

令和 3 年度
一般選抜 試験問題
英語・数学 (120分)

出題科目	ページ	解答方法
英 語	4～17	左の2科目を解答してください。 解答時間の配分は自由です。
数 学	18～23	

I 注意事項

- 1 配布された問題冊子・解答用紙は、試験開始の指示があるまで開かないでください。
- 2 ページの脱落や重複、印刷の不鮮明な箇所があった場合には、直ちに監督者に申し出てください。
- 3 受験番号および解答は必ず解答用紙の所定の欄に記入してください。
- 4 この問題冊子の余白等は適宜利用してもかまいません。
- 5 質問、中途退室など用件のある場合は、手を挙げて申し出てください。
- 6 退室時は、問題冊子は閉じ、解答用紙は裏返しにしてください。
- 7 試験に関わるすべての用紙は、持ち帰ることはできません。

II 解答上の注意

- 1 「解答上の注意」が、裏表紙に記載してあるので、この問題冊子を裏返して必ず読むこと。ただし、問題冊子を開いてはいけません。

英 語

(解答はすべて解答用紙に記入すること)

第 1 問 次の英文を読み、下の問い (問 1・問 2) に答えよ。

Takuo Aoyagi, a Japanese engineer whose pioneering work in the 1970s led to the modern pulse oximeter, a lifesaving device that clips on a and shows the level of oxygen in the blood and that has become a critical in the fight against the novel coronavirus, died on April 18 in Tokyo. He was 84.

The pulse oximeter has become “an indispensable addition to .

,” said V. Courtney Broaddus, a professor emeritus of medicine at the University of California, San Francisco. Historically, patients were measured by four vital signs: temperature, blood pressure, pulse and respiratory rate. “It has become the fifth vital sign,” she said of oxygen level.

While many coronavirus patients do feel chest pain, fever and other symptoms, Dr. Broaddus said, the pulse oximeter “has become especially important because humans do not a low oxygen saturation alone.”

Moreover, some Covid patients seem not to have other symptoms. As a result, when moderately or mildly ill patients test positive for the coronavirus, they may be sent home with a pulse oximeter so that they can their oxygen level and return to the hospital if it drops.

Mr. Aoyagi’s contribution to medical science was built on decades of innovation and invention. His dream had been to detect oxygen saturation levels without having to draw blood. His early research tried to measure cardiac output (the amount of blood the heart pumps), using a method known as dye dilution, which involves a patient with dye. Instead of withdrawing the blood downstream and measuring the concentration of dye, he attempted instead to use early oximeters, some of which were developed

during World War II to help military pilots breathe at high altitudes.

Those early devices, which clamped to the ear, tended to be inaccurate, unreliable and cumbersome, but Mr. Aoyagi was fascinated by the underlying technology: using two wavelengths of light—red and infrared—to measure blood oxygen levels. (Hemoglobin, the protein in blood that transports oxygen, absorbs light when it binds with oxygen.)

But he soon ran into a problem. Blood does not flow like an open tap, but pulses through the body , thus preventing an accurate recording of dye levels. The problem, however, turned out to be an opportunity. By a mathematical formula to cancel out this “pulsatile noise,” he created a device that measured oxygen levels with greater accuracy than before.

(出典 John Schwartz and Hikari Hida. “Takuo Aoyagi, an Inventor of the Pulse Oximeter, Dies at 84.” *The New York Times*, May 5, 2020. Retrieved September 17, 2020 from <<https://nytimes.com>>.) (一部改変)

(注) oximeter, 酸素濃度計; professor emeritus, 名誉教授;
respiratory rate, 呼吸数; saturation, 飽和状態; dilution, 希釈;
cumbersome, [大きくて] 扱いにくい; pulsatile, 脈動する

問1 英文の ~ に入れるのに最も適当なものを、それぞれ下の①～⑦のうちから選べ。

- | | | | | |
|----------|------------|------------|---------|--------|
| ① finger | ② medicine | ③ research | ④ sense | ⑤ tool |
| ⑥ track | ⑦ work | | | |

問2 英文の ~ に入れるのに最も適当なものを、それぞれ下の①～⑦のうちから選べ。

- | | | | |
|---------------|----------------|---------------|-------------|
| ① associating | ② devising | ③ differently | ④ injecting |
| ⑤ irregularly | ⑥ occasionally | ⑦ smoothly | |

第2問 次に与えられた語について、1～3 (～) は下線部の発音が同じものを、4～6 (～) は第1アクセント(第1強勢)の位置が同じものを、それぞれ下の①～④のうちから1つずつ選べ。

1. migrant
① diagram ② itinerary ③ physical ④ wilderness

2. accurate
① alter ② astronaut ③ ancient ④ radiate

3. drought
① drown ② shoulder ③ southern ④ taught

4. as · sess
① crit · ic ② ed · it ③ o · bese ④ pat · tern

5. mech · an · ism
① ab · sen · tee ② a · void · ance
③ go · ril · la ④ haz · ard · ous

6. ag · ri · cul · ture
① ca · su · al · ty ② co · in · ci · dent
③ ma · nip · u · late ④ man · u · fac · ture

第3問 次の1～5の文の ～ に入れるのに最も適当なものを、それぞれ下の①～④のうちから1つずつ選べ。

1. The chairman's proposal attack from several committee members.
① got down ② went with ③ came under ④ brought up

2. Brushing after every meal with fluoride toothpaste is an easy way to keep tooth decay .
① at bay ② in effect ③ in vain ④ to no avail

3. UV rays damage the skin. Dermatologists recommend using a sunscreen every day .
① down the drain ② off shore
③ on the mark ④ without fail

4. I don't like Professor Green as a person, but there is no that he is very intelligent.
① telling ② knowing ③ denying ④ accepting

5. Once paralyzed and anesthetized, the patient into his mouth to keep his tongue from slipping back.
① had a plastic tube inserted ② has been inserted a plastic tube
③ inserted a plastic tube ④ was inserted a plastic tube

第4問 次の対話文の ~ に入れるのに最も適当なものを、それぞれ下の①～⑨のうちから1つずつ選べ。

Jenny: What happened to your previous roommate? Did she find a better place?

Claire: Mary? Everything seemed to be going fine, but then out of the blue she decided to drop out.

Jenny: So where did she go?

Claire: She moved back to her hometown, and that's the last I heard.

Jenny: Too bad for her, but that gives me an idea.

Claire: You mean you're interested in the room? In that case you'd better strike while the iron is hot. Several people have already shown interest. It's a great location!

Jenny: Sure is. It's just a stone's throw away from the campus. That's very convenient, but what about shopping, entertainment and so on?

Claire: Lots of great stores, restaurants, cafes... Everything's right on our doorstep.

Jenny: Wow! I think you've convinced me. When can I move in?

- ① It was just what I'd expected would happen.
- ② It goes without saying that she'll come back.
- ③ Her loss could be my gain.
- ④ In terms of convenience, it's a mixed bag.
- ⑤ I guess she just wasn't cut out for college life.
- ⑥ We can make a beeline for the college.
- ⑦ We've got all the bases covered around here.
- ⑧ All we can do is keep our fingers crossed.
- ⑨ I was afraid you might ask that.

第5問 次の問い（問1～4）のパラグラフ（段落）には、まとまりをよくするために取り除いた方がよい文が一つある。取り除く文として最も適当なものを、それぞれ下線部①～④のうちから1つ選べ。

問1

25

In 2012, a millionaire in San Jose, California, died during a robbery. Lukis Anderson was charged with the murder. Police found his DNA on the millionaire's fingernails. There was just one problem. ①Left-behind DNA is usually unstable, meaning it will break down with time. ②Anderson was unconscious in the hospital during the crime. Later, investigators learned what caused the mistake. ③The paramedics who took Anderson to the hospital were the same ones who tried to save the millionaire's life. ④Somehow, the paramedics accidentally transferred Anderson's DNA to the millionaire's fingernails.

(出典 Tina Hesman Saey. "Shaking hands could transfer your DNA — leaving it on things you never touched." *Science News for Students*. April 17, 2019. Retrieved September 18, 2020 from <<https://www.sciencenewsforstudents.org>>.) (一部改変)

問2

26

In the early 20th century, Arctic explorer Vilhjalmur Stefansson spent five years eating just meat. This meant that his diet consisted of around 80% fat and 20% protein. ①Twenty years later, he did the same as part of a year-long experiment at New York City's Bellevue Hospital in 1928. ②His symptoms disappeared after he lowered his fat intake and he raised his protein intake. ③Stefansson wanted to disprove those who argued that humans cannot survive if they only eat meat. ④But unfortunately for him, in both settings he very quickly became ill when he was eating lean meats without any fat. He developed "protein poisoning", nicknamed "rabbit starvation".

(出典 Jessica Brown. "We don't need nearly as much protein as we consume."
BBC. May 8, 2020. Retrieved September 18, 2020 from
<<https://www.bbc.com>>.) (一部改変)

問3

27

Bioluminescence — the emission of light by an organism — occurs in a wide range of animals and microorganisms, including some fungi, insects, fish, marine invertebrates and bacteria. ①You can transfer four genes from these glowing organisms into the plants — and wire them into plant metabolisms. ②Some of the most famous examples of the phenomena include the flickering of fireflies. ③Scientists discovered that the bioluminescence found in some mushrooms was metabolically similar to some of the natural processes found in plants. ④Then they were able to transfer DNA sequences into tobacco plants, causing them to give off a bright green glow. Researchers found that this glow lasted for the whole of the plant's life cycle.

(出典 Amy Woodyatt. "Scientists create glow-in-the-dark plants." *CNN*. April 27, 2020. Retrieved September 18, 2020 from <<https://edition.cnn.com>>.)
(一部改変)

問4

28

Sickle cell anemia is an inherited red blood cell disorder in which there aren't enough healthy red blood cells to carry oxygen throughout your body. ①Normally, the flexible, round red blood cells move easily through blood vessels. ②In sickle cell anemia, the red blood cells are shaped like sickles or crescent moons. ③This condition is inherited when the copies of the gene in each cell have mutations. ④These rigid, sticky cells can get stuck in small blood vessels, which can slow or block blood flow and oxygen to parts of the body. There's no cure for most people with sickle cell anemia.

(出典 "Sickle cell anemia." *Mayo Clinic*. Retrieved September 18, 2020 from
<<https://www.mayoclinic.org>>.) (一部改変)

第6問 次の1～3の文において、それぞれ下の①～⑦の語句を並べ替えて空所を補い、最も適当な英文を完成させよ。解答は ～ に入れるものの番号のみを答えよ。文頭に来る語も小文字で始まっている。

1. in fluctuating temperatures, space food is dehydrated and vacuum sealed.

- ① a long ② designed ③ for ④ safe
⑤ stay ⑥ time ⑦ to

2. A team of researchers are investigating whether potentially toxic metals reported lung damage.

- ① be ② contributing ③ e-cigarettes ④ found
⑤ in ⑥ might ⑦ to

3. Biosafety Level 4 is reserved for labs dealing with the most dangerous or treatments.

- ① are ② few ③ for ④ there
⑤ vaccines ⑥ viruses ⑦ which

第7問 次の英文を読み、下の問い（問1・問2）に答えよ。

It was in 1931 when the first influenza vaccines were cultured using fertilized chicken eggs.

In the West, the vaccines given therapeutically have relied on viruses that have been killed, leaving only the residue of proteins to trigger the immune response. In Soviet Russia, however, virologists followed a completely different course: administering viruses that were alive but "attenuated," meaning weakened. Aside from perhaps giving more of an immunologic boost, this technique appeared advantageous in that the patient could simply inhale a tiny whiff of the vaccine rather than have an injection. Not only might this be less problematic in terms of skin reactions, but it might also be vastly cheaper for massive immunization programs, especially in developing countries.

Virologists and public health officials in the West had been wondering for quite a while if the Soviet approach made more sense. In the early 1990s, with the collapse of the USSR, we finally had a chance to compare notes, and I was the one who went over to make the comparison.

In the early nineties, CDC and Baylor College of Medicine began collaborating with the Research Institute of Influenza, St. Petersburg, and the Tarasievich State Institute for Control of Biological Products in Moscow to conduct a blind placebo-controlled study that compared the effectiveness of US and Russian vaccines. Their test subjects were 555 schoolchildren in Vologda, Russia.

In 1992, I flew to St. Petersburg to meet with our Russian colleagues. Once we got to Vologda, we visited the schools where the studies were being carried out. When all was said and done, our technique of using killed virus led to local reactions (primarily redness at the injection site) in 27 percent of the kids. Kids in the attenuated vaccine group had coryza (inflammation around the nose) only 12 percent of the time and sore throat

8 percent of the time, so in terms of avoiding complications, score one for the Russians.

Four weeks after the vaccination, the children who'd received our killed vaccine showed roughly 20 percent more antibodies. But on the acid test of preventing school absenteeism due to acute respiratory illness during flu season, the outcome was 56 percent for killed vaccine and 47 percent for attenuated vaccine, suggesting that the two approaches are roughly equivalent.

Ten years later, in January 2003, a live influenza vaccine was introduced in the United States. I was acting as the infectious diseases associate global director, deploying epidemiologists to investigate a marked expansion of influenza A(H5N1) among birds in Eurasia and Africa with cases of severe human infection. The virus had reemerged for the first time since the deadly poultry outbreaks in Hong Kong in 1997. This is a highly pathogenic, fast-mutating strain of bird flu that continues to be found in multiple species, as well as in humans. It would go on to kill 60 percent of the 638 people infected. There is clear evidence for a handful of cases of secondary but limited human-to-human transmission, but if this had gone viral, literally and figuratively, it would have been a horrific pandemic. This one was scary (A)given that 2.5 percent of people infected with the 1918-19 influenza pandemic died.

The pattern of bird migration back and forth to Africa (B)put Europe squarely in the crosshairs, and part of my job was to assess how well the European Union countries were prepared in terms of surveillance and disease detection and laboratory systems. Tens of millions of birds died of influenza A(H5N1), and hundreds of millions were slaughtered and disposed of to limit the spread in Southeast Asia, Russia and Central Asia, the Caucasus, the Balkans, the Middle East, West Africa, and throughout Europe.

(C)One thing about tracking disease outbreaks is that it teaches you humility. In the years after the influenza A(H5N1) outbreak began, we

figured another outbreak was only a matter of time, and we expected it would be bird flu and that it would start in Asia, as it often had in the past. So we were keeping an eye on the Eastern Hemisphere, waiting for bird flu, when a different strain came from the opposite direction — via Mexico — and clobbered us with a variant of influenza A(H1N1)p that had originated in pigs. The strain contained genes from four different viruses: North American swine influenza, North American avian influenza, human influenza, and swine influenza viruses typically found in Europe and Asia.

This was in 2009, and it spread up to San Diego and Texas and then across the United States, where it led to seventeen thousand deaths. In Mexico, the disease was much deadlier and led to a five-day shutdown of the whole country to contain the outbreak. We had been dreading one thing and we got another, and it caught us completely by surprise.

This strain is still out there, by the way. In 2014, there were more than thirty thousand cases in India, with more than two thousand deaths. There were also deaths in California and Texas, and in Canada. It is possible that this strain of swine flu did indeed originate in Asia; we don't know. Either way, it drove home the point that no country can afford to isolate its public health system. It has to be part of a global public health infrastructure. You can't get away with saying, "We're the richest country in the world. We have good doctors and a solid health care surveillance system. We're safe." It just doesn't work that way.

(出典 Ali S. Khan (2016). *The Next Pandemic: On the Front Lines Against Humankind's Gravest Dangers*. PublicAffairs. Kindle 版)

(注) culture, 培養する; therapeutically, 治療目的で; residue, 残留物;

Soviet Russia, ソビエト時代のロシア; virologist, ウイルス学者;

immunologic, 免疫性の; whiff, 一嗅ぎ;

USSR, ソビエト社会主義共和国連邦;

CDC, Centers for Disease Control and Prevention (アメリカ疾病予防管理センター) ; placebo, プラシーボ、偽薬; acid test, 厳正な評価; respiratory, 呼吸器官の; epidemiologist, 伝染病学者; poultry, 家禽; pathogenic, 病原性の; mutate, 突然変異する; clobber, 打ちのめす; variant, 変異体; swine, 豚; avian, 鳥

問 1 本文の内容に合うように、次の 1～4 の文の 38 ～ 41 に入れるのに最も適当なものを、それぞれ下の①～④のうちから 1 つずつ選べ。

1. Virologists and public health officials in the West 38 .

- ① had been striving for a long time to produce live vaccines
- ② didn't know how the Russians made vaccines
- ③ had been expecting the Russians to approach them first
- ④ had been curious to know if attenuated vaccines were more practical

2. The underlined part "(A)given that" can be replaced by 39 .

- ① concerning
- ② considering
- ③ consolidating
- ④ corresponding

3. The underlined part "(B)put Europe squarely in the crosshairs" means 40 .

- ① suggested that Europe was in imminent danger
- ② forced Europeans to evacuate immediately
- ③ made European nations be fair and square
- ④ missed Europe altogether

4. The underlined part “(C)One thing about tracking disease outbreaks is that it teaches you humility” implies that tracking disease outbreaks is

41 .

- ① surprisingly easy to do
- ② a dangerous thing to do
- ③ harder than you might imagine
- ④ a very important task for humanity

問2 次の1～6の文について、42 ～ 47 の答えとして最も適当なものを、それぞれ下の①～④のうちから1つずつ選べ。

1. Which of the following is true about attenuated vaccines? 42

- ① They were developed in the West and later adopted in Soviet Russia.
- ② They always trigger less immune response than killed vaccines.
- ③ Instead of requiring a shot in the arm, they could be breathed in.
- ④ They are unsuitable for massive immunization programs.

2. What did the study comparing killed viruses and attenuated vaccines find about reactions to the vaccination? 43

- ① There was little difference in the rates of subjects who had some kind of complications.
- ② Attenuated vaccines caused fewer cases of complications than killed vaccines did.
- ③ There were more subjects who suffered from sore throat than who suffered from inflammation around the nose.
- ④ Some subjects experienced redness at the injection site as well as sore throat.

3. Which is true about the results of the study? 44

- ① About 20% of the subjects who had received killed vaccine showed antibodies.
- ② The results suggested attenuated vaccine is practically as effective as killed vaccine.
- ③ There were too many children absent from school for researchers to reach a conclusion.
- ④ The results were much more favorable to attenuated vaccine than killed vaccine.

4. Which is true about influenza A(H5N1)? 45

- ① It killed 2.5 percent of people infected.
- ② It became a horrific pandemic.
- ③ It was more lethal than the influenza of 1918-19.
- ④ It first emerged in 2003.

5. Which is true about the 2009 outbreak? 46

- ① Based on past experience, epidemiologists successfully predicted where and how it would occur.
- ② The United States suffered more deaths from influenza A(H1N1)p than Mexico did.
- ③ Epidemiologists were caught by surprise because four different strains of pig flu were present simultaneously.
- ④ Influenza A(H1N1)p entered the US from Mexico, but the origin of the virus is still unknown.

6. What does the author maintain? 47

- ① Every country should allocate enough funds for its public health system.
- ② Preventing the spread of viruses requires international cooperation.
- ③ It is rich countries' obligation to distribute their resources to poor countries.
- ④ Developed countries are safe from pandemics.

解答上の注意（1：英語，2～4：数学，5：共通）

- 1 解答はすべて解答用紙の解答番号に対応した解答欄にマークしてください。

10 と表示のある問いに対して

(例1) ③と解答する場合は、解答番号10の③にマークしてください。

解答番号	解 答 欄
10	① ② <input checked="" type="radio"/> ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

(例2) ②と⑦を解答する場合は、解答番号10の②と⑦にマークしてください。

(複数解答の場合)

解答番号	解 答 欄
10	① <input checked="" type="radio"/> ③ ④ ⑤ ⑥ <input checked="" type="radio"/> ⑧ ⑨ ⑩

- 2 問題の文中の **アイ**、**ウ** などには、特に指示がないかぎり、符号（-）、数字（0～9）が入ります。ア、イ、ウ、…の一つ一つは、これらのいずれか一つに対応します。それらを解答用紙のア、イ、ウ、…で示された解答欄にマークして答えなさい。

(例) **アイ** に-8と答えたいとき

ア	<input checked="" type="radio"/> 0 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
イ	① ② ③ ④ ⑤ ⑥ ⑦ <input checked="" type="radio"/> ⑧ ⑨

なお、同一の問題文中に **ア**、**イウ** などが2度以上現れる場合、2度目以降は、**ア**、**イウ** のように細字で表記します。

- 3 分数形で解答する場合、分数の符号は分子につけ、分母につけてはいけません。

例えば、 $\frac{\text{エオ}}{\text{カ}}$ に $-\frac{4}{5}$ と答えたいときは、 $\frac{-4}{5}$ として答えなさい。

また、それ以上約分できない形で答えなさい。

例えば、 $\frac{3}{4}$ 、 $\frac{2a+1}{3}$ と答えるところを、 $\frac{6}{8}$ 、 $\frac{4a+2}{6}$ のように答えてはいけません。

- 4 根号を含む形で解答する場合、根号の中に現れる自然数が最小となる形で答えなさい。

例えば、 $4\sqrt{2}$ 、 $\frac{\sqrt{13}}{2}$ 、 $6\sqrt{2a}$ と答えるところを、 $2\sqrt{8}$ 、 $\frac{\sqrt{52}}{4}$ 、 $3\sqrt{8a}$ のように答えてはいけません。

- 5 解答用紙に正しく記入・マークされていない場合は、採点できないことがあります。特に、解答用紙の受験番号欄に正しくマークされていない場合は、その科目は0点となります。