THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

SECOND SEMESTER EXAMINATION

CH 422 –ORGANOMETALLIC COMPOUNDS AND NANOTECHNOLOGY

TUESDAY 25TH OCTOBER 2022 – 12:50 PM

TIME ALLOWED: 2 HOURS

INFORMATION FOR CANDIDATES: -

1. You will have 10 minutes to read the question paper. You **MUST NOT** begin writing in the answer book during this time.
2. **ANSWER ALL QUESTIONS.**
3. All answers **MUST** be written on the answer book provided
4. Calculators are permitted in the examination room. Lecture notes, notebooks plain papers and textbooks are **NOT** allowed.
5. Mobile phones are not allowed. **SWITCH OFF THE MOBILE PHONES.**
6. Show all workings and calculations in the answer book.
7. **DRAW the STRUCTURES** clear and visible.
8. **DO NOT** overwrite.
9. Write your name and number clearly on the front page. **DO IT NOW.**

MARKING SCHEME: Total 50 marks

1. (a) How are the organometallic compounds classified?

   (b) Write the FOUR major applications of organometallic compounds.

   (Total = 8 marks)

2. (a) Apply 18 electron rule to the following compounds and determine their electron counts. Based on the result, classify them as stable or unstable compound:

   (i) $[Mn(H_2O)_6]^{2+}$

   (ii) $[CpFe(CO)_2]_2$

   (iii) CuCl(CO)

   [6 marks]

   (b) Draw the structures of the following organometallic compounds:

   (i) Cp_2TiCl_2 (Titanocene dichloride),

   (ii) ferrocene

   [2 marks]

   (Total = 8 marks)

3. (a) Why most of the organometallic compounds are highly reactive and sensitive?

   (b) Use valance bond theory (VBT) and deduce the hybridization, shape and magnetic property of Ferrocene

   (c) Chromium forms two common anionic carbonyls: $[Cr(CO)_5]^{n-}$ and $[Cr(CO)_4]^{m-}$. Deduce the probable charges, n and m, on these ions. (Hint: use EAN rule)

   (Total = 9 marks)

4. (a) Distinguish between top-down and bottom-up approaches for nanoparticle synthesis.

   (b) Write any THREE advantages of chemical method of synthesis of nanomaterials.

   (c) What are nanomaterials? Why did we not hear about nanotechnology in the past?

   (d) Explain the chemical vapour deposition method for the synthesis of carbon nanotube.

   (Total = 12 marks)

5. (a) How are carbon nanotubes (CNTs) classified based on their chirality? Explain the main types.

[4 marks]

(b) State any TWO characterization tools for nanomaterials. Explain with suitable example each.

[4 marks]

(c) Explain the role of nanomaterials in space or defence fields.

[4 marks]

(d) What happens if CNTs enter into human or animal body?

[1 mark]

(Total = 13 marks)

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Periodic Table of the Elements