

## Test 2: Identification and Production of Materials II

Total 25 marks (Suggested time 45 minutes)

### Directions to students

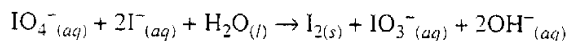
- Answer the following questions on your own paper.
- Part A contains 5 multiple-choice questions, each worth 1 mark. Select the alternative A, B, C or D that best answers the question.
- Part B contains 5 short answer and longer response questions.
- You may use the standard formula sheet supplied.

### PART A

1. Some isotopes of elements are stable and others are radioactive. The nucleus becomes unstable when
  - (A) the neutron to proton ratio is close to 1 and the atomic number is small.
  - (B) the neutron to proton ratio is greater than 1 and the atomic number is large.
  - (C) there are not enough neutrons in the nucleus to counteract the strong forces of repulsion between protons.
  - (D) there are too many neutrons in the nucleus to counteract the strong forces of repulsion between protons.
2. Which of the following conditions are necessary to electrorefine copper?
  - (A) a Galvanic cell with a pure copper cathode and an impure copper anode
  - (B) an electrolytic cell with an impure copper anode and a pure copper cathode
  - (C) an electrochemical cell with an impure copper cathode and a pure copper anode
  - (D) an electrolytic cell with a pure copper anode and an impure copper cathode
3. The soil in which tobacco is grown is treated with phosphate fertilizers that are rich in uranium and its decay products. The particles inhaled by the smoker contain small amounts of lead-210. This is a hazard to the smoker because
  - (A) lead-210 has a long half-life.
  - (B) the lead coats the lining of the lungs and prevents gas exchange.
  - (C) the decay products have long half-lives and build up in the lungs.
  - (D) lead-210 has a long half-life and constant exposure to  $\alpha$  and  $\beta$  radiation from its decay products causes cancer.

4. In nuclear reactors the nuclei of atoms are bombarded with neutrons. The products of these reactions are
- (A) transuranium elements.
  - (B) transuranium elements and commercial isotopes.
  - (C) transuranium elements, commercial isotopes and energy.
  - (D) transuranium elements, commercial isotopes, energy and more neutrons.

5. Consider the redox reaction:



When  $\text{IO}_4^-$  ions are added to a solution containing radioactive iodide ions, the radioactivity appears in the  $\text{I}_{2(s)}$  and not the  $\text{IO}_3^-$  ions. From this information it can be deduced that

- (A) the  $\text{I}^-{}_{(aq)}$  ions are oxidised to form  $\text{I}_{2(s)}$ .
- (B) the  $\text{I}^-{}_{(aq)}$  ions are reduced to form  $\text{I}_{2(s)}$ .
- (C) the  $\text{IO}_4^-$  ions are oxidised to form  $\text{IO}_3^-$  ions.
- (D) the  $\text{IO}_4^-$  and  $\text{IO}_3^-$  ions do not take part in the reaction.

## PART B

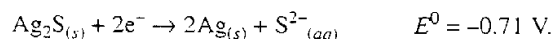
Marks

### Question 6 (2 marks)

Tarnished silver contains  $\text{Ag}_2\text{S}$ . The tarnish can be removed by placing the silverware in an aluminium saucepan containing salt ( $\text{NaCl}$ ). Explain, using equations, the electrochemical basis for this household procedure.

2

The half-cell reaction is



### Question 7 (4 marks)

In this module, you gathered, processed and presented information on the structure and chemistry of a dry cell or a lead-acid cell.

- (a) Name the cell you studied and state the composition of the cell's anode, cathode and electrolyte. 1½

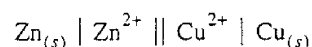
You evaluated this cell in comparison to a number of other cells.

- (b) Name ONE other cell. ½
- (c) Describe how this named cell is different from a dry cell **or** lead-acid cell in terms of
- (i) its chemistry. 1
  - (ii) its environmental impact. 1

<b>Question 8</b>	(4 marks)	Marks
(a)	Identify an example of the use of electroplating and	
(i)	Draw a fully labelled diagram showing the object to be electroplated and identify the cathode, anode and electrolyte.	2
(ii)	Write an equation for the reaction occurring at the cathode.	1
(b)	Explain why the process is used.	1

**Question 9** (5 marks)

A Galvanic cell is constructed with the cell notation:

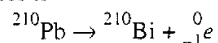


(a)	Draw a fully labelled diagram of the cell, showing the direction of electron flow, the cathode and the anode.	3½
(b)	Calculate the emf of the cell.	1½

**Question 10** (5 marks)

It takes  $4.51 \times 10^9$  years for uranium-238 to decay to thorium-234 by  $\beta$ -decay.

(a)	Write the equation for this decay reaction.	1
(b)	The thorium-234 decays twice to produce a different isotope of uranium. Explain how this process can occur.	2
(c)	After undergoing several more decay reactions, the uranium becomes lead-210. Given that the next step in the decay process is	2



deduce the next two possible decay equations to show lead-210 becoming lead-206.