Nom :_____Numéro d'étudiant :_____.

Examen de mi-session #2V2 de BIO3524 : Introduction à la Microbiologie

Cet examen comporte deux parties. La première partie d'une valeur de 20 points consiste de 20 questions à choix de réponses. Assurez-vous d'indiquer vos réponses sur cette feuille. **S.V.P., UTILISEZ DES LETTRES MAJUSCULES** pour indiquer vos réponses.

La deuxième partie d'une valeur de 10 points comporte 5 questions à courtes réponses. Assurez-vous de répondre à **SEULEMENT 4 DES 5** questions, sinon **seulement que les premières quatre questions répondues seront corrigées**.

1	**C**
2	**B**
3	**B**
4	**A**
5	**B**
6	**A**
7	**D**
8	**B**
9	**B**
10	**D**
11	**D**
12	**D**
13	**C**
14	**A**
15	**D**
16	**C**
17	**B**
18	**A**
19	**C**
20	**D**
21	**A**

Partie I:

1. Choose the order of antimicrobials representing the highest to the lowest toxic dose.

A. Polymixine B, an antiviral, chloramphenicol, an imidazole derivative.
B. An inhibitor of mitotic spindle fibers, chloramphenicol, polymixin B, vancomycin.
C. Aminopenicillin, cephalosporin, chloramphenicol, polymixin B.
D. An aminoglycoside, a macrolide, a carbapenem, a quinolone.

2. The Ym of a yeast strain « A » for biotin is 10g of cells/mole of substrate whereas the Yg of another strain « B » is 2g of cells/g of substrate. Which of the following statements must thus be true? (Molecular weight of biotin is: 10g/mole)

A. Strain « A » uses biotin more effectively than strain « B ».
B. It would be less expensive to produce the same quantity of strain « A » than of strain « B ».
C. Strain « A » uses less biotin than strain « B ».
D. None of these statements are true.

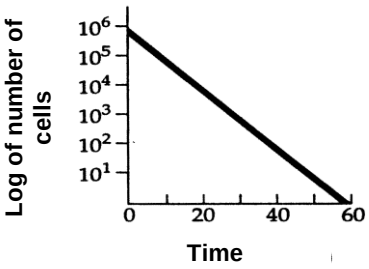
3. Which of the following statements is not an attribute associated with maggot therapy?

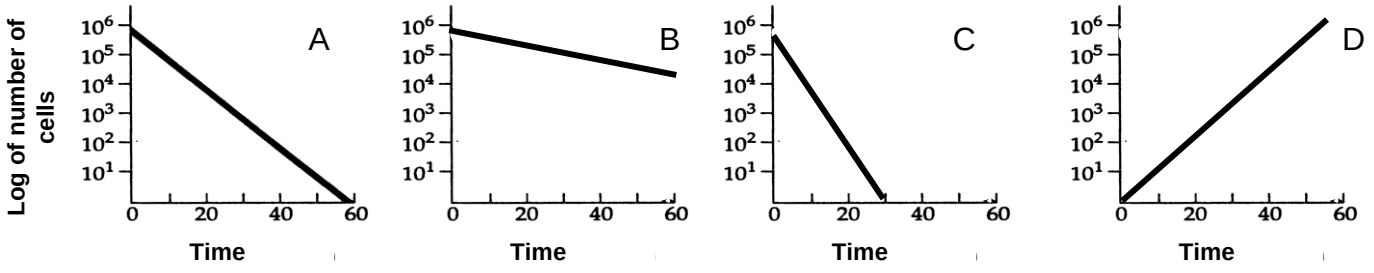
A. An acquired resistance is not possible.
B. Amplification of the antimicrobial agent.
C. Maggot therapy has bactericidal and antiseptic properties.
D. Trained personnel is not required.

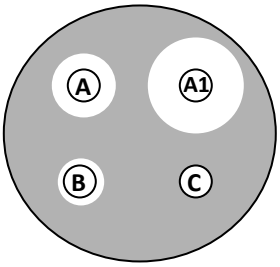
4. A researcher creates a virus which has the genome of the rabies virus inside the capsid and envelope of the influenza virus. What would be the consequence of an infection by such a virus?

A. Infected cells would release rabies virus.
B. Infected cells would release influenza virus.
C. Infected cells would release rabies virus which has the influenza capsid.
D. Infected cells would release influenza virus which has the capsid of the rabies virus.

5. This is the death profile of a suspension of spores in water treated with microwaves. Which of the profiles below would be expected if the same treatment had been performed without water?







6. This test represents a diffusion based sensitivity test to different antibiotics. All the antibiotics are of natural origin except for « A1 », which is a chemically modified derivative of « A ». What can be concluded according to these results?

A. The MIC of « A1 » is lower than that of « A ».
B. The MIC of « A1 » is higher than that of « A ».
C. The MBC of « A1 » is higher than that of « A ».
D. The modification confers to « A1 » a broader action spectrum.

7. According to the results of the Kirby Bauer assay, which of the antibiotics would be the best to treat an infection?

A. A.
B. B.
C. C.
D. This conclusion cannot be made from these results.

8. If all the antibiotics assayed in the Kirby Bauer assay had the same toxic dose, which one has the highest therapeutic index?

A. A.
B. A1.
C. B.
D. C.

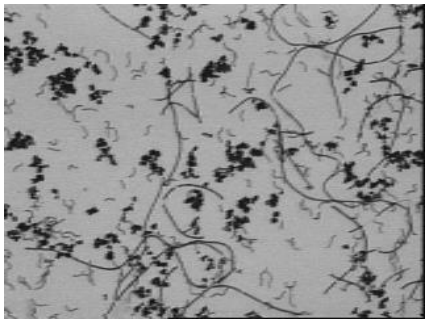
9. The acquired resistance to an antibiotic of bacteria « A » can be transferred to bacteria « B » when these are grown together in the same broth. The **filtrate** obtained after the filtration of a broth in which bacteria « A » was grown alone through a filter of 0.35µm retains the ability to transfer the resistance to « B ». However, the filtrate obtained with a filter of 0.0050µm loses this ability. What is the probable mechanism of transfer?

A. Conjugation.
B. Transduction.
C. Transformation.
D. Conjugation or transformation.

10. Why is the thermal death time (TDT) of sterilization shorter at the same temperature in an autoclave as compared to in the Pasteur oven?

A. The loss of heat is slower.
B. The heating time is shorter.
C. The Z value is lower.
D. The D value is lower.

11. A microscopic examination of a yogurt sample is shown. Which of these conclusions is valid based on what is observed?



A. The yogurt is contaminated.
B. The yogurt is not contaminated.
C. The yogurt is sterile.
D. None of these conclusions can be made according to the information on this image.

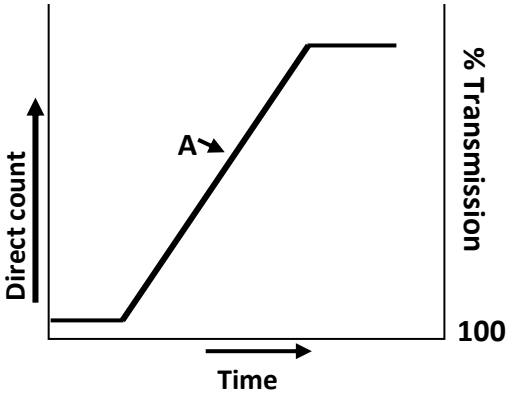
12. What type of antimicrobial therapy has the narrowest action spectrum?

A. Antibiotherapy.
B. Maggot therapy
C. Probiotic therapy.
D. Bacteriophage therapy.

13. A drug with the highest _?_ would be best for therapeutic purposes.

A. Toxic dose.
B. Therapeutic dose.
C. Therapeutic index.
D. Selective toxicity.

14. This is the growth profile of a bacteria that is sensitive to both penicillin and tetracycline. What would be the expected effect of adding tetracycline at the point indicated by "A"?



A. The direct count and the percentage transmission would remain constant.
B. The direct count and the percentage transmission would decrease.
C. The direct count and the percentage transmission would remain constant.
D. The direct count would remain constant whereas the percent transmission would decrease.

15. What would be the expected result following the addition of penicillin a short time after the addition of tetracycline at the time point indicated by point « A » on the above profile?

A. A decrease in the direct count and of the percentage transmission would be observed.
B. The direct count would decrease whereas the percent transmission would remain constant.
C. The direct count would remain constant whereas the percent transmission would decrease.
D. The direct count and the percentage transmission would remain constant.

16. During which growth phase would the addition of a macrolide have the least effect?

A. Lag.
B. Exponential.
C. Stationary.
D. The effect would be the same in all growth phases.

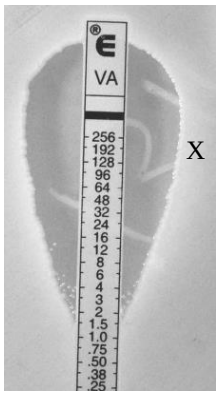
17. Biotin is optional for *E.coli* since when needed these bacteria can synthesize this nutrient. What would be the observed effect on the growth profile when biotin was exhausted from a given medium?

A. The stationary phase would be initiated.
B. A second lag phase would be initiated.
C. The death phase would be initiated.
D. No effect would be observed.

18. A bacterial culture goes from 10^3 to 10^6 cells/ml in 12 hours. According to this data, what should be the total number of generations, the generation time, and the growth rate constant respectively?

A. ~10 generations, ~72 minutes and ~0.83 generations /hour.
B. ~10 generations, ~60 minutes and ~1.0 generations / hour.
C. ~15 generations, ~75 minutes and ~0.80 generations / hour.
D. ~15 generations, ~36 minutes and ~1.7 generations / hour.
E. None of these answers are correct.

19. This image represents an E-test done on a bacteria. What is the antibiotic concentration at the point indicated by the "X"?



The units on the strip are µg/ml

A. Approximately 192µg/ml.
B. Approximately 1.5µg/ml.
C. Less than 1.5µg/ml.
D. Greater than 192µg/ml.

20. The optical densities of two broth cultures, « A » and « B » are 0.1 and 0.6 respectively. Which of the following conclusions can be made with certainty?

A. The number of live bacteria in broth « A» is higher than that in broth « B ».
B. The number of bacteria in broth « A » is lower than that in broth « B ».
C. Broth « A» contains less CFUs/ml than broth « B ».
D. None of these conclusions can be made with absolute certainty.

21. Which of the following disinfectants would be effective against C*lostridium* spores?

A. Aldehydes.
B. Alcohols.
C. Halogens.
D. Detergents.

Partie 2. Répondre à <u>SEULEMENT 4 DES 5</u> questions, sinon seulement que les premières quatre questions qui auront été répondues seront corrigées.

1. A broth contains a mixed culture of two bacteria; *Escherichia coli* and *Bacillus stearothermophillus* at concentrations of 10^{10} and 10^{8} cells/ml respectively.

A. You wish to heat the broth at 100°C to reduve the numer of *E.coli* cells to less than one cell per mL. Based on the parameters presented below, what is the minimum amount of time required to accomplish this? (1 point)

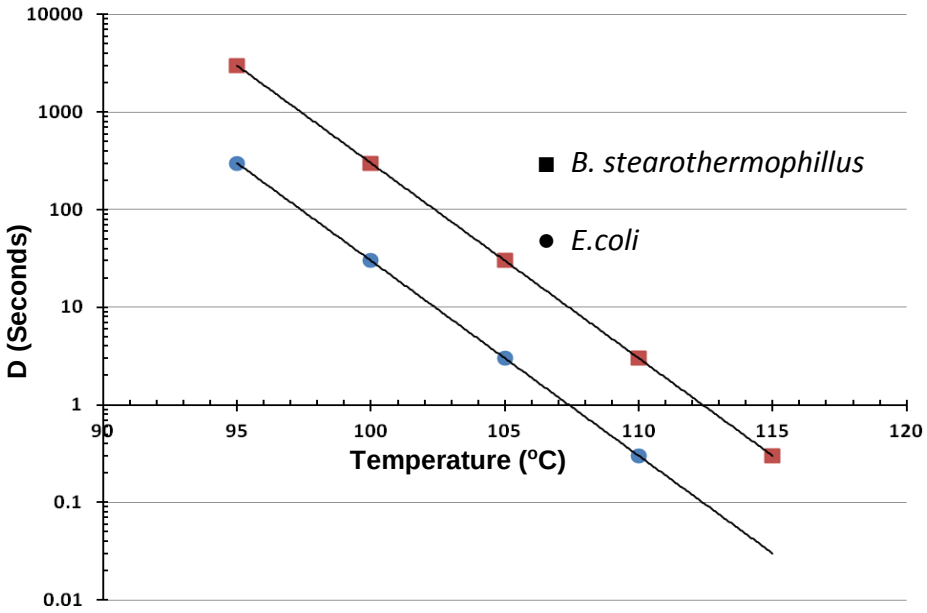
D_{110} of *E.coli* = 0,3 second
Z of *E.coli* = 5°C

approx. 300sec. or 5 min.

B. What would be the concentration of *B. stearothermophillus* after the treatment performed in "A"? (0.5 point)
D_{100} of *B. stearothermophillus* = 300 seconds

10^7 Cells/ml

C. According to the above data and the sensitivity profiles presented below, what is the TDP of the mixed culture? (1 point)



approx. 103°C

2. A bacterial culture of *Streptococcus thermophilus* goes from 10^5 cells/ml to 10^9 cell/ml from noon to 5 o'clock.

A. Based on this data, indicate the following values : (1 point)

n:	**13.2 generations**
g:	**22.7min. or 0.378 h**
K:	**2.6gen./h or 0.044 gen/min**
µ:	**0.03cell./min. or 1.8cell/h**

B. At approximately what time did the culture reach a density of 2.5 X 10^8 cells? (0.5 point)

(255 min) or à 4h 15min

C. To determine the cellular concentration at 5 h, a direct count is done on a hemocytometer slide of which the counting chamber has the following dimensions: 0.5mm X 0.5mm X 0.02mm. If the counting chamber has 100 squares, what should be the average number of cells per square? (0.5 point)

50 cellules

D. To confirm the concentration of *Streptococcus thermophilus* obtained with the direct count, a viable count was performed. In comparison to the direct count, what result would be expected for the viable count? It would be the same, higher, or lower? Justify your answer in two sentences or less. (0.5 point)

3. Indicate whether each of the following statements is true or false.

A. .___**F**_____Without an RNA polymerase in their capsid, positive stranded RNA viruses would be noninfectious.

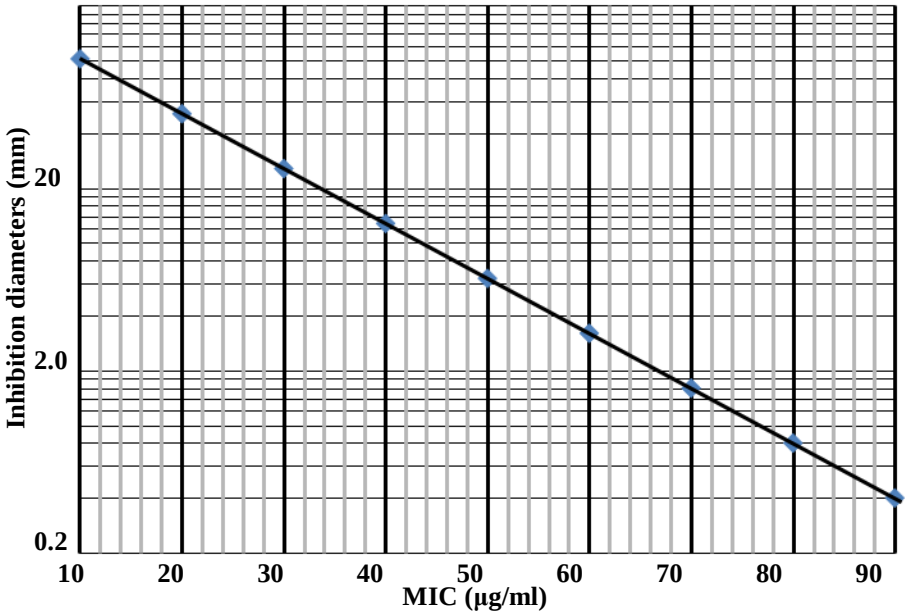
B. .___**F**_____All viruses have either a viral DNA or RNA polymerase.

C. .___**F**_____The replication of all viruses goes through a positive or negative RNA intermediate.

D. .___**F**_____The classification of viruses is only bases on their genome type.

E. .___**F**_____Following the penetration of all viruses, spike proteins remain at the cell surface.

4.



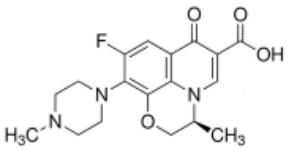
Ab	C1-C2 (µg/mL)	LD50 (µg/mL)	Diameters (mm)	Sensitivity
A	40-80	25	6.0	**RI**
B	50 - 100	200	10.0	**S**
C	100 -300	150	3.0	**S**
D	40 - 60	100	1.0	**R**

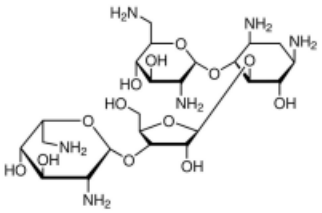
A. The graph illustrates the inhibition diameters corresponding to the MICs of a pathogen isolated from a patient. The table presents the physiological data for the different antibiotics as well as the inhibition diameters observed on a Kirby Bauer assay. Indicate in the table if the pathogen is resistant (« **R** »), sensitive (« **S** »), or of intermediate resistance (« **IR** ») to each of the antibiotics. (1 point)

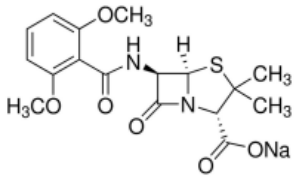
B. Indicate which antibiotic would be best to treat the patient Indicate all the reasons for your choice (maximum of 4 sentences) (1.5 point)

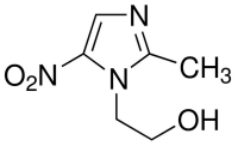
- The bacteria is sensitive to antibiotics B and C.
- The therapeutic index of antibiotic B is higher than that of C (4.5 Vs 2.5)
- The toxic dose of B is higher than Cmax, whereas the one of C is lower.
- Best antibiotic is B.

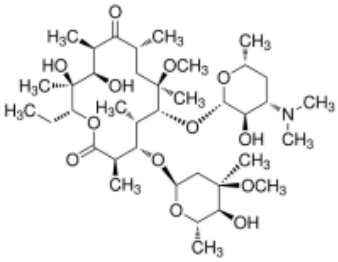
5. Indicate **all** structures which corresponds to each of the characteristics listed. Indicate « X » if none of the structures corresponds to the characteristic listed. **The same answer can be used more than once.** (2.5 points)

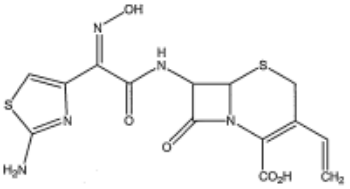
A 

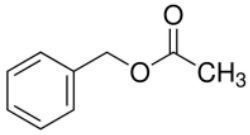
B 

C 

D 

E 

F 

G 

H $CH_3(CH_2)_7CH{=}CH(CH_2)_7CH_2OH$

Beta lactam ____CF____.

Targets membrane ____DH____.

Bacteriostatic ____E____.

Cephalosporin ____F____.

Lowest LD50 ____D____.

Targets protein synthesis ____BE____.

Chloramphenicol ____X____.

Targets DNA synthesis ____A____.

Antifungal ____D____.

Antiviral ____X____.

Formulas:

Growth :

$N = N_0 \times 2^n$ $n = t/g$ $n = 3.3(\log N - \log N_o)$

$\mu = ((\log 10N - \log 10N_0) 2.303) / (t - t_0)$

$\mu = \ln 2/g$ $K = n/t$

Mortality :

$-kt = \ln (N_o/N)$ $D = t/(\log N_o - \log N)$ $\log(\frac{D_b}{D_a}) = \frac{T_a - T_b}{z}$