

* Make a pair of name and his(her) achievement (1 point per each correct pair)

1	Agostino Bassi		
2	Alexander Flemming		
3	Antony van Leeuwenhoek		
4	Carl Woese		
5	Charles Chamberland	3	a discovered "animacules"
6	Edward Jenner	8	b refuted spontaneous generation of maggots
7	Elie Metchnikoff	19	c proposed the Cell theory
8	Francesco Redi	13	d disproved spontaneous generation using swan neck flasks
9	John Needham	16	e demonstrated anthrax caused by <i>Bacillus anthracis</i>
10	John Tyndall	11	f published on antiseptic surgery
11	Joseph Lister	7	g discovered phagocytes
12	Lazzaro Spallanzani	20	h used agar in culture medium
13	Louis Pasteur	4	i suggested three domains of life
14	Richard Petri	1	j first showed a microorganism can cause disease
15	Robert Hooke		
16	Robert Koch		
17	Sergei Winogradsky		
18	Shibasaburo Kitasato		
19	Theodore Schwann		
20	Walter Hesse (Fannie Hesse)		

* Answer with a short sentence

1 Why don't most light microscopes use 30X ocular lenses for greater magnification? (5 points)

The maximum resolution of microscope using visible light (blue-green light) is approximately 0.2 μm (p. 20), which indicates the useful limit of magnification as X1,000. In typical light microscope, the objective lens has the maximum magnification of x100. Typical ocular lenses are x10 and x15, which is enough to reach the limit of magnification as X1,000.

2 Compare the plasma membranes of Bacteria, Archaea and Eukarya cells (5 points)

Bacteria: Ester-linked phospholipids and hopanoids; some have sterols
 Archaea: Glycerol diethers and diglycerol tetraethers; some have sterols
 Eukarya: Ester-linked phospholipids and sterols

3 Compare the cell walls of gram-positive and gram-negative bacteria (5 points)

Gram-positive walls have thick, homogeneous layers of peptidoglycan and teichoic acid
 Gram-negative has a thin peptidoglycan layer surrounded by a complex outer membrane containing LPS(lipopolysaccharide)s

- 4 Why does peptidoglycan contain the unusual D isomers of alanine and glutamic acid rather than the L isomers observed in proteins? (4 points)

The presence of D-amino acids protects against degradation by most peptidases, which recognize

- 5 List prokaryotic cytoskeleton proteins, their eukaryotic counterparts (6 points)

FtsZ (tubulin); MreB(actin); Crescentin(intermediate filament proteins)

- 6 Two microorganisms were isolated from soil samples. We surveyed their carbon, energy and electron sources and had following results.

Isolate#1 can fix CO₂ and oxidizing sulfur as energy and electron source.

Isolate#2 use glucose as a carbon, energy and electron source.

What are these two microbe's nutritional type based on carbon, energy and electrons? (6 points)

Isolate#1 -> chemolithoautotrophy

Isolate#2 -> chemoorganoheterotrophy

- 7 What is enriched media? Give an example (4 points)

a nutrient was fortified to encourage to growth of fastidious bacteria; blood agar

- 8 Calculate the mean growth rate (k) and generation time (g) of a culture that increases in the exponential phase from 1×10^2 to 1×10^8 in 10 hours (5 points)

$k = \log N_t - \log N_0 / 0.301t$; $k=2.0$; $g = 0.5$

- 9 What are toxic effects of O₂? How do aerobes and other oxygen-tolerant microbes protect themselves from these effects? (6 points)

Oxygen can become toxic because of the production of hydrogen peroxide, superoxide radical, and hydroxyl radical. These are destroyed by the enzymes superoxide dismutase, catalase and peroxidase (additional 3 points for giving chemical reaction examples)

- 10 What are five major classes of microorganisms with respect to temperature preference? (5 points)

1) psychrophiles

2) psychrotroph(facultative psychrophiles)

3) mesophiles

4) thermophiles

5) hyperthermophiles

11 Which physical or chemical agent would be the best choice for sterilizing the following items: (5 points)

1. glass pipettes -
2. nutrient agar -
3. antibiotic solution -
4. interior of biological safety cabinet -
5. wrapped package of plastic petri plates -
dry heat; autoclave(moisted heat); filtration; filtration; sterilizing gas

12 (from your Homework) Bannie Bossler, who is studying 'quorum sensing', trys to develop a drug for Cholera disease caused by *Vibrio cholerae*. Explain her strategy to treat Cholera in terms of manipulating 'quorum sensing' (9 points)

(Key words)

Description of quorum sensing;

Unlike other pathogenic bacteria, *V. cholerae* turns off virulent genes when it reaches 'quorum' (decisive population);

Using some chemicals (autoinducers), make *V. cholerae* decide to turn off virulent genes before it shows enough population to be infectious;

* Define following terms (1 point each)

- 1 acid-fast staining
- 2 antiport
- 3 antisepsis
- 4 axoneme
- 5 barophilic
- 6 cardinal temperature
- 7 chemotaxis
- 8 clathrin
- 9 coenocytic
- 10 curing
- 11 D-value

-
- 12 disinfection
 - 13 exosporium
 - 14 facilitated diffusion
 - 15 fluorochromes
 - 16 glycocalyx
 - 17 iodophor
 - 18 mordant
 - 19 negative staining
 - 20 osmotolerant
 - 21 pellicle
 - 22 peritrichous
 - 23 protoplast
 - 24 PTS
 - 25 S-layer
 - 26 selective toxicity
 - 27 siderophores
 - 28 slime layer
 - 29 sterilization
 - 30 thermal death time

31 Why is 70~80% alcohol more effective for killing microorganisms rather than 100% alcohol? (? points)

100% alcohol quickly dehydrates surface waters of microorganisms, which prevent diffusion of alcohol into the cell to kill target microbes by denaturing proteins and membranes .