UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY ANF FOOD TECHNOLOGY
DIPLOMA IN BIOTECHNOLOGY

MODULE MCB1AE2
MICROBIOLOGY IB

CAMPUS **DFC**

JUNE 2016
FORMATIVE ASSESSMENT

DATE: 9 June 2016:	**SESSION 12:30 – 14:30**
ASSESSOR(S):	**MR K MACLEAN**
INTERNAL MODERATOR:	**MR L ALAGIOZOGLOU**
EXTERNAL MODERATOR:	**N/A**
DURATION	**2 HOURS**
MARKS:	**140**

SURNAME AND INITIALS: _____

STUDENT NUMBER: _____

CONTACT NR: _____

NUMBER OF PAGES: 6 PAGES

REQUIREMENTS : ASSESSMENT ANSWER SCRIPTS.
: ONE POCKET CALCULATOR PER STUDENT.
: A MCQ CARD.

INSTRUCTIONS TO STUDENTS:

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1. THIS QUESTION PAPER MUST BE HANDED IN **SEPARATELY** WITH YOUR ANSWER BOOK AND MCQ ANSWER CARD.
2. DO NOT FOLD THE MCQ CARD!
3. WRITE YOUR SURNAME AND INITIALS ON THE MCQ CARD.

QUESTION 1

MCQ questions. Answer on the separate MCQ card and hand in with your answer book.

1.1 The following are macro-elements:

a. Carbon.
b. Calcium.
c. Manganese.
d. All of the above are macro-elements.
e. Only (a) and (b).

1.2 The following are / is / an example/s of / a growth factor/s:

a. D-galactose.
b. Carbon.
c. Nitrogen.
d. (b) and (c).
e. None of the above is growth factors.

1.3 Organisms which uses organic molecules as a carbon source are:

a. Heterotrophs.
b. Autotrophs
c. Chemolithoautotrophy
d. None of the above

1.4 Exponential bacterial growth in a nutrient broth could become unbalanced in an:

a. Test tube
b. Continuous culture unit if the waste products are not controlled
c. (a) and (b)
d. None of the above are correct

1.5 Cell density can be measured with the aid of an:

a. Special microscope slide
b. Spectrophotometer
c. Electronic colony counter
d. Special autoclave

1.6 The rate of incoming medium in a vessel which is equal to the removal of medium in a vessel is called a:

a. Turbidostat
b. A minimal nutrient
c. Batch culture
d. Chemostat

1.7 A spectrophotometer measures the ___ of the culture in the growth vessel.

a. absorbance or transmittance
b. minimal nutrient
c. temperature
d. oxygen

1.8 Sulphur is required for _____ synthesis.

a. amino acid
b. iron
c. carbohydrate
d. lipid

1.9 Acidophilic bacteria has a minimum and maximum pH of:

a. 0-5.5
b. 1-5.5
c. 0-5.8
d. 1-5.8

1.10 Barophiles are organisms which grow optimally in the ocean at depths of:

a. 10 meters
b. 20 meters
c. 1000 meters
d. Any depth

1.11 Nutrient agar could be used as a differential media.

a. True
b. False

1.12 Autotrophs use carbon dioxide as its sole carbon source.

a. True
b. False

1.13 All microbiology equipment including petri dishes and media can be sterilised in an autoclave.

a. True
b. False

1.14 In nature many microbes forms biofilms on surfaces

a. True
b. False

1.15 Vitamins included in the media for microbial cultivation serves as:

a. purines
b. pyrimidines'
c. enzymes
d. halogens
e. enzyme co-factors **[15]**

QUESTION 2

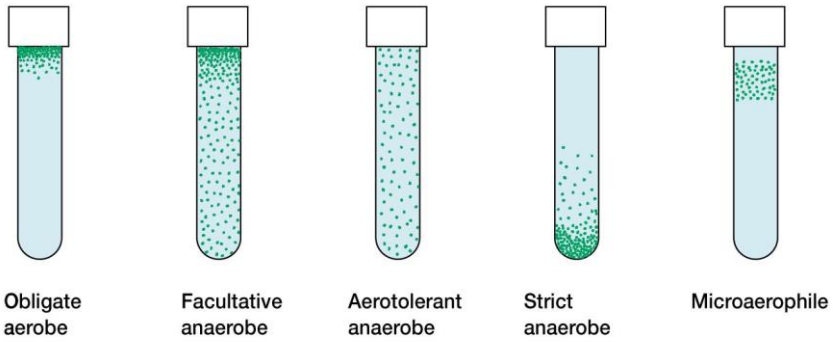
2.1 **Fill in the open spaces** indicated by a letter of the alphabet. Write it in your answer book and **NOT** on the test paper.

The reduction of microbial numbers to a level deemed safe is called _(a)_ .
A lactose positive colony appears red on MacConkey agar due to _(b)_ being activated when the pH decreases. Carrier proteins, called _(c)_ may sometimes increase the rate of diffusion across a semipermeable membrane in bacteria. Chemical agents that kill or inhibit growth of microorganisms on tissue are called_(d)_.
A total of _(e)_ ml of the specimen is transferred to agar during the pour plate technique and the final count is measured as _(f)_. Cell constituents are synthesized during the _(g)_ phase of the bacterial growth curve. The advantage of using a counting chamber to count microorganisms is that one can distinguish between _(h)_ and _(i)_ cells. A microbial population can be kept in the log exponential growth phase when using a _(j)_ culture system.

[10]

QUESTION 3

3.1 Name the four measures involved in a heat-killing experiment and give the definitions of each measure. (8)
3.2 Number the test tubes below 1-5 (from left to right) then provide the oxygen requirements for these microbes in your answer book using the appropriate number. (5)



3.3 Differentiate between “Flash and Ultra High temperature” pasteurization of milk. (4)

3.4 Certain chemicals can be used for the control microorganisms. Give an example of a halogen which can be used and also describe its mode of action. In addition, give one disadvantage of this chemical as a potential threat to human health. (3)

[20]

QUESTION 4

4.1 You obtained 164 colonies from the 1/100 dilution on a nutrient agar plate in a serial dilution experiment where you used the spread plate technique. With the aid of neat calculations demonstrate and explain how you would determine the total psychrophilic bacterial count. Additionally explain what you would change to perform the same experiment for mesophilic coliforms. (7)

4.2 Name five (5) vitamins required by certain microorganisms and give the function of each. Also give an example of a microorganism requiring the vitamin. (15)

4.3 With the aid of a graph explain the bacterial growth curve. Give possible reasons for entering growth inhibition at some point in the graph. (8)

[30]

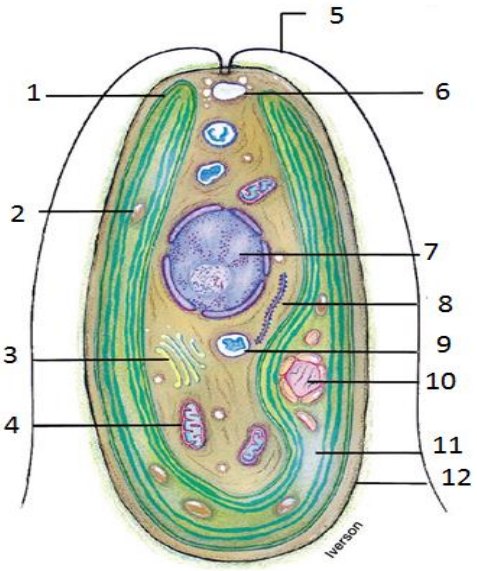
QUESTION 5

5.1 Describe how algae reproduce asexually. (7)

5.2 Elaborate on the biotechnological value of algae. (6)

5.3 Label the ultrastructure of the algal cell below in your answer book. (12)

[25]



QUESTION 6

6.1 Tabulate the differences between bacteria and viruses. (12)
6.2 Differentiate between *the Mycoplasmas* and *Rickettsia's.* (8)
[20]

QUESTION 7

7.1 Explain the life cycle of *Entamoeba histolytica* and name the causative agents for African sleeping sickness. (10)
7.1 Describe the life cycle of the malaria parasite in humans. (10)
[20]

TOTAL 140

Microbiology MCB1AE2 MEMORANDUM June 2016

Q1

1.1 e
1.2 e
1.3 a
1.4 c
1.5 b
1.6 d
1.7 a
1.8 a
1.9 a
1.10 d
1.11 b
1.12 a
1.13 b
1.14 a
1.15 e

Q2

a) sanitation
b) phenol red dye
c) permeases
d) antiseptics
e) 1 ml
f) Cell forming units
g) lag
h) dead
i) alive
j) continuous

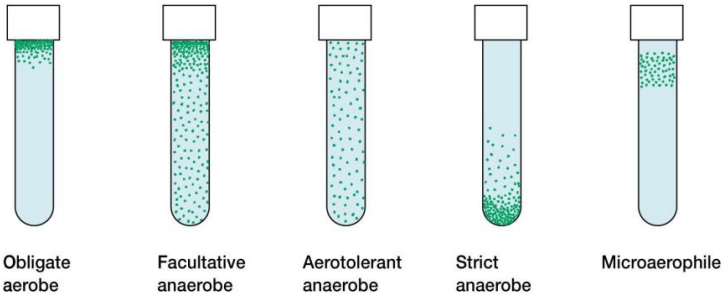
Q3

3.1

- **thermal death time (TDT)**
  - shortest time needed to kill all microorganisms in a suspension at a specific temperature and under defined conditions
- **decimal reduction time (*D* or *D value*)**

  - time required to kill 90% of microorganisms or spores in a sample at a specific temperature
- ***Z* value**
  - increase in temperature required to reduce *D* by 1/10
- ***F* value**
  - time in minutes at a specific temperature needed to kill a population of cells or spores

3.2



1).Need 2).Prefer 3).Ignore 4).Toxic 5).2-10%

3.3

- **flash pasteurization** (high temperature short-term – HTST)
  - 72°C for 15 seconds then rapid cooling
- **ultrahigh-temperature (**UHT) sterilization
  - 140 to 150°C for 1 to 3 seconds

3.4

- **e.g., iodine**
  - oxidizes cell constituents and iodinates proteins
  - skin damage, staining, and allergies can be a problem
  - **OR**

- **e.g., chlorine**
  - oxidizes cell constituents
  - can react with organic matter to form carcinogenic compounds

Q4

4.1

164 colonies x 10 --- (to convert0.1 ml to 1ml) x 100 --- (dilution factor = --- 164000 CFU/ML --- 37 degrees Celsius
Will change media --- and temperature

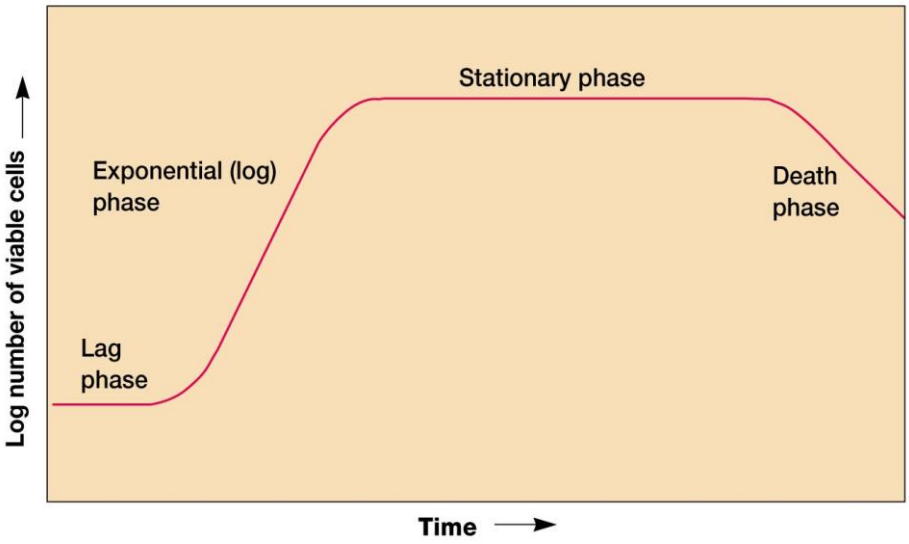
4.2

Table 5.3 Functions of Some Common Vitamins in Microorganisms

Vitamin	Functions	Examples of Microorganisms Requiring Vitamin[a]
Biotin	Carboxylation (CO_2fixation) One-carbon metabolism	*Leuconostoc mesenteroides* (B) *Saccharomyces cerevisiae* (F) *Ochromonas malhamensis* (A) *Acanthamoeba castellanii* (P)
Cyanocobalamin (B_{12})	Molecular rearrangements One-carbon metabolism—carries methyl groups	*Lactobacillus* spp. (B) *Euglena gracilis* (A) Diatoms and many other algae (A) *Acanthamoeba castellanii* (P)
Folic acid	One-carbon metabolism	*Enterococcus faecalis* (B) *Tetrahymena pyriformis* (P)
Lipoic acid	Transfer of acyl groups	*Lactobacillus casei* (B) *Tetrahymena*spp. (P)
Pantothenic acid	Precursor of coenzyme A—carries acyl groups (pyruvate oxidation, fatty acid metabolism)	*Proteus morganii* (B) *Hanseniaspora*spp. (F) *Parameciums*pp. (P)
Pyridoxine (B_6)	Amino acid metabolism (e.g., transamination)	*Lactobacillus* spp. (B) *Tetrahymena pyriformis* (P)
Niacin (nicotinic acid)	Precursor of NAD and NADP—carry electrons and hydrogen atoms	*Brucella abortus, Haemophilus influenzae* (B) *Blastocladia pringsheimii* (F) *Crithidia fasciculata* (P)
Riboflavin (B_2)	Precursor of FAD and FMN—carry electrons or hydrogen atoms	*Caulobacter vibrioides* (B) *Dictyosteliums*pp. (F) *Tetrahymena pyriformis* (P)
Thiamine (B_1)	Aldehyde group transfer (pyruvate decarboxylation, α-keto acid oxidation)	*Bacillus anthracis* (B) *Phycomyces blakesleeanus* (F) *Ochromonas malhamensis* (A) *Colpidium campylum* (P)

[a]The representative microorganisms are members of the following groups: bacteria (B), fungi (F), algae (A), and protozoa (P).

4.3



- nutrient limitation
- limited oxygen availability
- toxic waste accumulation
- critical population density reached

Q5

5.1

- **Asexual**
  - **fragmentation**

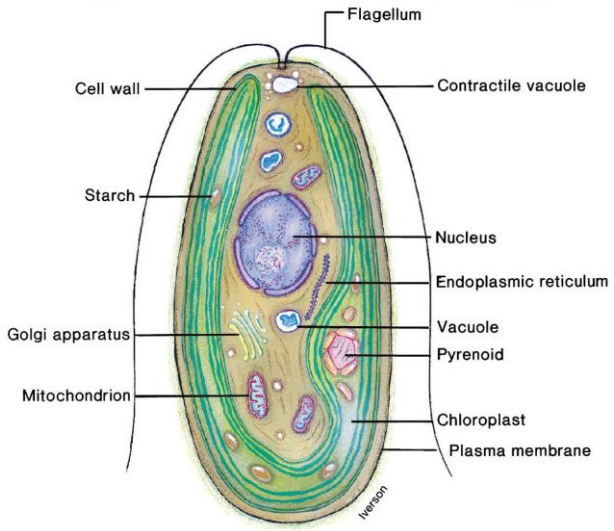
- thallus breaks up and each fragment forms a new thallus

– **spores**
  - zoospores – flagellated motile
  - aplanospores – nonmotile
– **binary fission**
  - mitotic nuclear division followed by cytoplasmic division

5.2

– cleaning and polishing agents
– deodorizers
– fertilizers
– filters
– soundproofing and insulating materials
– paint additive

5.3



Q6

6.1

Bacteria	**Virus**
➢ Has cell wall (Peptidoglycan/Lipopolysaccharide)	➢ Has no cell wall (Protein coat present)
➢ Unicellular	➢ No cells
➢ Has both RNA & DNA floating in cytoplasm.	➢ Has either RNA/DNA enclosed in protein coat
➢ Can grow on non-living surfaces	➢ Must have a living host to multiply
➢ Are intercellular(They live in between cells)	➢ Are intracellular(They infiltrate the hosts cells and live inside the cell)
➢ Reproduces asexually	➢ Invades the host cell and takes over the cell causing it to replicate viral DNA/RNA

6.2

- **MYCOPLASMAS**

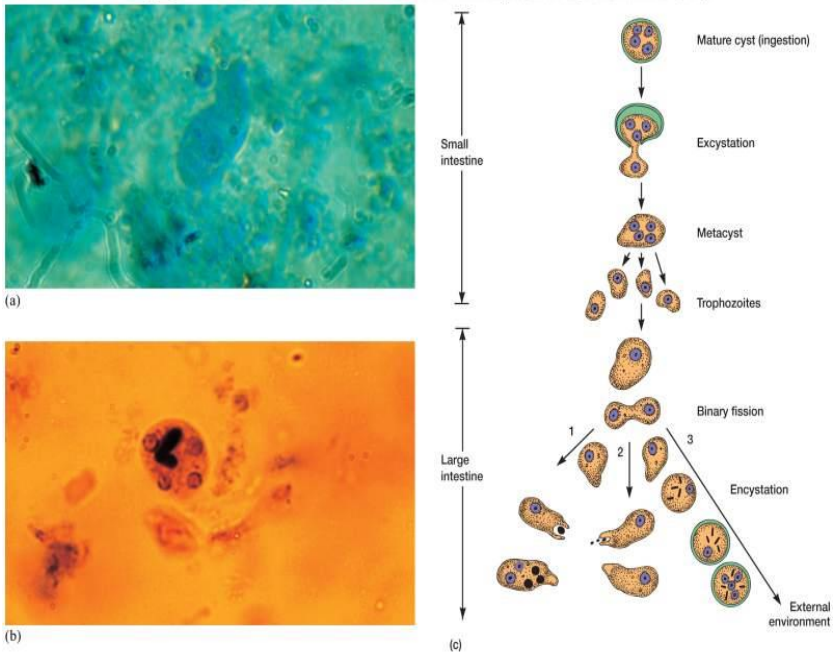
- ✓ No cell wall
- ✓ Cocci – pear shaped
- ✓ Pleomorphism
- ✓ "Fried egg" **(ANY 3)**

- **RICKETTSIAS**

- ✓ Pleomorphic (rod-cocci)
- ✓ Gram negative
- ✓ Parasitic or mutualistic
- ✓ Smallest bacteria

Q7

7.1



Trypanasoma

7.2