

Name:

First Name:

Sciper:

## Physics of Life (PHYS-468)

## Mock Exam

For questions requiring a "Written answer", please use the provided space. If not sufficient, use the backside of the exam sheets and indicate in the space where the answer continues.

For "multiple choice" questions, answer with a 'T' for 'true' and a 'F' for false in the boxes. More than one case might be true. Only correctly answered boxes will give points, incorrectly answered boxes will not give negative points. (That means, guessing is better than not answering at all.)

Good luck.

**1 What are the differences between Prokaryotes and Eukaryotes? (Written answer)**

**2 Compartments (Multiple choice. Mark as 'T' or 'F'. More than one case might be true)**

- One of the functions of the lysosome is the digestion of worn-out organelles in both animal and plant cells
- Mitochondria are replaced in plant cells by chloroplasts
- The rough endoplasmatic reticulum contains ribosomes on the cytosol surface that translate proteins directly into the ER-lumen for vesicular packing
- The DNA is found tightly packed in a dense structure called Nucleolus

**3 Fatty acids .... (Multiple choice. Mark as 'T' or 'F'. More than one case might be true)**

- ...have a hydrophobic tail and a hydrophilic head
- ...usually range from C10 to C20 in length, in both even and odd configurations.
- ...pack closely together if they are completely saturated
- ...have a high melting point if they are unsaturated due to the steric hindrance of the introduced kinks.

**4 Membrane fluidity is essential for ...**

**(Multiple choice. Mark as 'T' or 'F'. More than one case might be true)**

- ... membrane fusion.
- ... phospholipid flip-flop.
- ... proper separation of membranes during division events.
- ... lateral diffusion of proteins on the membrane.

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**5 Make a sketch of an ATPase and label the components. (Written, drawn)****6 From strongest to weakest, the interaction-strength in biomolecules are (select one):**

- Charge-charge interactions, Hydrogen bonds, Van der Waals interactions, Hydrophobic, covalent bonds
- Covalent bonds, charge-charge interactions, Hydrogen bonds, hydrophobic interactions, Van der Waals interactions
- Covalent bonds, charge-charge interactions, hydrophobic interactions, hydrogen bonds, Van der Waals interactions
- Hydrophobic interaction, covalent bonds, charge-charge interactions, hydrogen bonds, Van der Waals interactions

**7 List the approximate values for the interaction types.**

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**8 Draw a fatty acid's structure, indicate hydrophobic and hydrophilic areas, and explain why these areas have those properties.**

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9 You know you have the following amino acid sequence MRGEKDHKDCGILC. Given are also the isoelectric points for all amino acids.

aminoacid	pl	
Ala	A	6.1
Arg	R	10.8
Asn	N	5.4
Asp	D	2.9
Cys	C	5.0
Gln	Q	5.7
Glu	E	3.1
Gly	G	6.1
His	H	7.6
Ile	I	6.0

Leu	L	6.0
Lys	K	9.5
Met	M	5.7
Phe	F	5.9
Pro	P	6.3
Ser	S	5.7
Thr	T	5.6
Trp	W	5.9
Tyr	Y	5.6
Val	V	6.0

9.a At which pH value is the net-charge of the sequence 0?

9.b How can this information be exploited in research?

9.c What advantage do you exploit the abovementioned condition in comparison to SDS-PAGE?

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10 You have a complex protein mixture containing proteins of the different sizes and charges as shown below (generalized). How would you separate the proteins? Name the techniques and how they function. Try to be as efficient as possible.

Compound	Size	Charge	Ligand binding?
A	50 kDa	Negative	No
B	25 kDa	Intermediate hydrophobic	Yes
C	25 kDa	Weak hydrophobic	No
D	15 kDa	Negative	Yes
E	50 kDa	Strong hydrophobic	No
F	15 kDa	Positive	Yes

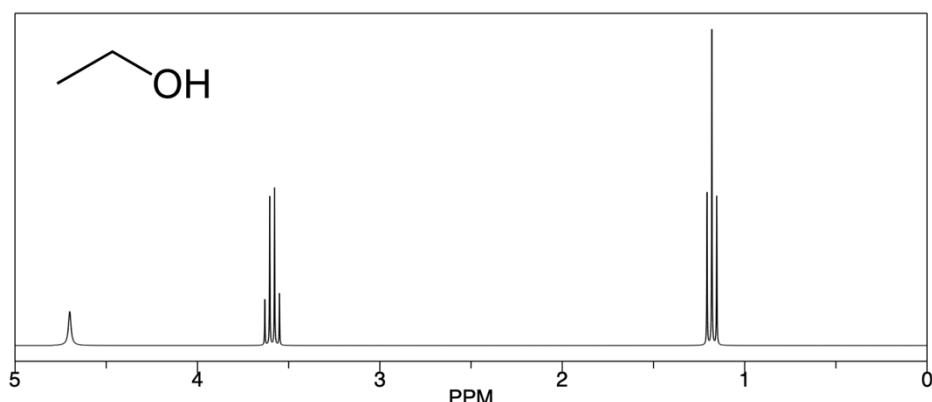
11 What is the difference between a Newtonian and a non-Newtonian fluid? How do non-Newtonian fluids react under stress?

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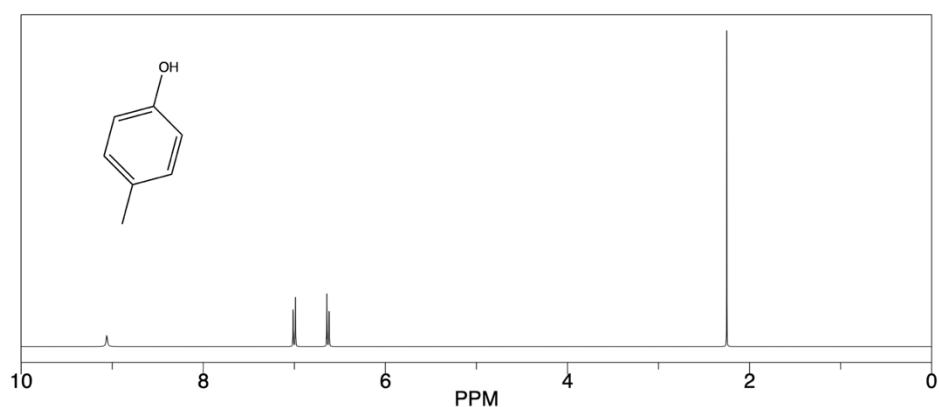
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**12 Assign the different H-atoms to their corresponding peaks in the following two NMR spectra.**

**Spectrum A:**



**Spectrum B:**



**13 What are the integral parts every mass spectrometer needs to have?**