Final Examination
2017/2018 Academic Session

May/June 2018

JIK310 – Physical Chemistry II
[Kimia Fizik II]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains **SEVEN** printed pages before you begin the examination.

Answer **FIVE (5)** questions. Answer the questions in English. You may also answer the questions in Bahasa Malaysia, but not a mix of both languages.

All answers must be written in the answer booklet provided.

Each question is worth 20 marks and the mark for each sub question is given at the end of that question.

In the event of any discrepancies in the exam questions, the English version shall be used.

Sila pastikan bahawa kertas peperiksaan ini mengandungi TUJUH muka surat yang bercetak sebelum anda memulakan peperiksaan ini.

Jawab LIMA (5) soalan. Jawab soalan-soalan dalam Bahasa Inggeris. Anda juga dibenarkan menjawab soalan dalam Bahasa Malaysia, tetapi campuran antara kedua-dua bahasa ini tidak dibenarkan.

Setiap jawapan mesti dijawab di dalam buku jawapan yang disediakan.

Setiap soalan bernilai 20 markah dan markah subsoalan diperlihatkan di penghujung subsoalan itu.

Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.

Answer **FIVE (5)** questions.
*Jawab **LIMA (5)** soalan.*

1.   (a).   Describe **THREE (3)** features of catalysis by zeolites?

               *Terangkan **TIGA (3)** ciri-ciri pemangkin oleh zeolit?*

               (6 marks/*markah*)

       (b).   Comment on the statement that "colloid is not a substance but state of a substance"?

               Komen pada kenyataan bahawa "koloid bukan bahan tetapi keadaan bahan"?

               (4 marks/*markah*)

       (c).   Action of soap is due to emulsification and micelle formation. Give your comment.

               Tindakan sabun adalah disebabkan oleh pengemulsian dan pembentukan misel. Berikan komen anda.

               (6 marks/*markah*)

       (d).   Why is it necessary to remove CO during the production of ammonia by the Haber's process?

               Kenapa CO perlu dikeluarkan semasa penyediaan ammonia melalui proses Haber?

               (2 marks/*markah*)

       (e).   How is adsorption of a gas related to its critical temperature?

               Bagaimana penjerapan gas berkaitan dengan suhu kritikalnya?

               (2 marks/*markah*)

2.   (a).   Name **TWO (2)** examples where the cohesive force dominates over the adhesive force and vice versa.

*Namakan **DUA (2)** contoh yang mana daya kohesif menguasai daya pelekat dan sebaliknya.*

(4 marks/*markah*)

(b).   Explain why a water strider can glide on water with your knowledge on cohesion in water.

Terangkan mengapa ayak-ayak boleh meluncur di atas air dengan pengetahuan anda tentang kohesif dalam air.

(4 marks/*markah*)

(c).   Explain with the aid of diagrams, what will happen when a liquid droplet is dropped on the surface of a solid?

Terangkan dengan bantuan gambar rajah, apakah yang akan terjadi apabila suatu titisan cecair dititiskan ke permukaan suatu pepejal?

(6 marks/*markah*)

(d).   Explain what a surfactant is. Name **TWO (2)** types of surfactants based on their chemical properties.

*Terangkan apakah surfaktan. Namakan **DUA (2)** bahan aktif permukaan berdasarkan sifat-sifat kimianya.*

(6 marks/*markah*)

3. (a). The adsorption of a gas is described by the Langmuir isotherm with K = 0.75 kPa^{-1} at 25 °C. Calculate the pressure at which the fractional surface coverage is :

   (i).   0.15

   (ii). 0.95

   (iii). If "I" is the inhibitor on a unimolecular surface reaction of a gas molecule "A", what is the fraction of surface covered by A?

   Penjerapan gas digambarkan oleh isoterma Langmuir dengan K = 0.75 kPa^{-1} pada 25 °C. Hitung tekanan di mana liputan permukaan pecahan ialah:

   (i).   0.15

   (ii). 0.95

   (iii). Jika "I" adalah perencat pada tindak balas permukaan satu molekul bagi suatu molekul gas "A", apakah pecahan permukaan yang diliputi oleh A?

   (6 marks/*markah*)

(b). Langmuir reported the following results for the adsorption of nitrogen gas, N_2, on mica at 90 K:

Pressure, p (Pa)	0.28	0.34	0.40	0.49	0.60	0.73	0.94	1.28	1.71	2.35	3.35
Volume of gas adsorbed, V, mm³ (20 °C, 1 atm) g⁻¹	12.0	13.4	15.1	17.0	19.0	21.6	23.9	25.5	28.2	30.8	33.0

(i). Show that these data obey the Freundlich isotherm at low pressure.

(ii). Calculate the number of moles of N_2 equivalent to monolayer volume, V_m, and given that b = 1.56 Pa^{-1}.
[Conversion factors: R = 8.314 x 10^{-5} bar m^3 K^{-1} mol^{-1}; 1 atm = 1.01325 bar]

Langmuir melaporkan keputusan berikut bagi penjerapan gas nitrogen N_2, ke atas mika pada 90 K:

Tekanan, p (Pa)	0.28	0.34	0.40	0.49	0.60	0.73	0.94	1.28	1.71	2.35	3.35
Isipadu gas terjerap, V, mm³ (20 °C, 1 atm) g⁻¹	12.0	13.4	15.1	17.0	19.0	21.6	23.9	25.5	28.2	30.8	33.0

(i). Tunjukkan bahawa data ini mematuhi isoterma Freundlich pada tekanan rendah.

(ii). Kira bilangan mol N_2 setara kepada isipadu lapisan mono, V_m, dan diberi b = 1.56 Pa^{-1}.
[Faktor pertukaran: R = 8.314 x 10^{-5} bar m^3 K^{-1} mol^{-1}; 1 atm = 1.01325 bar]

(14 marks/*markah*)

4. (a). The number of chirps per minute of a cricket at several temperatures is 178 at 25.0 °C, 126 at 20.3 °C, and 100 at 17.3 °C. Find the activation energy for the chirping process.

Bilangan kicauan perminit seekor cengkerik pada beberapa suhu adalah 178 pada 25.0 °C, 126 pada 20.3 °C, dan 100 pada 17.3 °C. Cari tenaga pengaktifan untuk proses kicauan.

(10 marks/*markah*)

(b). The thermal decomposition of an organic nitrile produced the following data.

Penguraian terma nitril organik menghasilkan data berikut.

$t\ (10^3\ s)$	0	2.00	4.00	6.00	8.00	10.00	12.00	∞
Nitrile (mol dm^{-3})	1.50	1.26	1.07	0.92	0.81	0.72	0.65	0.40

Determine the order of the reaction and the rate constant.

Tentukan tertib tindak balas dan pemalar kadar.

(10 marks/*markah*)

5. Sketch the five adsorption isotherms in the BET (Brunauer, Emmett and Teller) classification. Explain each of the isotherms with an example.

Lakarkan lima jenis isoterma penjerapan mengikut pengelasan BET (Brunauer, Emmett dan Teller). Terangkan pengertian setiap jenis isoterma ini dan berikan satu contoh bagi setiap isoterma tersebut.

(20 marks/*markah*)

6.   (a).   Write the **FOUR (4)** differences between physisorption and chemisorption?

*Tuliskan **EMPAT (4)** perbezaan antara fizijerapan dan pengkimierapan?*

(8 marks/*markah*)

    (b).   Give **THREE (3)** ways in which the rate of reaction could be increased.

*Berikan **TIGA (3)** cara di mana kadar tindak balas dapat ditingkatkan.*

(6 marks/*markah*)

    (c).   Write **THREE (3)** characteristics of enzyme catalysed reactions.

*Tuliskan **TIGA (3)** ciri tindak balas bermangkin enzim.*

(3 marks/*markah*)

    (d).   What is meant by activity and selectivity of a catalyst?

Apakah yang dimaksudkan dengan aktiviti dan kepilihan suatu mangkin?

(3 marks/*markah*)

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