M13/4/CHEMI/SP3/ENG/TZ1/XX/M

International Baccalaureate®
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MARKSCHEME

May 2013

CHEMISTRY

Standard Level

Paper 3

21 pages

Subject Details: Chemistry SL Paper 3 Markscheme

Mark Allocation

Candidates are required to answer questions from **TWO** of the options **[2 x 20 marks]**. Maximum total = **[40 marks]**.

1. A markscheme often has more marking points than the total allows. This is intentional.

2. Each marking point has a separate line and the end is shown by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are underlined are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by ***OWTTE*** (or words to that effect).

8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script.

10. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

11. If a question specifically asks for the name of a substance, do not award a mark for a correct formula unless directed otherwise in the markscheme. Similarly if the formula is specifically asked for, unless directed otherwise in the markscheme, do not award a mark for a correct name.

12. If a question asks for an equation for a reaction, a balanced symbol equation is usually expected, do not award a mark for a word equation or an unbalanced equation unless directed otherwise in the markscheme.

13. Ignore missing or incorrect state symbols in an equation unless directed otherwise in the markscheme.

Option A — Modern analytical chemistry

Penalize incorrect bonds (eg, C bonded to HO) or missing hydrogens once only in all of Option A.

A1. (a) CH_3COCH_3 **and** CH_3CH_2CHO; ***[1]***
Accept full or condensed structural formulas.
Ignore incorrect names as long as structures are correct.

(b) same/similar (types of) bonds / both contain the carbonyl group/C=O; ***[1]***
Do not accept same functional group.

(c) (mass spectrum of) CH_3CH_2CHO contains peak at $m/z = 29$ / CH_3COCH_3 does **not** contain peak at $m/z = 29$;
(corresponding to) loss of C_2H_5 / $M_r - C_2H_5$ / CHO^+ / loss of CHO / M_r – CHO / $C_2H_5^+$;

OR

(mass spectrum of) CH_3CH_2CHO contains a (strong) peak at $m/z = 57$ / CH_3COCH_3 does **not** contain a (strong) peak at $m/z = 57$;
(corresponding to) loss of H / $M_r - H$ / $CH_3CH_2CO^+$; ***[2]***
Penalize missing + once only in A1.

(d) (i) *m/z = 86:* $CH_3CH_2CH_2COCH_3^+/C_3H_7COCH_3^+/C_5H_{10}O^+$;
m/z = 71: $CH_3CH_2CH_2CO^+/C_3H_7CO^+/C_4H_7O^+$;
Accept $CH_3COCH_2CH_2^+$
m/z = 43: $CH_3CH_2CH_2^+$ / CH_3CO^+ / $C_3H_7^+$ / $C_2H_3O^+$; ***[3]***
Penalize missing + once only in A1.

(ii) $CH_3CH_2CH_2^+$ and CH_3CO^+/two species have this mass/*m/z*; ***[1]***
Do not penalize missing + in this part.

A2. (a) components are <u>adsorbed</u> on stationary phase/silica (gel)/silicon dioxide/SiO_2;
components dissolve in mobile phase/solvent;
Accept soluble instead of dissolve.
Reference must be made to idea of dissolving or solubility for M2.

each component has different affinity for two phases / *OWTTE*;
each component takes a different amount of time to emerge / components move through column at different rates; ***[3 max]***

(b) column chromatography allows separation of components to be used later (while thin-layer chromatography is mostly used for identification only) / column chromatography can separate larger quantities than thin-layer chromatography / *OWTTE*; ***[1]***

A3. (a) (ratio of) area under each peak / integration trace; ***[1]***
Accept size of peak but not height of peak.

(b) $CH_3CH_2COCH_2CH_3$; ***[1]***

(c) 1700–1750 (cm^{-1}) **and** 2850–3100 (cm^{-1}); ***[1]***
Accept a single value or a smaller range within each range.

A4. (a) (i) radio waves; ***[1]***

(ii) microwaves / IR/infrared; ***[1]***

(iii) IR/infrared; ***[1]***

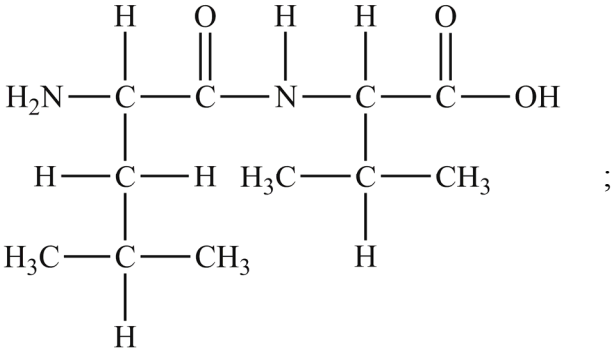
(b) *Similarity:*
lines / only certain frequencies/wavelengths/energies / discrete / not continuous / absorptions and emissions occur at the same frequencies/wavelengths;

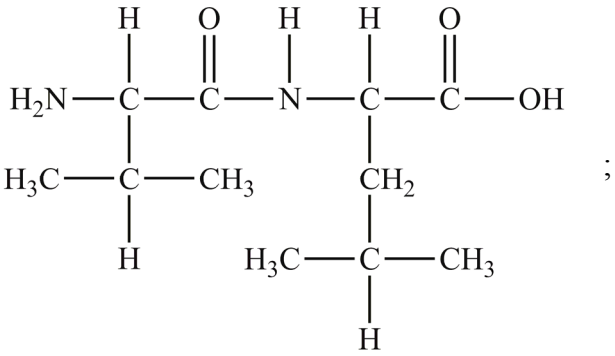
Difference:
emission spectra have only a few frequencies/bright lines while absorption spectra show all frequencies/have a coloured background except for a few missing/black lines / *OWTTE*; ***[2]***
Accept emission spectra have fewer frequencies included than absorption spectra.
Accept a suitable diagram to illustrate one or both points.

Option B — Human biochemistry

Penalize incorrect bonds (eg, C bonded to HO) or missing hydrogens once only in all of Option B.

B1. (a) (i)


;


;

[2]

Accept full or condensed structural formulas.
Penalize incorrect representation of peptide link (COHN or NHOC) once.
*Award **[1]** for a correct peptide link if the rest of the structure is incorrect.*

(ii) water/H_2O; ***[1]***

(b) sample of amino acids/mixture placed/spotted on gel/polyacrylamide/PAGE/ paper **and** buffer solution/solution of known pH;
potential difference/voltage applied;
Do not accept current.
Allow potential for potential difference.
Allow electric field applied.

if the (amino acid's) isoelectric point is below the pH (of buffer) it is negatively charged / if the (amino acid's) isoelectric point is above the pH (of buffer) it is positively charged;
different amino acids move different distances/rates according to their charge/isoelectric point / different amino acids move at different rates towards oppositely charged electrodes / *OWTTE*;
spray/develop with ninhydrin/organic dye / detected by staining/fluorescence under UV light;
measure distance travelled **and** compare with standards/isoelectric points; ***[4 max]***

(c) *Any two for* ***[1]***
structural / growth / repair
Allow more specific function eg, forms tendons/muscles/eye lens/ nails/hair, repair of tissue/cells etc.

enzyme / biological catalyst
hormone / chemical messenger
transport of molecules
Allow movement/carriage of molecules, and chemicals instead of molecules / OWTTE.
Do not award mark for transport alone.

storage of molecules
Do not award mark for storage alone.
Allow chemicals instead of molecules / OWTTE.

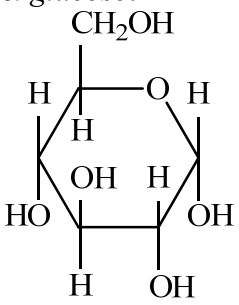
lubrication
(to make/produce) immunoproteins/antibodies
energy source ***[1]***
Do not accept energy storage.
Allow more specific examples of any of the above.

B2. (a) contain carbonyl (group)/C=O;
have at least two hydroxyl/OH (groups);
Do not accept hydroxide instead of hydroxyl.

CH_2O empirical formula; ***[2 max]***
Do not accept $C_xH_{2y}O_y$ or $C_6H_{12}O_6$.

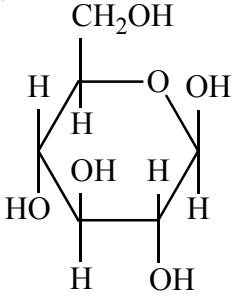
(b) (i)

α-*glucose*:



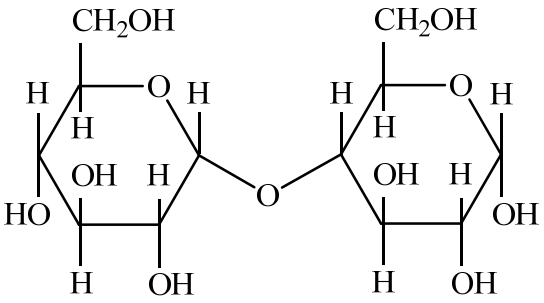
;

β-*glucose*:



; ***[2]***

Award ***[1 max]*** *if position of OH is correct in both structures at C1 but other groups/moieties (eg, CH_2OH) or H are missing.*
Award ***[1 max]*** *if the alpha and beta structures are labelled in reverse.*

(ii)  ; ***[1]***

(c) (i) (plant) material/cellulose not hydrolyzed by enzymes produced/secreted by digestive tract / *OWTTE*; ***[1]***
Accept (plant) material/cellulose not digested.
Accept "material that passes through digestive system without being affected" / OWTTE.

(ii) reduces constipation;
provides bulk for alimentary canal (muscles to stay healthy) / *OWTTE*;
reduces irritable bowel (syndrome)/IBS;
prevents colorectal/bowel cancer developing;
prevents obesity;
prevents Crohn's disease;
prevents diabetes mellitus / type 2 diabetes;
prevents diverticulosis;
prevents piles / reduces hemorrhoids; ***[3 max]***

B3. (a) both fat soluble;
both contain mainly non-polar/hydrocarbon parts (and only one OH group) / *OWTTE*; ***[2]***
Do not award ECF if water soluble is stated for either vitamin.
Do not award M2 for answers such as "since both do not have many OH groups present".

(b) rickets / bone deformation; ***[1]***

Option C — Chemistry in industry and technology

C1. (a) mining bauxite/ore destroys landscape;
purification of bauxite/ore produces red mud/iron(III) oxide/pollutants;
fluoride as waste product needs to be removed / *OWTTE*;
Allow fluorine waste products/fluorine as waste product needs to be removed.

extraction requires large amounts of electricity from power stations which can emit pollutants / *OWTTE*;
Accept specific examples for power stations (for example nuclear etc.).

global warming caused by CO_2 produced; ***[2 max]***

(b) homogeneous mixture of metals/metal(s) and non-metal(s); ***[1]***

(c) increase in aluminium's strength; ***[1]***

(d) *Any two for* ***[1]***
resistant to corrosion / unreactive (due to oxide layer)
malleable
shiny / poor thermal radiator ***[1]***
Accept non-toxic.
Accept good thermal conductor.
Do not accept low density or other properties that do not relate to food packaging.

C2. (a) $C_{10}H_{22}$: gasoline/petrol / fuel / kerosene;
Do not allow just combustion or cars.
Allow gas for cars/automobiles instead of gasoline but not gas alone.

C_2H_4: chemical feedstock / *OWTTE*; ***[2]***
Accept suitable example such as manufacturing plastics/polymers but not just plastics.

(b) alkenes; ***[1]***

(c) solid surface has active sites / reactants adsorb on solid surface;
Do not accept absorb instead of adsorb.

brings reactants close together in correct orientation;
weakens reactant bonds / reactants bonds are easier to break; ***[2 max]***

(d) can be easily removed/filtered from reaction mixture / large amount of reactant molecules pass over catalyst that is in a fixed position / can be used at high temperatures; ***[1]***

(e) selectivity to produce (a high yield of) the desired product / *OWTTE*;
extent to which rate of reaction is increased/E_a is lowered;
amount of reactant converted to product per amount of catalyst;
Accept efficiency / conversion rate.

ability to work under different/a range of conditions;
environmental/health impact;
catalytic poisoning / active sites become blocked;
cost in relation to life expectancy / *OWTTE*;
ease of removal from reaction mixture; ***[2 max]***

C3. (a) polarity / presence of dipole (moment); ***[1]***

(b) *Any two for **[1]***
graphite
cellulose
(spider) silk
DNA
biphenyl nitriles
soap
Kevlar ***[1]***

(c) *Thermotropic liquid crystals:*
pure substances **and** exhibit liquid-crystal properties in a certain temperature range;

Lyotropic liquid crystals:
solutions **and** exhibit liquid-crystal properties in a certain concentration range; ***[2]***

*Award **[1 max]** for thermotropic pure substances **and** lyotropic solutions.*
*Award **[1 max]** for thermotropic in a certain temperature range **and** lyotropic solutions in a certain concentration range.*

C4. (a) *Isotactic:* methyl groups all oriented on same side of polymer chain **and**
Atactic: methyl groups oriented randomly; ***[1]***
Diagram alone is not sufficient – unless difference stated in words.

(b) closer packing of isotactic chains;
isotactic has stronger van der Waals'/London/dispersion/intermolecular forces (than atactic); ***[2]***
Accept opposite statements for atactic.
Allow vdW as abbreviation for van der Waals' or FDL for London/dispersion.

Option D — Medicines and drugs

D1. (a) *Mild analgesics:*
intercept pain stimulus at source / inhibit release of substances/prostaglandins that cause pain/swelling/fever / *OWTTE*;

Strong analgesics:
(temporarily) bond to receptor sites in brain / prevent transmission of pain impulses in central nervous system/CNS / *OWTTE*; ***[2]***
*Award **[1 max]** if states that mild analgesics act at source and strong analgesics act at brain/CNS.*

(b) *Advantage **[1 max]**:*
does not irritate stomach wall / does not produce stomach ulcers/bleeding;
recommended to be used for children / allergic reactions rare / not linked to Reye's syndrome / can be manufactured in liquid form;

*Disadvantage **[1 max]**:*
does not reduce inflammation;
causes blood disorders;
overdose can lead to serious damage to kidney/brain/liver; ***[2 max]***
Do not accept answers unrelated to its use as an analgesic such as it does not thin blood.

(c) increased risk of stomach bleeding; ***[1]***

(d) (i) *Any two for **[1]***
amine
benzene ring / phenyl
alkene
ether ***[1]***
Allow benzene or phenyl (group) but not arene.

(ii) ester; ***[1]***

Names of functional groups must be stated for both marks in part (d).
Do not apply ECF in (d) if formulas (for example, C=C) given instead of names.

D2. (a) *Moderate dosage:*
relieves anxiety
Allow calmness/soothing effect/causes one to relax.

relaxes muscles
induces sedation / slows down mental activity
lowers heart rate
Allow induces sleep but not for both moderate and high.
Allow fatigue for induces sleep.

increases respiration/breathing rate
dilation of pupils of the eyes
constriction of arteries
sweating

High dosage:
induces sleep / loss of consciousness
Allow fatigue for induces sleep.
Accept coma/death.
Allow hypnosis.

alters perception
slurred speech
loss of balance / staggering ***[1]***

*Any one effect for moderate dosage **and** any one effect for high dosage needed for mark.*

(b) (i) $K_2Cr_2O_7$; ***[1]***

(ii) orange to green; ***[1]***
Allow yellow instead of orange.

(iii) +3/III; ***[1]***
Do not allow incorrect notation such as 3+ or 3.

(iv) $3CH_3CH_2OH + 2Cr_2O_7^{2-} + 16H^+ \rightarrow 3CH_3CO_2H + 4Cr^{3+} + 11H_2O$
correct formulas of CH_3CH_2OH and $Cr_2O_7^{2-}$/$K_2Cr_2O_7$ as reactants **and** CH_3CO_2H/CH_3COOH and Cr^{3+} as products;
full balanced chemical equation; ***[2]***
M2 can only be scored if M1 is correct.
Allow full balanced chemical equation to produce ethanal,
$3CH_3CH_2OH + Cr_2O_7^{2-} + 8H^+ \rightarrow 3CH_3CHO + 2Cr^{3+} + 7H_2O$.
Accept full or condensed structural formulas.

(v) ethanoic acid; ***[1]***
Allow acetic acid.
Allow ethanal/acetaldehyde.

(c) infrared (spectroscopy)/IR;
CH characteristic band (at 2950 cm^{-1}) for ethanol / C–H bonds in ethanol absorb at certain frequency/wavelength;
Do not award M2 for CH characteristic band if however wavenumber range/value is given for OH (eg, 3200–3600 cm^{-1} or value in between or even 2500–3300 cm^{-1}).

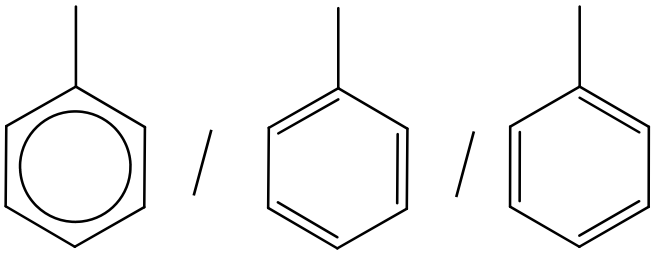
area under peak used to measure concentration (of ethanol);
Accept "size of" instead of "area under".
Do not accept "height" instead of "area under".

OR

fuel cell;
ethanol converts/oxidized to CO_2 and H_2O;
(energy released converted to) voltage/potential difference (which is) proportional to/can be used to measure concentration (of ethanol); ***[3]***
Allow potential instead of potential difference.

D3. (a) *Any two for **[1]***
increase brain activity/concentration/mental alertness
Allow just increase alertness/wakefulness.

increase heart rate
increase rate of breathing / increases respiratory rate / relaxes air passages / helps breathing
palpitations/tremors/shakes
reduces appetite
insomnia/sleeplessness/fits/restless behaviour/agitation/hallucinations/delusory behaviour ***[1]***

(b) (i)  ; ***[1]***

Accept either delocalized or Kekulé structure.
Do not allow just C_6H_5–.
Do not allow benzene ring on its own without the bond extending toward a substituent (which may be also given as R).

(ii) amphetamine; ***[1]***

Option E — Environmental chemistry

E1. (a) specific CFC compound; ***[1]***
Accept CFC/chlorofluorocarbon.
Allow water vapour.

(b)

Environmental Concern	Impact	Way to reduce impact
Global warming	melting of polar ice/thermal expansion causes flooding of some coastal areas/rising sea levels / *OWTTE*; *Do not allow flooding of coastal areas/rising sea levels alone.* climate change affects crop yields/ biodistribution/spread of certain microorganisms / *OWTTE*; *Do not accept climate change on its own.* *Accept specific examples.* more extremes of weather conditions / desertification; ***[1 max]*** *Accept specific examples of extreme weather (eg, stronger hurricanes).* *Do not allow generic answers such as changes in precipitation, changes in temperature, increase in Earth's temperature.*	decrease consumption of fossil fuels / *OWTTE*; *Accept practical suggestion for reducing fuel consumption (for example, car pooling) or use of alternative energy sources.* *Do not allow answers such as "using the car less decreases CO_2".*
Ozone depletion	more UV radiation causes skin cancer/ cataracts/decrease of plankton/damage to plants / *OWTTE*; *Do not allow general terminology such as skin damage, skin problems, eye problems etc.*	use alternatives to CFCs; *Accept specific alternatives to CFC (for example, alkanes).* *Do not allow "decrease CFCs / use less CFCs".*

[4]

E2. (a) (i) fertilizer / (decomposition of) animal/massive organic waste / food processing waste / (nitric acid in) acid rain / nitric acid formed from NO_2 / (nitrogen oxide produced in the) internal combustion engine / lightening; ***[1]***
Do not accept car exhaust.

(ii) electrical components / capacitors / transformers / plasticizers / adhesives / paints / surface coatings / refrigerants / coolants / pesticides; ***[1]***

(iii) burning of organochlorine compounds / weed killers/herbicides / volcanic eruptions / forest fires; ***[1]***
Accept incinerators.

(b) (i) (denitrifying) bacteria;
under anaerobic conditions;
reduce/convert nitrate to nitrogen;

OR

use of algae/microalgae / algal ponds;
nitrate used up as nutrient; ***[2 max]***

(ii) cheaper; ***[1]***
Do not accept no harmful products.

E3. (a) leaches/removes nutrients from soil;
Accept specific ions for nutrients.

plant leaves are damaged;
Do not allow just damages plants.

increasing aluminium concentration in the soil;
root damage;
limestone buildings/rocks/statues react with acid;
lakes become acidic killing fish;
toxic metal ions leached/enter into water supplies; ***[3 max]***

(b) redox / oxidation-reduction;
Do not accept reduction or oxidation on their own.

$2NO + 2CO \rightarrow N_2 + 2CO_2$; ***[2]***
Accept equation between NO and a hydrocarbon in petrol.

E4. waste in landfills takes a long time to decompose while incineration is fast/immediate;
Accept waste in landfills takes a longer time to decompose.

waste in landfills takes up (much) more space than incinerated waste;
landfills produces less toxic gases than incineration / incineration produces HCl/dioxins while landfills do not;
landfills produce methane which is used as a fuel **and** heat energy from incineration can also be used;
landfills cause toxins to leach/enter into soil/ground water/water table while incineration does not / *OWTTE*; ***[4 max]***
Do not allow a mark for stating landfills are cheap whereas incineration is an expensive process.
Accept opposite statements for incineration.
*Award **[3]** if four distinct points are given without a comparison, **[2]** for three, **[1]** for two.*

Option F — Food Chemistry

F1. (a) time until the food no longer maintains the expected quality desired by consumer / *OWTTE*;
due to changes in flavour/odour/texture/appearance / due to microbial spoilage; ***[2]***

(b) water content;
bacterial/fungal degradation / microbial spoilage;
chemical/pH change;
light;
temperature;
Accept heat.

contact with air/oxygen; ***[2 max]***

(c) (perception of flavours in lipids due to) disagreeable smell/taste/texture/appearance / *OWTTE*; ***[1]***

(d) (i) substance that delays onset/slows rate of oxidation; ***[1]***
Some indication of slowing required. Do not allow prevention of oxidation.

(ii) selenium/Se; ***[1]***

(iii) shellfish/tuna/fish / red meat/beef / eggs / grains/cereals/corn/wheat/rice / nuts / chicken / turkey / garlic / nuts / legumes/soybeans / cheese; ***[1]***
Accept other correct food source of Se.
Do not apply ECF from (d) (ii) ie, food must be based on Se.

(e) (i) 2-BHA
3-BHA
BHT
THBP ***[2]***
*Award **[2]** for all (four).*
*Award **[1]** for three.*
Accept all.

(ii) THBP does not contain t-butyl group / no; ***[1]***

(iii) (free) radical scavenger / reacts with (free) radicals which could oxidize food / *OWTTE*; ***[1]***

F2. (a) dye is water-soluble **and** pigment is not soluble in water; ***[1]***
Reference to water must be made at least once.

(b) (i) carotenoids/carotenes; ***[1]***

(ii) colour masked changing light-absorption properties (resulting in colour variation) / protein holds pigment/astaxanthin tightly / protein forms a complex with the pigment/astaxanthin / *OWTTE*; ***[1]***
Do not allow protein combines with pigment.

(iii) (astaxanthin stable in heat but high temperature causes) protein to change shape/denature/uncoil/break down / *OWTTE*;
cartenoid pigment released from the protein (allowing red colour to appear) / other colours absorbed / *OWTTE*; ***[2]***
M2 can only be scored if M1 is correct.

F3. (a) (i) RCH=NR′; ***[1]***
Allow RCHNR'.

(ii) water/H_2O; ***[1]***

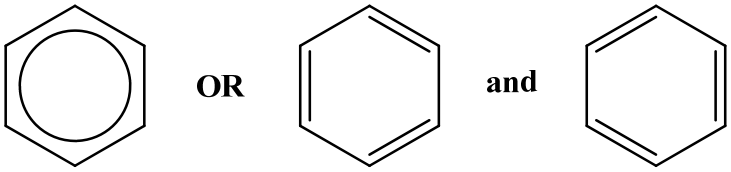
(b) rearrangement / dehydration / fragmentation / degradation / formation of heterocyclic (nitrogeneous) compounds / polymerization / reduction; ***[1]***
Allow fission.

Option G — Further organic chemistry

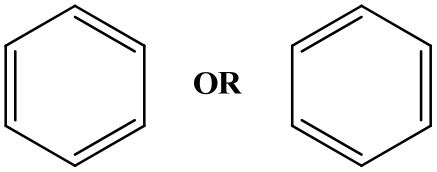
Penalize incorrect bonds (eg, C bonded to HO) or missing hydrogens once only in all of Option G.

G1. (a) six-membered ring (of carbon atoms) / hexagonal;
planar;
Allow flat.

all carbon to carbon bond lengths equal / all bonds have bond order of 1.5 / all carbon to carbon bonds intermediate between single and double;
resonance/delocalization;
all bond angles 120 ; ***[3 max]***
Accept all carbons sp^2.
*Award **[2 max]** for representation of full delocalized benzene structure or two Kekulé structures without any explanations.*
For example:



*Award **[1 max]** for one Kekulé structure or for the name cyclohexatriene without any explanations.*
For example:

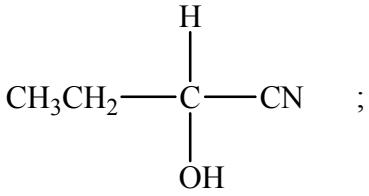


(b) only one isomer exists for 1,2-disubstituted benzene compounds (since two isomers would exist if alternate double bonds were present) / only three disubstituted benzene compounds rather than four;
undergoes substitution reactions / does not decolourize bromine water / does not undergo addition reactions;
the enthalpy change of hydrogenation/combustion is less exothermic than would be expected if benzene contained three double bonds/not 3 times that of cyclohexene / *OWTTE;* ***[1 max]***

(c) (bromomethyl)benzene/$C_6H_5CH_2Br$ reacts faster (with hydroxide/nucleophile);
Accept opposite statement for bromobenzene.

(Bromomethyl)benzene/$C_6H_5CH_2Br$:
electron deficient carbon of $–CH_2Br$ group susceptible to attack by nucleophiles / *OWTTE*;
Bromobenzene/C_6H_5Br:
nucleophiles repelled by electron cloud on benzene / C–Br bond stronger / strong pull of electronegative Br decreases electron deficient/δ^+ C (in C–Br bond), so less likely to be open to attack by nucleophiles / benzene ring prevents nucleophile attacking from opposite direction to the C–Br bond / lower polarity of C–Br bond / *OWTTE*; ***[3]***
Allow more detailed explanation for M3 such as interaction between p-electrons/lone pairs/non-bonding electrons on Br with (π-)delocalized electrons of benzene ring which makes C-Br bond stronger / OWTTE.

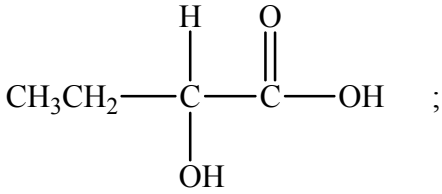
G2. (a) (i) **A:**



;

[1]

(ii) **B:**

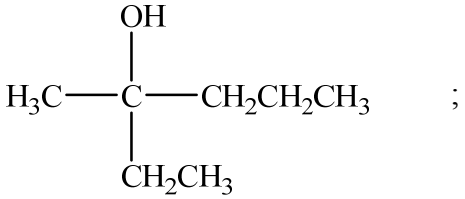


;

[1]

(b) (i) **C:**
CH_3CH_2MgBr; ***[1]***

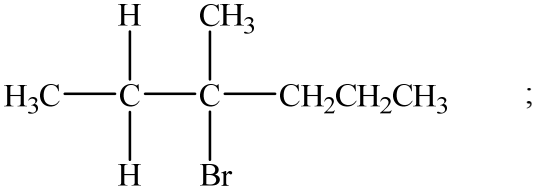
(ii) **D:**



;

[1]

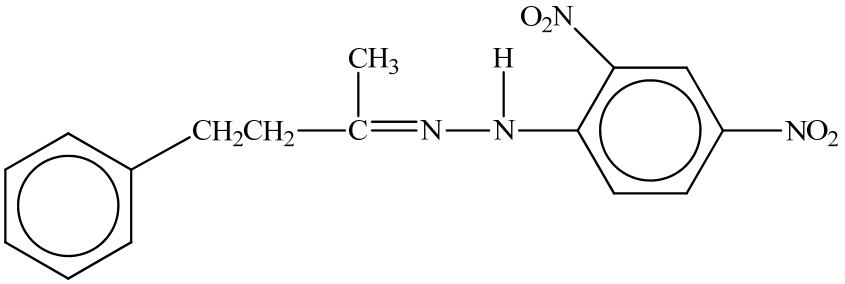
(c) **E:**



;

[1]

(d) **F:**

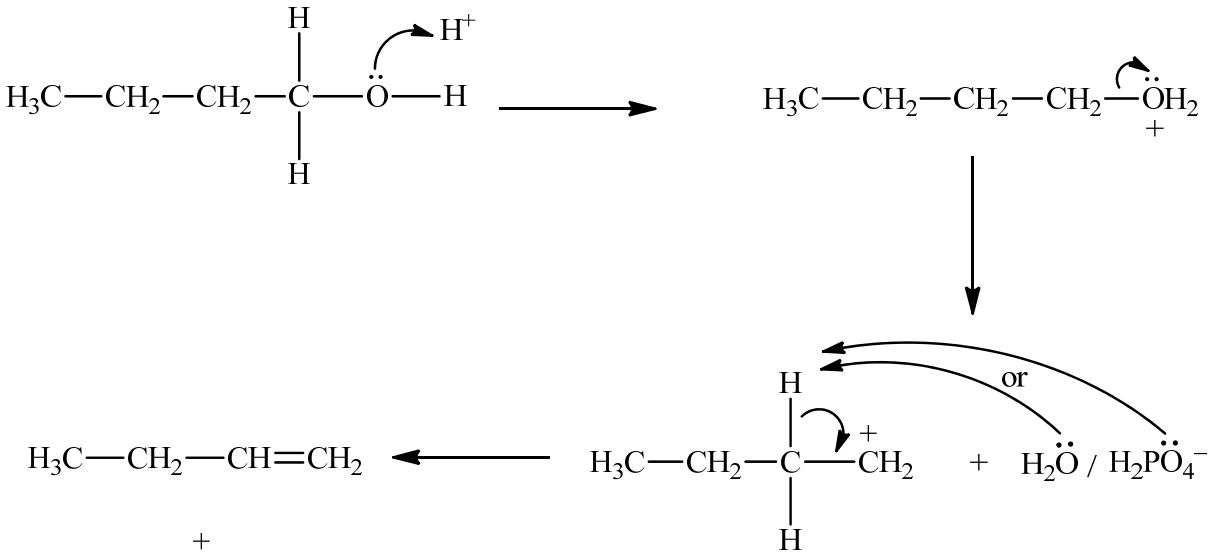


;

[1]

Accept full or condensed structural formulas throughout G2.

G3. (a)



curly arrow going from lone pair on O to H^+;
curly arrow showing H_2O leaving **and** representation of positively charged O intermediate;
curly arrow going from lone pair on O of $H_2O/H_2PO_4^-$ to H **and** curly arrow going from CH bond to $C–C^+$ to form C=C;
No mark for M3 if C^+ is not represented.

formation of organic product $CH_3CH_2CH=CH_2$ **and** H_3O^+/H_3PO_4; ***[4]***

(b) sulfuric acid is an oxidizing agent / side-products can occur using sulfuric acid / *OWTTE*; ***[1]***
Allow charring.
Allow opposite statement for phosphoric acid (eg, not complicated by side-reactions / OWTTE).
Do not accept answers such as "phosphoric acid has more protons".

G4. chloroethanoic acid;
chlorine withdraws electrons from (carboxyl) carbon atom/O–H bond allowing H^+ to leave more easily/O–H bond fission to be easier / chlorine withdraws electrons stabilizing anion making it a weaker base / *OWTTE*; ***[2]***