S_2}$ の値を求めよ。

(3) 下のデータの中央値を求めよ。

14, 29, 54, 11, 63, 53, 4, 78, 25, 9

(4) 1 から 6 までの数字が記入された球が 1 球ずつある。これらの球を袋の中に入れ、3 つの球を無作為に取り出すとき、その中の最小の数字を X とする。

(4-1) $X = 2$ となる確率を求めよ。

(4-2) X の期待値(平均値)を求めよ。

4 次の各問いに答えよ。ただし、答えは結果のみを解答欄に記入せよ。

(1) 曲線 $y = x(x - a)(2x - a)$ と直線 $y = -x + t$ が $0 \leq t \leq a$ であるようなすべての t に対して相異なる 3 点で交わるような a の値の範囲を求めよ。

(2)

$$\int_1^2 \frac{dx}{x^2 - 2x + 2}$$

を求めよ。

(3) $f'(2) = 3$ を満たす 2 次関数 $f(x)$ について

$$\int_{2-\pi}^{2+\pi} f(x) \sin\left(\frac{x}{2} - 1\right) dx$$

の値を求めよ。