



IB Chemistry – HL

Topic 10 Answers

1. C
2. C
3. C
4. C
5. B
6. B
7. A
8. D
9. B
10. D
11. B
12. D
13. C
14. $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$;

Accept more detailed formula.

butan-2-ol;

Accept 2-butanol.

ECF for correct name of another C_4 alcohol.

contains a chiral/asymmetric carbon atom/four different groups around one carbon atom;

(plane of) plane-polarized light rotated in opposite directions;

4

[4]

15. methyl methanoate;
 HCOOCH_3 ;

Accept other correct alternative.

[2]

16. (the molecule contains a) chiral/asymmetric carbon atom/carbon atom with four different groups;
polarized light passed through;
(plane of polarization) rotated in opposite/different directions;

[3]

17. (i) $\text{HOCH}_2\text{CH}_2\text{OH}$;
 $\text{HOOC}_6\text{H}_4\text{COOH}$;

2



(ii) reactants have two functional groups/*OWTTE*;

1

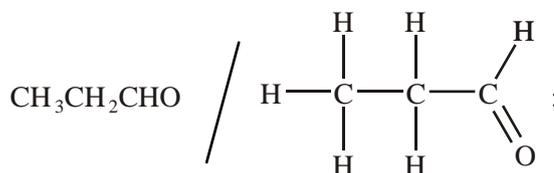
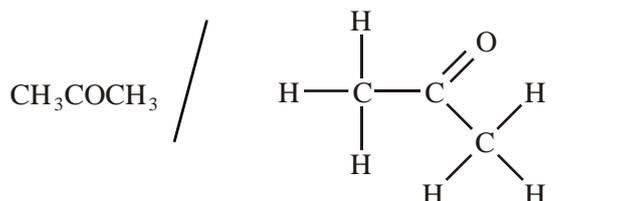
[3]

18. (i) same molecular formula but different structural formula/
arrangement of atom within a molecule/*OWTTE*;

1

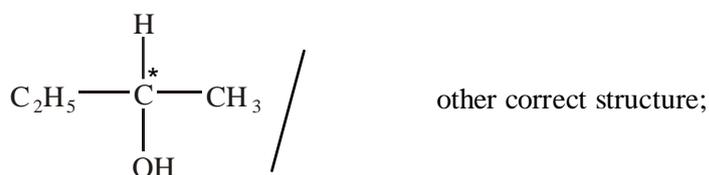
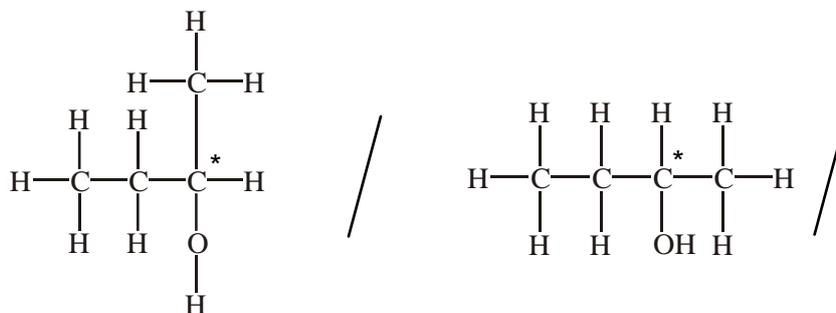
(ii)

2



Accept unsaturated alcohol and cyclic alcohol as alternative answers. If more than two correct isomers given – no penalty – but a third incorrect structure cancels a correct one. i.e. two correct, one incorrect equals [1].

(iii) isomers that can rotate plane polarized light in opposite directions;
Do not accept bend, reflect plane-polarized light.



Penalize missing bonds/hydrogens.

correct identification of chiral carbon (*);

3

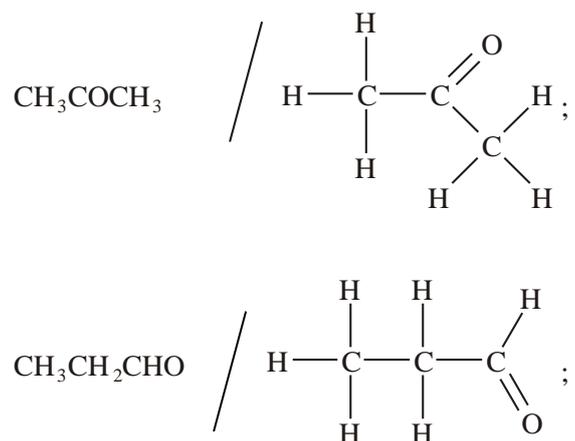
[6]

19. (i) same molecular formula but different structural formulae/arrangement
of atoms within a molecule/*OWTTE*;

1



(ii)



2

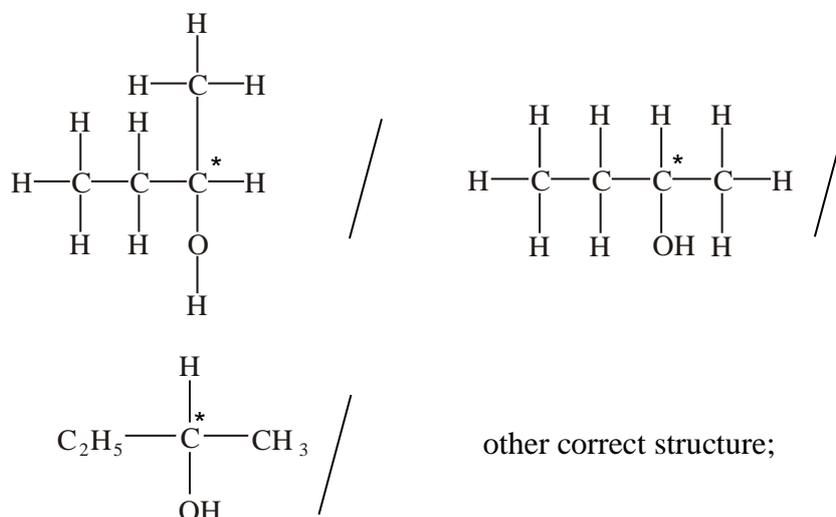
Accept unsaturated alcohol and cyclic alcohol as alternative answers.

If more than two correct isomers given – no penalty – but a third incorrect structure cancels a correct one. i.e. two correct, one incorrect equals [1].

(iii) isomers that can rotate plane polarized light in opposite directions;

Accept two molecules/compounds, which are mirror images of each other.

Do not accept bend, reflect plane-polarized light.

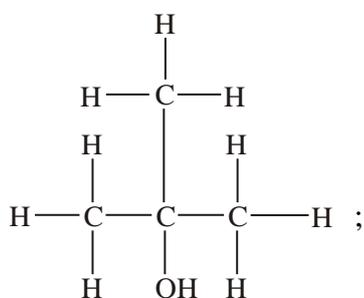
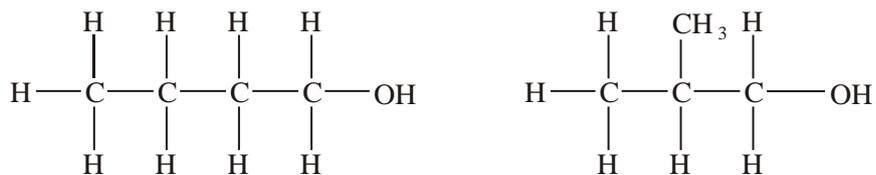


correct identification of chiral carbon (*);

3

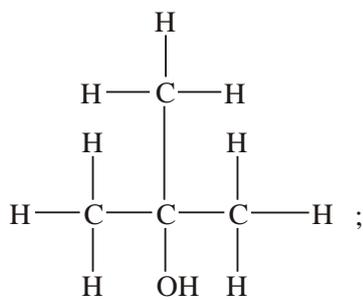


(iv)



Award [1] mark for 3 structures

2-methylpropan-2-ol /



2

Penalize [1] mark for the omission of H in (i) to (iv).

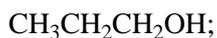
[8]

20. (i)

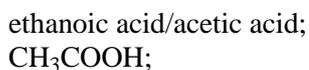


1

(ii) propan-1-ol/1-propanol;



Accept full structural formula showing all bonds and atoms but
no mark if H atoms missing

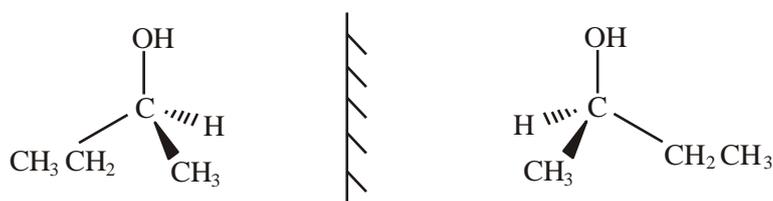


Accept full structural formula penalize missing Hs only once
ECF from incorrect ester in (i) above

4

[5]

21. (i)



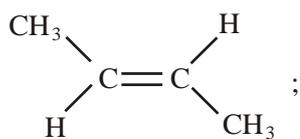
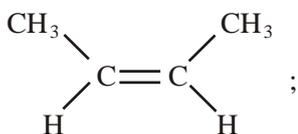
2

Award [2] for both tetrahedral structures, or [1] if tetrahedral
structure is not clear.

(ii) plane polarized light;
rotation in opposite/different directions;

2

(iii)



2

(iv) curly arrow showing attack by OH^- on end H;
curly arrow showing C–Br bond fission;
curly arrow showing formation of double bond;
 H_2O and Br^- shown as products;
max

3

Award [1] each for any three.
If but-2-ene formed, award [2 max].

[9]





Award [1] for both reactants and [1] for both products (accept $C_2H_4O_2$).

methyl methanoate;

3

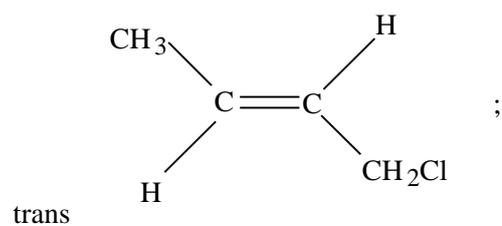
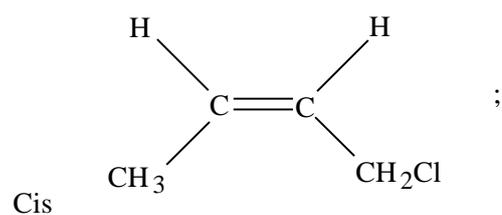
[3]

23. (a) (i) no rotation possible due to double bond/ π bond;
Accept restricted or hindered rotation.

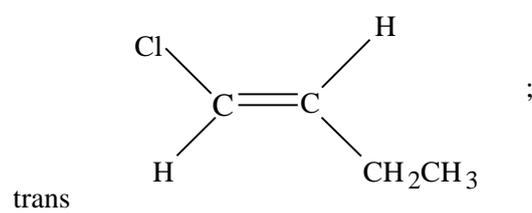
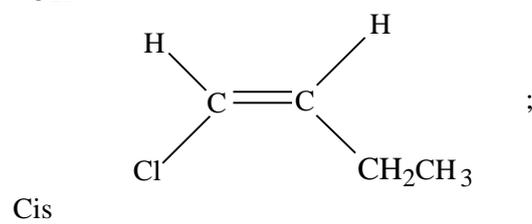
1

(ii)

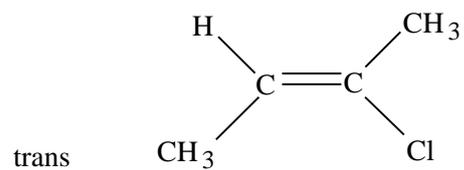
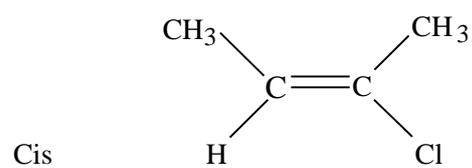
2



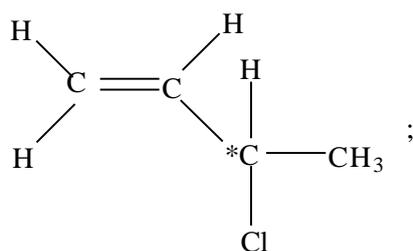
OR



OR



(iii)

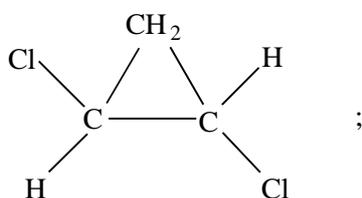


2

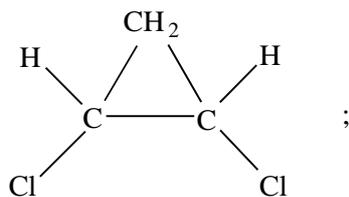
Award [1] for the structure and [1] for showing * on the correct carbon atom.

- (b) restricted rotation because C—C bond is now part of a cyclic system;

3



trans

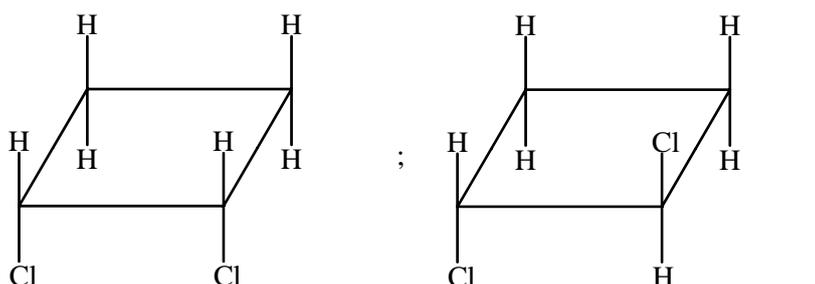


Cis

[8]

24. (a) restricted rotation because C—C bond is now part of a cyclic system;

3



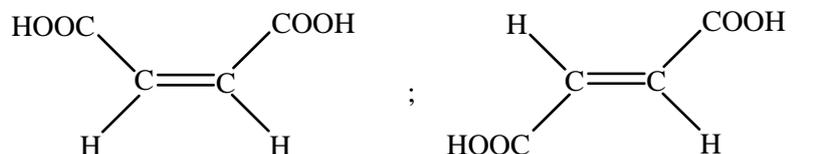
Award [1] for each correct 3D structure.

If correct structure, but not 3D, or wrongly labelled award [1] only.

Accept 1,3-disubstituted cyclo compound, or any other correct isomer.



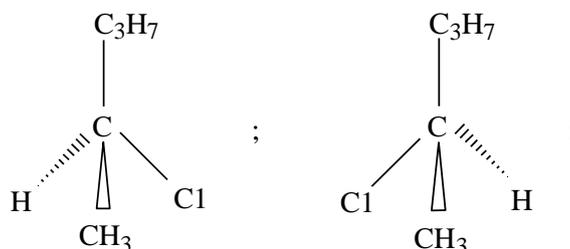
(b) (i) 2



(ii) cis isomer (has lower melting point than the trans-isomer);
intramolecular hydrogen bonds/weaker intermolecular forces
/less close packing; 2

(iii) (gentle) heating of a sample of each isomer;
cis isomer readily releases water vapour (forming a cyclic anhydride); 2

(c) (i) 2-chloropentane;



3

Award [1] for each correct 3D structure.

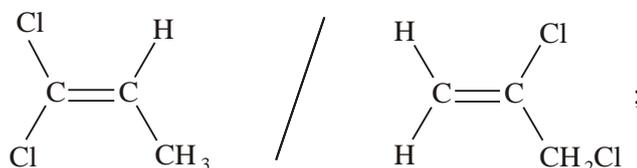
If correct structures, but not 3D, award [1] only.

(ii) rotation of the plane polarized light in opposite directions; 1

[13]

25. (a) restricted/no rotation around double bond/pi bond; 1

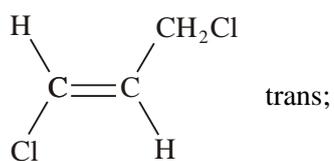
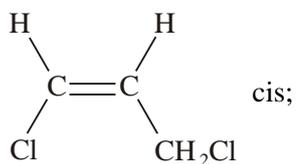
(b) Accept either of these structures



two identical atoms on one side of double bond/interchanging CH₃
and H/Cl and CH₂Cl makes no difference; 2



(c)



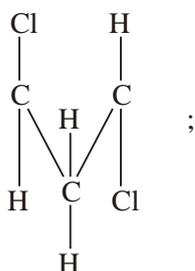
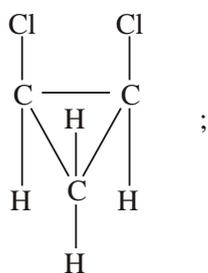
Award [0] if structure of another isomer drawn.

Award [1] if both structures correct but unlabelled or wrongly labelled.

Award [1] for each correctly drawn and labelled structure.

2

(d)



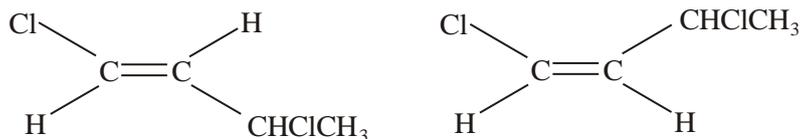
Award [0] if structure of another isomer drawn.

2

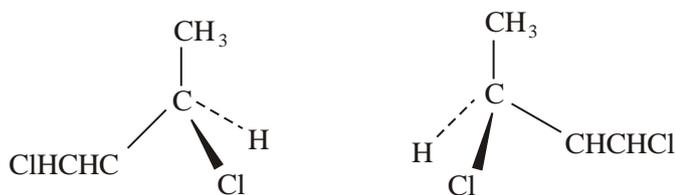
[7]



26. (a)



one correct structural formula;
two distinct isomeric structures shown;



one correct structural formula shown as 3-D;
two distinct isomeric structures shown;

4

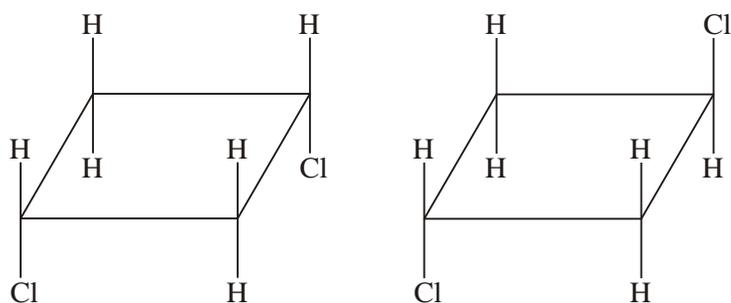
(b) it contains equal amounts/moles of the two optical isomers/enantiomers/
d (dextro/dextrorotatory) and l(levo/levorotatory);

1

(c) polarimeter/plane-polarized light;
plane (of polarization) rotated in opposite directions;
no rotation for racemic mixture;

3

(d)



one correct structural formula;
two distinct isomeric structures shown;

2

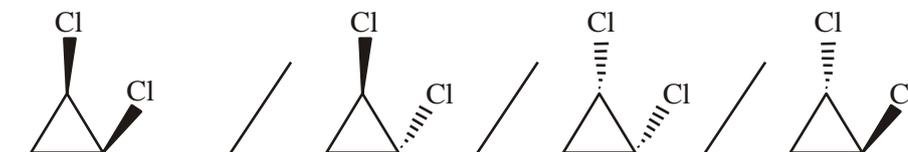
[10]



27. (a)



and 1,1 dichlorocyclopropane;



(*cis-* or *trans-*) 1,2 dichlorocyclopropane;

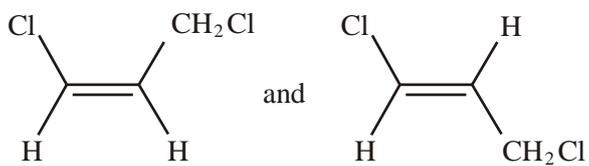
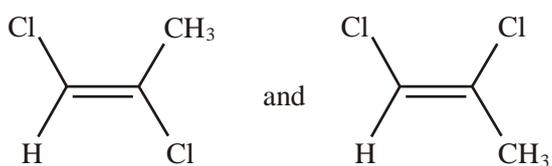
2

Award point for the correct name corresponding to the related isomer.

Accept diagrams that do not display 3 dimensional structure.

Award [1 max] for correct structures only, without the corresponding names.

(b)



2

[4]