UNIVERSITI SAINS MALAYSIA

First Semester Examination
2014/2015 Academic Session

December 2014 / January 2015

EKC 107 – Organic Chemistry
[Kimia Organik]

Duration : 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of ELEVEN pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEBELAS muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instruction: Answer **ALL** (4) questions.

*[**Arahan:** Jawab **SEMUA** (4) soalan.]*

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

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

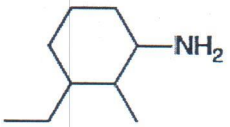
...2/-

Answer ALL questions.

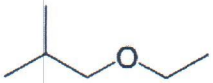
1. [a] Give IUPAC name for each compound

[i] $(CH_3)_2CHCH_2CH(CH_2CH_3)CH(OH)CH_2CH_3$

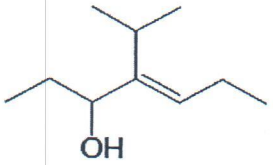
[2 marks]

[ii] 

[2 marks]

[iii] 

[2 marks]

[iv] 

[2 marks]

[b] Give the structure corresponding to each name

[i] (3*E*)-4-ethyl-3-heptene

[2 marks]

[ii] diisobutyl ether

[2 marks]

[iii] 6-sec-butyl-7,7-diethyl-4-decanol

[2 marks]

[iv] cyclobutylcycloheptane

[2 marks]

[c] The melting points (*mp*) and boiling points (*bp*) of two isometric alkanes are as follows: $CH_3(CH_2)_6CH_3$, *mp* = -57 °C and *bp* = 126 °C; $(CH_3)_3CC(CH_3)_3$, *mp* = 102 °C and *bp* = 106 °C.

[i] Explain why $CH_3(CH_2)_6CH_3$ has a lower melting point but higher boiling point.

[4 marks]

[ii] Explain why there is a small difference in the boiling points of the two compounds, but a huge difference in their melting points.

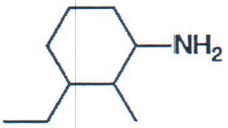
[5 marks]

Jawab <u>SEMUA</u> soalan.

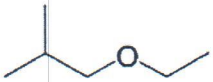
1. [a] *Berikan nama IUPAC bagi setiap sebatian*

[i] $(CH_3)_2CHCH_2CH(CH_2CH_3)CH(OH)CH_2CH_3$

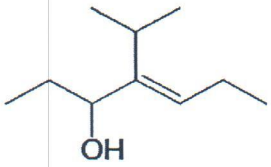
[2 markah]

[ii] 

[2 markah]

[iii] 

[2 markah]

[iv] 

[2 markah]

[b] *Berikan struktur yang sepadan dengan setiap nama*

[i] *(3E)-4-etil-3-heptena*

[2 markah]

[ii] *diisobutil eter*

[2 markah]

[iii] *6-sec-butil-7,7-dietil-4-dekanol*

[2 markah]

[iv] *siklobutilsikloheptana*

[2 markah]

[c] *Takat lebur (*mp*) dan takat didih (*bp*) dua alkana isometrik adalah seperti berikut:* $CH_3(CH_2)_6CH_3$, mp = *-57 °C dan* bp = *126 °C;* $(CH_3)_3CC(CH_3)_3$, mp = *102 °C dan* bp = *106 °C.*

[i] *Terangkan mengapa* $CH_3(CH_2)_6CH_3$ *mempunyai takat lebur yang lebih rendah tetapi takat didih yang lebih tinggi.*

[4 markah]

[ii] *Terangkan mengapa terdapat perbezaan kecil pada takat didih kedua-dua sebatian, tetapi perbezaan besar pada takat lebur.*

[5 markah]

...4/-

2. [a] Write a stepwise mechanism that shows how a very small amount of CH_3CH_2Cl could be formed during the chlorination of CH_4. Please use curved arrows to show the movement of electrons.

[10 marks]

[b] Explain the differences in alkene reactivity for the following electrophilic addition reactions. Show the necessary reaction mechanisms in your answers.

[i] The reaction between $C_6H_5CH{=}CHC_6H_5$ and HBr is faster than the reaction between $CH_3CH{=}CHCH_3$ and HBr, even though both compounds are 1,2-disubstituted alkenes.

[8 marks]

[ii] When treated with H_2O in the presence of acid, $CH_2{=}C(CH_3)CH_2OCH_3$ reacts slower than $CH_2{=}C(CH_3)_2$.

[7 marks]

3. [a] Give the structural formula and another acceptable name for each of the following compounds.

[i] propionaldehyde

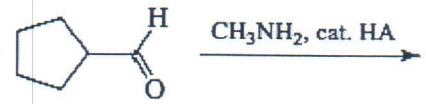
[ii] methyl iso-butyl ketone

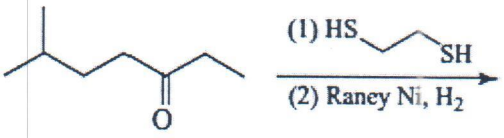
[4 marks]

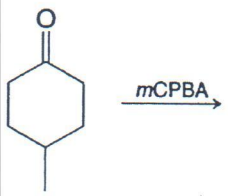
[b] Provide a synthesis route of propanal from an appropriate alcohol of your choice with all the necessary reagent.

[3 marks]

[c] Predict the major organic product from each of the following reactions.

[i] 

[ii] 

[iii] 

2. [a] *Tuliskan langkah demi langkah mekanisma yang menunjukkan bagaimana jumlah CH_3CH_2Cl yang sangat kecil boleh terbentuk semasa proses pengklorinan CH_4. Sila gunakan anak panah melengkung untuk menunjukkan pergerakan elektron-elektron.*

[10 markah]

[b] *Terangkan perbezaan kereaktifan alkena dalam tindak balas penambahan elektrofilik berikut. Tunjukkan mekanisma tindak balas yang berkaitan dalam jawapan anda.*

[i] *Tindak balas diantara $C_6H_5CH=CHC_6H_5$ dan HBr lebih cepat daripada tindak balas diantara $CH_3CH=CHCH_3$ dan HBr, walaupun kedua-dua sebatian adalah 1,2-disubstitusi alkena.*

[8 markah]

[ii] *Apabila dirawat dengan H_2O dengan kehadiran asid, $CH_2=C(CH_3)CH_2OCH_3$ bertindak balas lebih perlahan daripada $CH_2=C(CH_3)_2$.*

[7 markah]

3. [a] *Berikan formula struktur dan nama lain yang boleh diterima bagi setiap sebatian berikut:*

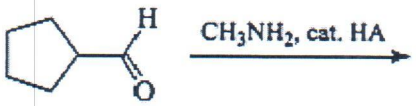
[i] *Propionaldehid*
[ii] *Metil iso-butil keton*

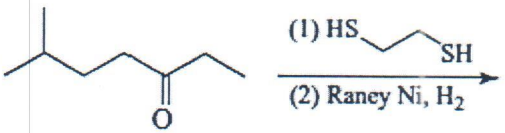
[4 markah]

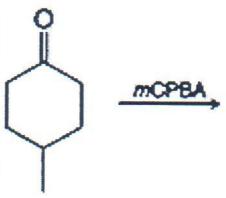
[b] *Berikan laluan sintesis propanal daripada alkohol pilihan anda yang sesuai dengan semua bahan kimia yang diperlukan.*

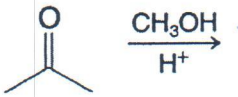
[3 markah]

[c] *Ramalkan produk organik yang utama dari setiap tindak balas berikut*

[i] 

[ii] 

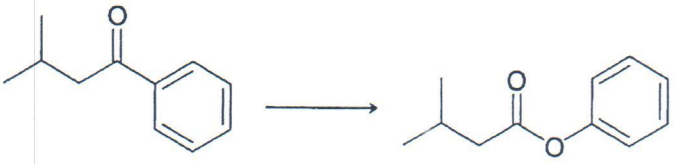
[iii] 

[iv] 

[3 marks]

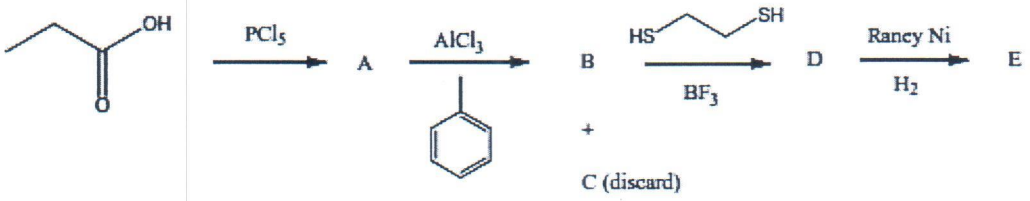
[d] Provide the reagent(s) needed to accomplish each of the following transformation.

[i] 

[ii] 

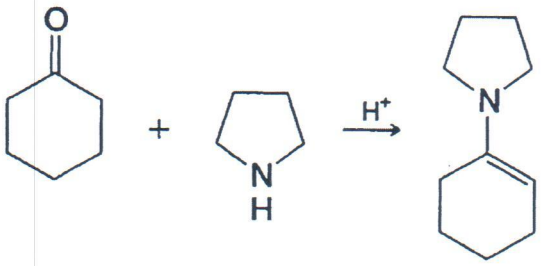
[4 marks]

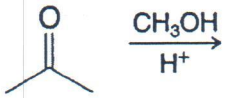
[e] Please provide the structural details of all significant intermediates of *A, B, C, D* and *E* for the following reaction sequence.



[5 marks]

[f] Provide the detailed mechanisms for each of the following reactions.

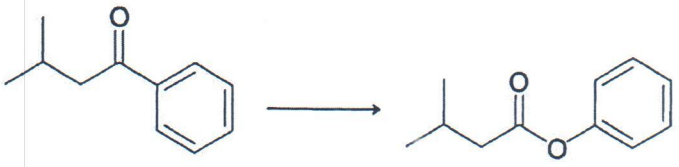
[i] 

[iv] 

[3 markah]

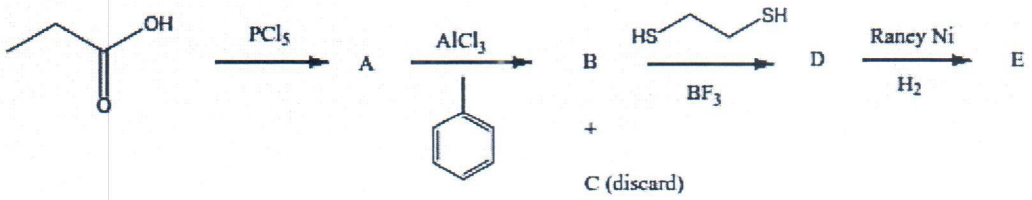
[d] Berikan bahan-bahan kimia yang diperlukan untuk memperolehi setiap transformasi yang berikut:

[i] 

[ii] 

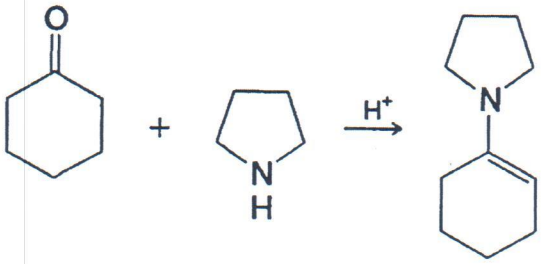
[4 markah]

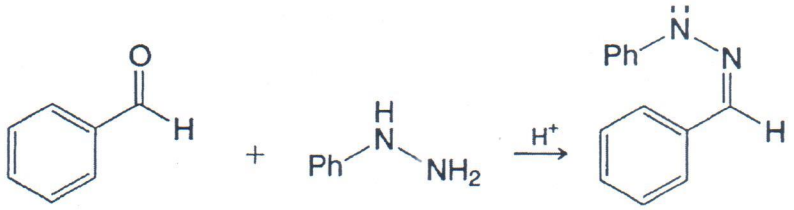
[e] Berikan butiran struktur semua perantaraan A, B, C, D *dan* E *bagi urutan tindak balas berikut:*



[5 markah]

[f] Berikan mekanisma terperinci bagi setiap tindak balas berikut

[i] 

[ii] 

[6 marks]

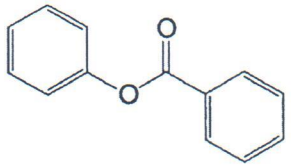
4. [a] Give the structural formula for each of the following:

[i] iso-propyl benzene

[ii] *p*-chlorobenzoic acid

[4 marks]

[b] One ring of phenol benzoate undergoes electrophilic aromatic substitituion much more readily than the other.



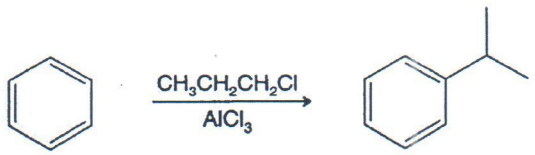
[i] Identify the more reactive ring.

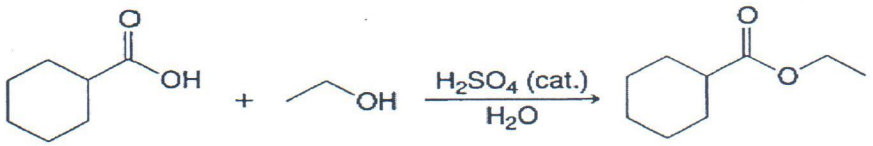
[2 marks]

[ii] Explain your answer.

[2 marks]

[c] Provide the detailed mechanism for each of the following reactions.

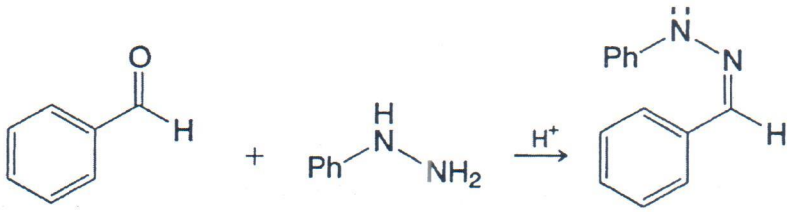
[i] 

[ii] 

[6 marks]

[d] *p*-aminobenzoic acid (PABA) is a compound that has been used in suncreens. Provide a synthesis route of PABA starting from toluene and any inorganic reagents required.

[4 marks]

[ii] 

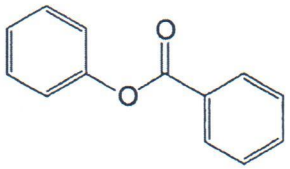
[6 markah]

4. *[a] Berikan formula struktur bagi setiap yang berikut:*

[i] iso-propil benzena
[ii] asid p-klorobenzoik

[4 markah]

[b] Satu cincin fenol benzoat mengalami penggantian elektrofilik aromatik jauh lebih mudah daripada yang lain.



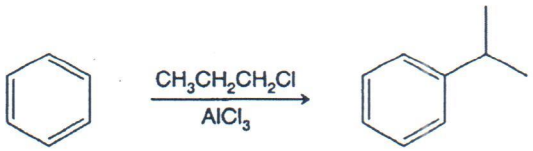
[i] Kenalpasti cincin yang lebih reaktif.

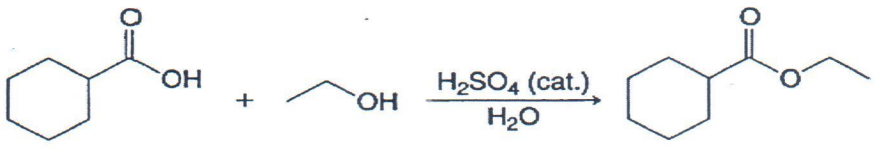
[2 markah]

[ii] Jelaskan jawapan anda.

[2 markah]

[c] Berikan secara terperinci mekanisma bagi setiap tindak balas berikut,

[i] 

[ii] 

[6 markah]

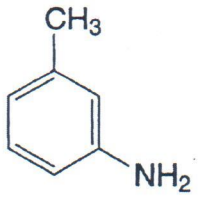
[d] p-aminobenzoik asid (PABA) adalah sebatian yang telah digunakan dalam pelindung matahari. Berikan laluan sintesis PABA bermula dari toulena dan lain-lain bahan kimia tak-organik yang diperlukan.

[4 markah]

...10/-

[e] Starting from either benzene or toluene and any other necessary reagents, show the reasonable synthesis route for the following compound. Provide a rationale for the synthetic route you choose.

[5 marks]

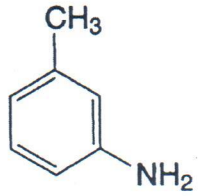


[f] Why it is necessary to perform iodolactonization reaction under slightly basic conditions?

[2 marks]

[e] *Bermula dari benzena atau toulena dan dengan bahan-bahan kimia lain yang diperlukan, tunjukkan laluan sintesis yang munasabah bagi sebatian berikut. Berikan alasan rasional untuk laluan sintetik yang anda pilih.*

[5 markah]



[f] *Mengapakah perlu untuk melakukan tindak balas "iodolactonization" di bawah keadaan sedikit beralkali?*

[2 markah]

- oooOooo -