

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

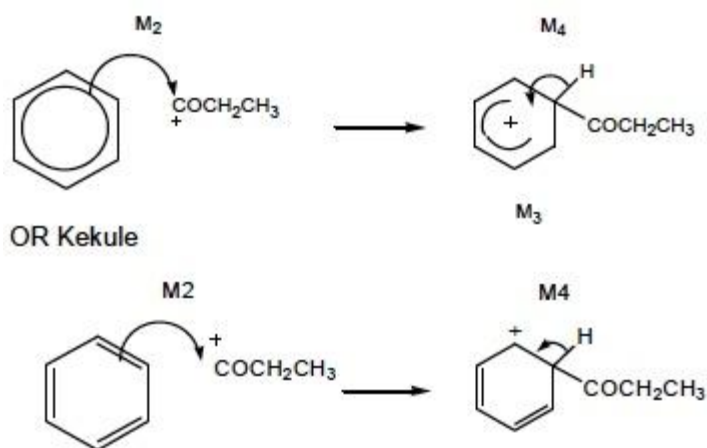
Mark Schemes

Q1.



Allow + on C or O in equation –
 But must be on C in mechanism

M1



M2 Arrow from inside hexagon to C or + on C

1

M3 Structure of intermediate

- horseshoe centred on C1 and must not extend beyond C2 and C6, but can be smaller
- + in intermediate not too close to C1 (allow on or "below" a line from C2 to C6)

1

M4 Arrow from bond into hexagon (Unless Kekule)

- Can allow M4 arrow independent of wrong M3 structure
- + on H in intermediate loses M3 not M4
- Ignore Cl⁻ and AlCl₄⁻
- used in M4

1

(b) Either...

1-phenylpropan-1-ol

1

NaBH₄ / LiAlH₄

1

Nucleophilic addition

1

Or...

1-phenylpropan-1-ol

1

H₂ with Ni/Pd/Pt

1

Addition/hydrogenation

1

*Both numbers needed for names**Ignore solvents*

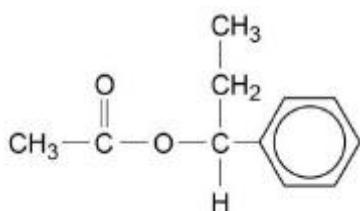
(c) Misty fumes / steamy fumes

*Allow sweet/fruity smell / white fumes**Not smoke*

1

(Nucleophilic) addition-elimination

1



1

[10]

This question is marked using Levels of Response. Refer to the Mark Scheme Instructions for Examiners for guidance on how to mark this question.	
Level 3 5-6 marks	All stages are covered and the explanation of each stage is generally correct and virtually complete. Answer communicates the whole process coherently and shows a logical progression from stage 1 and stage 2 to stage 3. Completely correct use of sign and language in Stage 3.
Level 2 3-4 marks	All stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies OR two stages are covered and the explanations are generally correct and virtually complete. Answer is mainly coherent and shows a progression through the stages. Some steps in each stage may be incomplete. Some errors in use of sign and language in Stage 3.
Level 1 1-2 marks	Two stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies OR only one stage is covered but the explanation is generally correct and virtually complete. Answer includes some isolated statements but these are not presented in a logical order or show confused reasoning.
Level 0 0 marks	Insufficient correct chemistry to gain a mark.

Indicative chemistry content

Stage 1 Bonding

- 1a) Each C has three (covalent) bonds
 1b) Spare electrons (in a p orbital) overlap (to form a π cloud)
 1c) delocalisation

Stage 2 Shape

- 2a) Planar
 2b) Hexagon/6 carbon ring/ 120° bond angle
 2c) C–C bonds equal in length / C–C bond lengths between single and double bond

Stage 3 Stability

- 3a) Expected ΔH° hydrogenation of cyclohexatriene = -360 kJ mol^{-1}
 3b) ΔH° hydrogenation benzene (is less exothermic) by 152 kJ mol^{-1}
 3c) Benzene lower in energy than cyclohexatriene / Benzene is more stable

6

- (b) Value within range -239 to -121

If outside range including positive values CE=0

1

Double bonds separated by one single bond / alternating (or shown in structure)

The wording 'close enough to allow delocalisation' would score M2 and

M3

1

Allows some delocalisation/overlap of p orbitals

Ignore reference to hydration here

1

[9]