

NAME:

SECTION:

Q1. Which of the following materials are commonly used as adhesion layers between polymeric substrates and noble metals?

- ☐ Cr
- ☐ Ti
- ☐ Al
- ☐ Si

Q2. Which of the following sentences describes the process of sputtering?

- ☐ It is a vacuum-based process in which atoms from a target material are released, pass into the gas phase by heating with an electron beam and are finally deposited onto the substrate.
- ☐ It is a vacuum-based process in which atoms from a target material are released, pass into the gas phase by Joule heating and are finally deposited onto the substrate.
- ☐ It is a vacuum-based process in which atoms from a target material are released by bombardment with energetic ions accelerated by an electric field and are finally deposited onto the substrate.

Q3. What are ALL the possible mechanisms at the electrode-electrolyte interface?

Answer:

Q4: Considering electrical neuromodulation: which waveform has the highest probability of resulting in a residual charge accumulation within the adjacent tissue?

- ☐ A balanced waveform
- ☐ An imbalanced waveform
- ☐ A symmetrical waveform
- ☐ An unsymmetrical waveform

Q5: True or false?

An action potential will always be triggered when the membrane potential of a neuron is depolarized.

Answer:

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Q6. The figure below represents a multilayer that has to be bent with a bending radius of 10 mm.

Materials	Young's modulus	Critical strain	Ultimate strength
Polyimide	2.5 GPa	2.9%	72 MPa
Parylene C	2.8 GPa	2.5%	69 MPa
Titanium (Ti)	110 GPa	0.2%	220 MPa
Platinum (Pt)	105 GPa	0.6%	630 MPa
Alumina (Al ₂ O ₃)	330 GPa	0.08%	260 MPa
Titania (TiO ₂)	230 GPa	0.14%	330 MPa

1) Assuming $\underline{E}_i = \frac{E_i}{(1-\nu^2)} \approx E_i$, calculate the neutral plane.

$z_n =$ μm

2) Calculate the maximum strain. Where is the maximum strain?

$\varepsilon_{max} =$ %

3) Calculate the maximum stress. Where is the maximum stress?

$\sigma_{max} =$ MPa

4) Is it ok if the multilayer is applied to a tube with radius of 1 mm? Why?

Solutions to the mock quiz

1. Cr, Ti
2. C
3. Capacitive, Faradaic (Redox) and Pseudocapacitive
4. B
5. False
6.
 - a. $z_n = 13.89 \mu\text{m}$
 - b. $\text{max} = 0.14\%$; It is at the bottom of polyimide
 - c. $\text{max} = 73.63 \text{ MPa}$; It is at the top of Alumina
 - d. No, because the strain and stress in Alumina and Titania are beyond the limits.