

**YUSO 2017
Microbe Mission
Exam Booklet**

*Do NOT write in this booklet. Fill in all your answers in the accompanying answer sheet.

YUSO 2017 Microbe Mission Examination

1.
 - a) What disease is screened for using the test displayed on the screen?
 - b) Is the disease caused by a bacterium, virus, fungus, or parasite?
 - c) If a person comes into contact with the 20 of the microbes that causes this disease, and the infectious dose is 10,000 microbes, how long will it take for the organism to become infected? Assume the microbe replicates every 20 minutes.
(space provided for scrap work)
2.
 - a) What type of microscope produced image A?
 - b) What type of microscope produced image B?
 - c) What type of microscope produced image C?
 - d) Why do many cell biologists prefer using the microscopes from A and B over the microscope from C?
3.
 - a) Name a disease that arises or is associated with misfolded cellular prion protein (PrP^c)
 - b) What part(s) of an organism is(are) the most affected by misfolded PrP^c?
 - c) A miracle cure converts the misfolded form of PrP^c prions, PrP^{Sc}, into healthy cellular prion PrP^C at a rate of 3 per minute. If you had a 10 μ L sample at a density of 90 PrP^{Sc} / μ L with originally no PrP^C, what percentage of the misfolded prion would be healthy after 27 minutes?
4.
 - a) In image A, which picture (left or right) represents gram-positive bacteria?
 - b) In image A, which picture (left or right) represents gram-negative bacteria?
 - c) In image B, which picture (left or right) represents gram-positive bacteria?
 - d) In image B, which picture (left or right) represents gram-negative bacteria?
 - e) What is the acid (designated by orange shapes designated by red arrow in image B) that is a distinguishing characteristic between gram-positive and gram-negative bacteria.
5.
 - a) What disease is associated with the organism displayed on the screen?
 - b) Is the disease caused by a bacterium, virus, fungus, or parasite?
 - c) A comfortable population density for this organism is 1997 individuals/ km.
How much area is needed to support a population of 22,224 individuals?

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6.

- a) What type of microscope is this?
- b) Label the lettered parts of the microscope:

7.

- a) What disease outbreak does this map depict?
- b) Is the disease viral, bacterial, fungal or parasitic and is there a vaccine available?
- c) On a microscope picture, the microbe responsible for this disease is 11 cm long and 1 cm wide. The scale says that every 0.5 cm equals 0.45 μm . What are the dimensions of the microbe in nm?

8.

- a) Jacob has been ill. Last week, he had a runny nose, mild cough, and low fever. This week, he has been experiencing spells of dry coughing. These spells last up to one minute.

What disease does Jacob have?

- b) Give the scientific name of the bacteria that causes this disease.
- c) Is there a vaccination for this disease?
- d) What is the most common method of treatment?

9.

- a) What is the microbe displayed on the screen?
- b) This microbe is primarily found where in the human body?
- c) Is this microbe able to survive acidic conditions?

10.

- a) Identify phases of the growth curve as shown.
- b) Focus on phase B. Assume phase B lasts from 2 hours to 10 hours. If the bacteria divides every 20 minutes and there are 16 colonies at 2 hours and 40 minutes, how many colonies will there be at 5 hours and 20 minutes?

11.

- a) What sort of microbe is responsible for the condition displayed on the slide?
- b) In order for the condition to occur, the microbe must obtain a population density of 60×10^7 microbes/ mm^2 . The area available for the microbes to inhabit is 510 mm^2 . If there are initially 5×10^7 microbes and they replicate every 2 minutes, how long will it take to obtain a population density of 60×10^7 microbes / mm^2 ?

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12.

- a) Identify the following microbes (i.e. 1-4 Archaea, bacteria, etc.) from their pictures.
- b) Rank 1, 2, 3, and 4 according to their size, from smallest to largest.

13.

- a) Which disease is associated with this organism?
- b) Is the disease viral, bacterial, fungal, protozoan, or parasitic?
- c) The microbe responsible for this disease can travel through an infected organism at a rate of 37 mm/ min. If the infected organism is 55 cm long, how long will it take for the microbe to travel all throughout the organism?

14.

- a) Identify the bacteria shapes A, B, and C.
- b) Match the following bacteria with their shape type (A – C).
 - a) *Treponema pallidum*
 - b) *Clostridium botulinum*
 - c) *Streptococcus pyogenes*

15.

- a) What disease's incidence range is shown on this map?
- b) Is the disease viral, bacterial, fungal, protozoan, or parasitic?
- c) The world population is 7.4 billion. If the microbe responsible for this disease can infect people at a rate 32375 people/ week, how many days will it take for the population of the world to be infected?

16.

- a) An image of the microbe that causes yellow fever is shown. Is this microbe a bacteria or a virus?
- b) What genus does this microbe belong to?
- c) How is yellow fever mainly transmitted to humans?
- d) How did this disease spread to South America from Africa in the 1600s?