5.25/10

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BT-308 BIOENGINEERING: QUIZ-I Date: 08.02.2024

Instructions: *Total marks: 10. Each of the 09 questions carries 01 mark. An additional 01 mark will be awarded to the students submitting the answer sheet within 4.30 pm (Sharp).*

1. Identify two performance factors for biosensors that attribute to their functional traits from the following list:
(A) Selectivity, (B) Cost, (C) Portability, (D) Design, (E) Market, (F) Sensitivity

2. Write the word/phrase against each acronym letter of "ASSURED", the criteria World Health Organization has suggested. Zero mark will be awarded for an incomplete or incorrect answer against any acronyms.

A: Affordable S: Specific S: Sensitive U: Usable R: Robust E: ——
D: Degradable

3. Fill the gaps in the following sentence using the words: oxidative, reductive.
The redox potential of the mediator, E^0_M, should be more positive and more negative than the redox potential of the enzyme active site E^0_E in the case of reductive $E^0_M > E^0_E$ and oxidative $E^0_M < E^0_E$ bioelectrocatalysis, respectively.

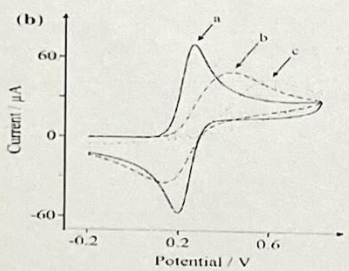
4. Do metals or non-metals exhibit surface plasmon resonance (SPR)? Why? Metals like Ag, Au and Pt exhibit SPR because of rigid lattice structure and low energy of fermi-level electrons.

5. The overall energetic efficiency of a biofuel cell is calculated as the ratio of charge produced by the cell over a time interval t to the heat of combustion of the organic substrate added in that time frame. Fill the gaps each with a right word.

6. Identify the correct relations among the amount of charge(C) developed, piezoelectric coefficient (d), force applied along the x-direction (F_x), the number of stacked elements (n), and crystal dimensions a, b for a longitudinal effect in piezoelectric materials from the following equations:
(A)$C_x=d_{xy}F_xn$ a/b, (B)$C_x=d_{xx}F_xn$ b/a, (C)$C_x=2d_{xx}F_xn$ a/b, (D)$C_x=d_{xx}F_xn$,
(E)$C_x=2d_{xy}F_xn$, (F) $C_x=d_{xy}F_xn$

7. Identify two correct answers without making any assumption from the following statements:
For oxidation of a target analyte on the electrode surface, the
(A) E_F> E of LUMO of the target, (B) E_F> E of HOMO of the target,
(C) E_F> E of HOMO and LUMO of the target, (D) E_F< E of LUMO of the target
(E) E_F = E of LUMO of the target, (F) E_F < E of HOMO of the target
The terminology/symbols follow the usual meaning as discussed in the classes.

8. From the cyclic voltammogram below, correlate the pattern of the graphs with the correct reaction(s):



(A) a → quasi-reversible, (B) a → non-reversible, (C) a → reversible, (D) b → reversible,
(E) b → irreversible, (F) b → quasi-reversible, (G) c → reversible, (H) c → quasi-reversible

9. If the enthalpy change of an enzymatic reaction associated with the conversion of 2000 g of a target analyte substrate to 1 mol of the product is -100 kj/mol, the heat capacity of the system is 1 kj/K.Kg, Seebeck coefficient is 0.01 V/K, then estimate the output potential difference (ΔV) of a thermopile, with one pair number of the thermocouple (Units must be shown, otherwise zero mark will be awarded).

→ 2kg

*****END*****

$\Delta V = \frac{2kg \times 1KJ/K.Kg \times 0.01 V/K}{1 mol \times (-100 KJ/mol)}$

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