

Course outline

How does an NPTEL online course work?

Week 0 :

Week 1

- Lecture 01 : Fundamentals of electrochemistry, definition of primary and secondary batteries
- Lecture 02 : Primary batteries and Secondary batteries
- Lecture 03 : Supercapacitors
- Lecture 04 : Concepts of Thermodynamics pertinent to Electrochemical Cells
- Lecture 05 : Kinetics of electrochemical cells and structural characteristics of electrodes

Lecture Materials

 Quiz: Week 1 : Assignment 1

 Feedback form for Week 1

Week 2

Week 3

Week 4

Week 5

Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

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Assignment Detailed Solution

Live Interactive session

Week 1 : Assignment 1

The due date for submitting this assignment has passed.

Due on 2021-08-18, 23:59 IST.

As per our records you have not submitted this assignment.

1) Which setup/devices are electrochemical energy storage devices?

1 point

- PEM Electrolyzers
- Dielectric Capacitors
- Lead-acid Batteries
- All of the above

- a
 b
 c
 d

No, the answer is incorrect.

Score: 0

Accepted Answers:

c

2) Which of the following statements is True?

1 point

- In case of an electrolyzer mode, positive electrode is anode and negative electrode is cathode
- In case of galvanic mode (electrochemical cell as power source), positive electrode is anode and negative electrode is cathode

- a
 b

No, the answer is incorrect.

Score: 0

Accepted Answers:

a

3) Ionic junction is defined as:

1 point

- Interface between two dissimilar metal conductors
- Interface between an electronic and ion conducting medium
- Interface between two ion conducting medium
- None of the above

- a
 b
 c
 d

No, the answer is incorrect.

Score: 0

Accepted Answers:

c

4) Which of the following cannot be a reference electrode?

1 point

- $Pt|H_2(g)|1M H_2SO_4$
- $Cl^-(4M)|Hg_2Cl_2(s)|Hg(l)|Pt$
- $Ag|AgCl|KCl$
- $Cu|1M CuSO_4$

- a
 b
 c
 d

No, the answer is incorrect.

Score: 0

Accepted Answers:

d

5) In which of the applications can a primary battery be used:

1 point

- Pacemakers
- Electric Vehicles
- Mobile Phones
- All of the above

- a
 b
 c
 d

No, the answer is incorrect.

Score: 0

Accepted Answers:

a

6) Which of the following electrochemical measurement techniques require a sinusoidal signal to be applied in the electrochemical cell?

1 point

- Chronoamperometry
- Chronopotentiometry
- Voltamperometry
- Impedancemetry

- a
 b
 c
 d

No, the answer is incorrect.

Score: 0

Accepted Answers:

d

7) Which of the following is not a type of thermal battery?

1 point

- Sodium-Sulphur battery
- Magnesium-Antimony battery
- Zinc-Bromine battery
- None of the above

- a
 b
 c
 d

No, the answer is incorrect.

Score: 0

Accepted Answers:

c

8) Which of the following is not a candidate for supercapacitor materials?

1 point

- Activated Carbon
- Polyaniline
- Lithium titanate
- None of the above

- a
 b
 c
 d

No, the answer is incorrect.

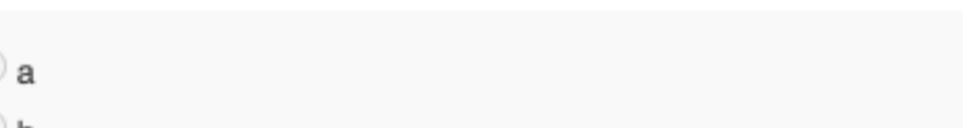
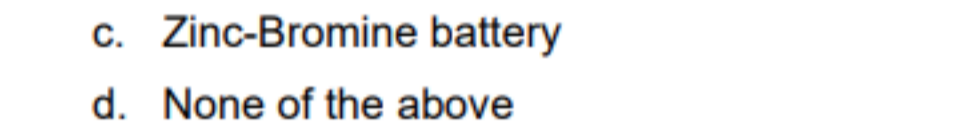
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Accepted Answers:

c

9) Choose the correct option set which will fit the blanks in the following reactions well:

2 points



- (I) - 2, 2 & (II) - 1, 1
- (I) - 2, 1 & (II) - 1, 1
- (I) - 1, 2 & (II) - 1, 2
- (I) - 1, 2 & (II) - 2, 1

- a
 b
 c
 d

No, the answer is incorrect.

Score: 0

Accepted Answers:

a

10) For a symmetric capacitor with a specific capacitance of each electrode being 100F/g, the capacitance of the device containing 1g of capacitor material in each electrode is:

2 points

- 25F
- 50F
- 200F
- 100F

- a
 b
 c
 d

No, the answer is incorrect.

Score: 0

Accepted Answers:

b

 11) Through a known process of synthesizing activated carbon, you have developed uniform activated carbon nanosheets in the form of rectangular sheets of dimension 78nm (L) * 100nm (B) * 2nm (T). You are asked to test its specific capacitance value in an ionic liquid electrolyte (1M LiTFSI in EMIM-TFSI) between 2.0V - 3.0V wrt to Li⁺/Li. In this voltage range, complete coverage of the active surface area is expected. The ions in the ionic liquid electrolyte form hard clusters of size 20nm. What is the specific capacitance value for this synthesized material? Through other engineering techniques, you are able to roll the activated carbon sheets into nanotubes along the L axis. What percentage change in the specific capacitance value will you observe due to this conversion? Assume single layer/monolayer adsorption process is occurring. Density of the material is 2.1g/cc. Assume charge of one electron is 1.6*10⁻¹⁹ C.

4 points

- 0.1953F/g, +210.35%
- 0.1953F/g, -210.35%
- 0.606F/g, +210.35%
- None of the above

- a
 b
 c
 d

No, the answer is incorrect.

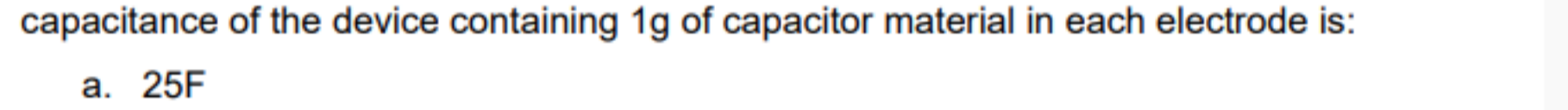
Score: 0

Accepted Answers:

d

 12) You are into the business of exploring new electrochemical energy storage chemistries and head a successful battery development group. One of your subordinates has come up with an idea of developing a battery with the use of LiCl dissolved in LiClO₃ at 423K. The subordinate proposed that the two electrodes which should be used are Lithium metal, in which lithium goes into the solution at the negative electrode. At the other end, the chlorate anions are reduced to form an insoluble layer of Li₂O over the positive electrode. You like the idea since it is very similar to Li-air battery chemistry, which is sought out by the market. You ask your subordinate to do a preliminary evaluation of this system and provide him with necessary values for calculation. Given that the thermochemical data for the presumably relevant components are as follows:

4 points



Choose the correct combination from the following table:

Reaction	Open Circuit Potential	Whether open circuit potential higher than 3V
(I) $Li^+ + e^- \rightarrow Li(s)$ (Neg) $LiClO_3 + 6Li^+ + 6e^- \rightarrow 3Li_2O + Cl^-$ (Pos)	(I) 2.565V	(I) True
(II) $Li^+ + e^- \rightarrow Li(s)$ (Neg) $LiClO_3 + 6Li^+ + 6e^- \rightarrow 3Li_2O + LiCl$ (Pos)	(II) 3.24V	(II) False
(III) $Li(s) \rightarrow Li^+ + e^-$ (Neg) $LiClO_3 + 6Li^+ + 6e^- \rightarrow 3Li_2O + LiCl$ (Pos)	(III) 3.89V	

- Reaction - II, Open Circuit Potential - II, Whether open circuit potential higher than 3V - I
- Reaction - III, Open Circuit Potential - I, Whether open circuit potential higher than 3V - II
- Reaction - II, Open Circuit Potential - I, Whether open circuit potential higher than 3V - II
- Reaction - III, Open Circuit Potential - III, Whether open circuit potential higher than 3V - I

- a
 b
 c
 d

No, the answer is incorrect.

Score: 0

Accepted Answers:

d