One answer and only one answer per question. Leaving a question blank or filling in 2+ answers will be incorrect no matter what.

  Italicized phrases are true. Do not assume more than is given in a question.

A = True, B = False   unless indicated otherwise. If any part of an answer is incorrect, treat all of it as incorrect. If different parts of an option are inconsistent with each other, consider it incorrect.

Infectious Disease Models

1-6. (5 pts) The basic reproductive number (R_0) is a model of the spread of an infectious agent. Which of the following are true?

1. (A)(B) R_0 is defined as the number of new infections per day caused by an infected individual.

2. (A)(B) If the R_0 value of a disease was 3, we would need to vaccinate at least 1/3 of the population to eradicate the disease. al

3. (A)(B) The epidemic threshold is the value of R_0 for which the number of individuals with the disease doubles every month.

4. (A)(B) Recalling the table of R_0 values shown in lecture, the R_0 for many infectious diseases was in the range of 2-20.

5. (A)(B) If R_0 exceeds 0, even slightly, it means that the disease can expand epidemically in the human population.

6. (A)(B) The larger the value of R_0, the more likely you are to be seriously ill if you get the disease. Diseases whose R_0 is 3 or less tend not to cause much illness or death.

7-9. (2 pts) What contributes to the value of R_0 for a disease in the human population?

7. (A)(B) Properties of the disease agent itself

8. (A)(B) Human behavior

9. (A)(B) The environment in which infections spread

10. (2 pts) From our models, which of the following is the closest approximate progression of the number of infected individuals for how a disease spreads when the first infected individual is introduced into a naïve population? The symbol '->' means 'gives rise to'. For example, 1 -> 3 means than one infected individual gives rise to 3 new infected individuals. Assume R_0 = 3. One answer only.

  (A) 1 -> 1 + 3 ->   2 + 3 ->   3 + 3 ->   4 + 3 -> ….
  (B) 1 -> 1 x 3 ->   2 x 3 ->   3 x 3 ->   4 x 3 -> ….
  (C) 1 -> 1.3 -> $(1.3)^2$ -> $(1.3)^3$ -> $(1.3)^4$ -> ….
  (D) 1 -> 3 -> 9 -> 27 -> 81 -> ….
  (E) There is not enough information provided by R_0 to know the progression .

Vaccines

11-14 (3 pts) How does vaccination work (for a virus)? Identify all methods that are true of current vaccines (as discussed in class).

11. (A)(B) Your body is introduced with either a part of a virus or a debilitated/weakened form of the whole virus to cause your immune system to respond to it and build a memory of it.

12. (A)(B) Your body is infected with the pathogenic form of the virus, but you are then treated with a drug before the virus can hurt you. Your immune system responds to the controlled infection and builds a memory of it.

13. (A)(B)) Your body is introduced with the immune molecules that directly attack the virus, should you get infected.

14. (A)(B) The vaccine is an anti-viral drug that is injected into and stays in your body for a long time and is ready to fight the virus in case you get infected.

15-19 (3 pts) Which types of vaccine design could be used so that you build immunity to **just** the covid spike protein but no other part of covid? **(A) could be used to elicit immunity to just the spike**
(B) could not, either because the design would elicit immunity to more than just the spike, or the design would not elicit immunity to even the spike

> **15. (A)(B)** Live, attenuated vaccines
>
> **16. (A)(B)** Whole, killed virus
>
> **17. (A)(B)** Pure viral protein vaccines
>
> **18. (A)(B)** RNA vaccines
>
> **19. (A)(B)** Recombinant vector vaccines

20-22 (1 pts) What are possible reasons a vaccination that you just received can protect you now but can fail to protect you in 10 years (in the absence of further vaccination)?

> **20 (A)(B)** The virus evolves to escape immunity
>
> **21 (A)(B)** Your immunity starts high but wanes
>
> **22 (A)(B)** The vaccine itself was present in your body for 5+ years but was lost by 10 years

23-25 (3 pts) Which are correct claims about covid vaccines?

> **23 (A)(B)** Current covid vaccines available in the US can (unintentionally) infect you with covid.
>
> **24 (A)(B)** Covid vaccines being administered in the US have not been tested in clinical trials.
>
> **25 (A)(B)** We expect the immunity from a covid vaccination should be lifelong.

Antibiotics

26-30 (5 pts) General points   **(A) = True   (B) = false**

> **26. (A)(B)** Most antibiotics we have available were discovered as natural compounds, not by chemical synthesis
>
> **27. (A)(B)** The evolution of bacteria resistant to antibiotics is a problem limited to the individuals who misused the antibiotics; it is not a problem for people or countries who use antibiotics prudently.
>
> **28. (A)(B)** The process by which antibiotics lose efficacy is from people developing a tolerance for the drug so that the drug can no longer work in them.
>
> **29. (A)(B)** New types of antibiotics are being created as often as new ones lose effectiveness.
>
> **30. (A)(B)** Antibiotics are a form of vaccine.

31-34 (3 pts) Why are many antibiotics starting to fail?

> **31 (A)(B)** People have developed a tolerance for the drugs so the drugs no longer function properly in those people
>
> **32 (A)(B)** We are using antibiotics against different species of bacteria than for which they were initially developed
>
> **33 (A)(B)** The bacteria have evolved resistance to the drugs
>
> **34 (A)(B)** The antibiotics are old and have chemically decayed

Covid

35. (1 pt) Since 2000, there have been how many new (previously unknown) and 'often fatal' corona virus types introduced into humans, regardless of whether they are still circulating?   One answer only.

> **(A)** one   **(B)** two **(C)** three   **(D)** four   **(E)** seven

36-38 . (2 pts) From where do we think the SARS viruses originated? Include all that apply.

    36. (A)(B) From harmless corona viruses that had been in the human population for decades

    37. (A)(B) From corona viruses in animal reservoirs

    38. (A)(B) From viruses in animals that were of a completely different type of virus than corona viruses; they only changed into corona viruses after they infected humans.

39-40 (1 pts) Which mortality properties are true of the 'often fatal' corona viruses that were introduced in humans since 2000?

    39. Very low death rates per infection at young ages (0 or nearly so).   One answer only

    (A) True of none of those viruses   **(B)** True of some but not all   **(C)** True of all

    40. High (>2%) death rates per infection at old ages. One answer only.

    (A) True of none of those viruses   **(B)** True of some but not all   **(C)** True of all

41-43 (2 pts) Why did the 'often fatal' corona viruses that preceded covid-19 not cause global pandemics?

    41 (A)(B) Social interventions suppressed their spread.

    42 (A)(B) They could spread only from animal to humans (not human-human) so the only intervention needed was to remove people from the animal sources

    43 (A)(B) They could spread from human to human but the R_0 was everywhere (in all settings) less than the epidemic threshold, so there was never any danger that they would spread.

44. (1 pt) (B) **Key code, name, and ID number**. Provide answer (**B**) on question 44 to indicate your key for this version of the exam.   Then upload your answers to the field on BbLearn (test 7 upload) in the usual format:

Format: **last name first name** , last 4 digits of your Vandal ID number , 1 answer 2 answer …

Easiest for me if you have you name and answers in a single row.