

# Markscheme

May 2018

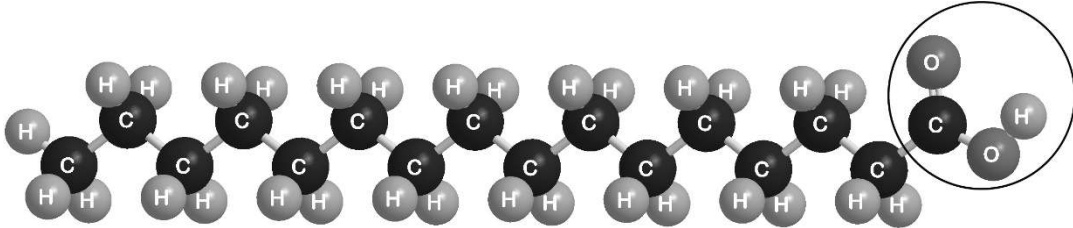
Chemistry

Standard level

Paper 3

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Section A

Question			Answers	Notes	Total
1.	a	i		<p>Must cut <math>\text{CH}_2\text{-CO}</math> bond <b>AND</b> enclose all of the <math>\text{-COOH}</math> group.</p>	1
1.	a	ii	<p>Any two of:</p> <ul style="list-style-type: none"> <li><math>\text{-COOH/CO/OH/carboxylate/carboxyl/hydroxyl/hydroxy}</math> group forms hydrogen bonds/H-bonds to water ✓</li> <li>London/dispersion/instantaneous induced dipole-induced dipole forces occur between hydrocarbon chains ✓</li> <li>hydrocarbon chain cannot form hydrogen bonds/H-bonds to water ✓</li> <li>strong hydrogen bonds/H-bonds between water molecules exclude hydrocarbon chains «from the body of the water» ✓</li> </ul>	<p>Accept “hydrophilic part/group forms hydrogen bonds/H-bonds to water”.</p> <p>Accept “hydrophobic section” instead of “hydrocarbon chain”.</p> <p>Award [1 max] for answers based on “the <math>\text{-COOH}</math> group being polar <b>AND</b> the hydrocarbon chain being non-polar”.</p>	2 max

Question			Answers	Notes	Total
1.	b	i	<p><i>Above about 240 cm<sup>2</sup>:</i> greater collision frequency/collisions per second between «palmitic acid» molecules and the barrier «as area reduced» ✓</p> <p><i>At less than about 240 cm<sup>2</sup>:</i> molecules completely cover the surface <b>OR</b> there is no space between molecules <b>OR</b> force from movable barrier transmitted directly through the molecules to the fixed barrier <b>OR</b> «palmitic acid» molecules are pushed up/down/out of layer ✓</p>	<p><i>For both M1 and M2 accept “particles” for “molecules”.</i></p> <p><i>For M1 accept “space/area between molecules reduced” OR “molecules moving closer together”.</i></p>	2
1.	b	ii	<p>amount of acid = «<math>5.0 \times 10^{-5} \text{ dm}^3 \times 0.0034 \text{ mol dm}^{-3}</math>» = <math>1.7 \times 10^{-7}</math> «mol» ✓</p> <p>number of molecules = «<math>1.7 \times 10^{-7} \text{ mol} \times 6.02 \times 10^{23} \text{ mol}^{-1}</math>» = <math>1.0 \times 10^{17}</math> ✓</p>	<p><i>Award [2] for correct final answer.</i></p> <p><i>Award [1] for “<math>1.0 \times 10^{20}</math>”.</i></p>	2
1.	b	iii	<p>«area = <math>\frac{240 \text{ cm}^2}{1.0 \times 10^{17}}</math> » <math>2.4 \times 10^{-15}</math> «cm<sup>2</sup>» ✓</p>		1

Question			Answers	Notes	Total
2.	a		$\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \checkmark$	Accept "CO <sub>2</sub> (aq)".	1
2.	b		measure the volume of gas at different times «plot a graph and extrapolate» <b>OR</b> measure the mass of the reaction mixture at different times «plot a graph and extrapolate» $\checkmark$	Accept other techniques that yield data which can be plotted and extrapolated.	1
2.	c	i	method 2 <b>AND</b> marble is in excess «so a little extra has little effect» <b>OR</b> large chips <b>AND</b> marble is in excess «so a little extra has little effect» <b>OR</b> method 2 <b>AND</b> HCl is limiting reagent «so a little extra marble has little effect» <b>OR</b> large chips <b>AND</b> HCl is limiting reagent «so a little extra marble has little effect» $\checkmark$	Accept, as a reason, that "as the mass is greater the percentage variation will be lower".	1
2.	c	ii	surface area <b>OR</b> purity «of the marble» $\checkmark$	Accept "shape of the chip".	1
2.	d	i	variation of individual values is much greater «than this uncertainty» <b>OR</b> «uncertainty» does not take into account «student» reaction time $\checkmark$		1
2.	d	ii	$\left\langle \frac{121.96 \text{ s}}{2} = 60.98 \text{ s} \right\rangle = 61 \text{ s} \checkmark$		1
2.	d	iii	systematic <b>AND</b> always makes the time shorter «than the actual value» <b>OR</b> systematic <b>AND</b> it is an error in the method used «not an individual measurement» <b>OR</b> systematic <b>AND</b> more repetitions would not reduce the error $\checkmark$	Accept, as reason, "it always affects the value in the same direction" <b>OR</b> "the error is consistent".	1

**Section B**

**Option A — Materials**

Question			Answers	Notes	Total
3.	a		«close packed» lattice of metal atoms/ions ✓ no spaces for water molecules to pass through the structure ✓		2
3.	b	i	composite ✓		1
3.	b	ii	melting point <b>OR</b> permeability <b>OR</b> density <b>OR</b> conductivity <b>OR</b> elasticity/stiffness <b>OR</b> brittleness/flexibility <b>OR</b> «tensile» strength ✓	Accept “colour/transparency”.	1

(continued...)

(Question 3b continued)

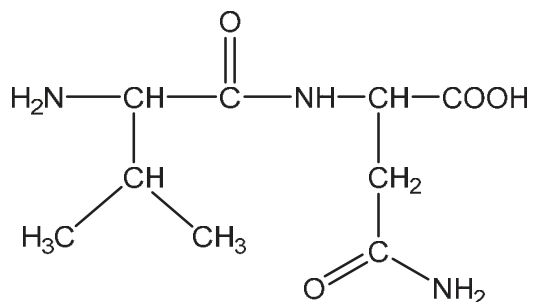
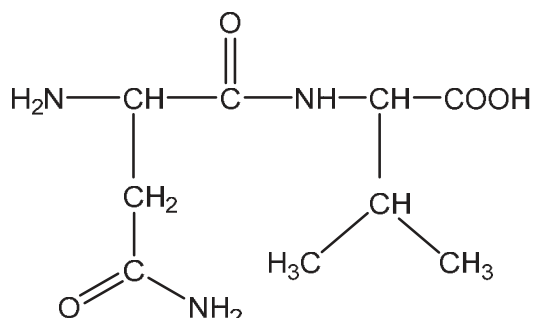
Question			Answers	Notes	Total
3.	b	iii	<p>Any three of:</p> <p>hydrocarbon/carbon-containing gas/compound ✓</p> <p>mixed with inert gas ✓</p> <p>heat/high temperature ✓</p> <p>«transition» metal catalyst ✓</p> <p>hydrocarbon/carbon compound decomposes to form carbon «nanotubes» ✓</p> <p>nanotubes form on catalyst surface ✓</p>	<p>Accept "ethanol" or specific hydrocarbons.</p> <p>Accept "N<sub>2</sub>", "H<sub>2</sub>", "NH<sub>3</sub>" or specific inert gases.</p> <p>Accept temperature or range within 600–800 °C.</p> <p>Accept specific metals such as Ni, Co or Fe.</p>	3 max
3.	b	iv	rod shaped molecules ✓		1

Question			Answers	Notes	Total
4.	a		soften/melt when heated <b>OR</b> can be melted and moulded ✓	Accept "low melting point" <b>OR</b> "can be moulded when heated".	1
4.	b	i	both have «long» hydrocarbon chains <b>OR</b> both have chains comprising CH <sub>2</sub> units ✓  HDPE has little/no branching <b>AND</b> LDPE has «more» branching ✓	Accept "CH <sub>2</sub> -CH <sub>2</sub> units".  Accept "HDPE more crystalline".	2
4.	b	ii	HDPE is more rigid/less flexible <b>OR</b> HDPE has a higher melting point <b>OR</b> HDPE has greater «tensile» strength ✓	Accept "HDPE has lower ductility".	1
4.	c	i	form «temporary» activated complexes/reaction intermediates ✓	Accept "consumed in one reaction/step" <b>AND</b> "regenerated in a later reaction/step". Accept "provides alternative mechanism".	1
4.	c	ii	inductively coupled plasma/ICP spectroscopy using mass spectroscopy/mass spectrometry/MS/ICP-MS <b>OR</b> inductively coupled plasma/ICP spectroscopy using optical emission spectroscopy/OES/ICP-OES ✓	Accept "atomic absorption/aa spectroscopy" or "MS/mass-spectroscopy/mass spectrometry".	1



Question		Answers	Notes	Total
4.	d	<p>Any two of: many types «of plastics» exist <b>OR</b> «plastics» require sorting «by type» ✓</p> <p>«plastics» need to be separated from non-plastic materials <b>OR</b> «often» composites/moulded on/bound to non-plastic/other components ✓</p>	<p>Accept other valid factors such as thermal decomposition of some plastics, production of toxic fumes, etc.</p>	2
4.	e	<p>«different classifications are appropriate for» different properties/applications/purposes ✓</p>		1
5.		<p>ratio of electrons : aluminium ions = 3 : 1 ✓</p> <p>amount Al « <math>\frac{1.296 \times 10^{13} \text{ C}}{96500 \text{ C mol}^{-1} \times 3}</math> » = <math>4.48 \times 10^7</math> «mol» ✓</p> <p>mass Al «= <math>4.48 \times 10^7 \text{ mol} \times 26.98 \text{ g mol}^{-1}</math>» = <math>1.21 \times 10^9</math> «g» ✓</p>	<p>Award [3] for correct final answer.</p>	3

Option B — Biochemistry

Question		Answers	Notes	Total
6.	a	 <p> <math display="block">\begin{array}{c} \text{H}_2\text{N}-\text{CH}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}-\text{CH}-\text{COOH} \\   \qquad \qquad   \\ \text{CH} \qquad \qquad \text{CH}_2 \\ / \ \backslash \qquad \qquad   \\ \text{H}_3\text{C} \ \text{CH}_3 \qquad \qquad \text{C} \\ \qquad \qquad \qquad \qquad \parallel \\ \qquad \qquad \qquad \qquad \text{O} \ \text{NH}_2 \end{array}</math> </p> <p><b>OR</b></p>  <p> <math display="block">\begin{array}{c} \text{H}_2\text{N}-\text{CH}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}-\text{CH}-\text{COOH} \\   \qquad \qquad   \\ \text{CH}_2 \qquad \qquad \text{CH} \\   \qquad \qquad / \ \backslash \\ \text{C} \qquad \qquad \text{H}_3\text{C} \ \text{CH}_3 \\ \parallel \\ \text{O} \ \text{NH}_2 \end{array}</math> </p> <p>correct structures of Val <b>AND</b> Asn ✓ correct amide link ✓</p>		2

Question			Answers	Notes	Total
6.	b		<p><i>Phenylalanine and valine:</i> London/dispersion/instantaneous induced dipole-induced dipole forces <b>OR</b> permanent dipole-induced dipole «interactions» ✓</p> <p><i>Glutamine and asparagine:</i> hydrogen bonds ✓</p>	<i>Do not accept dipole-dipole interactions.</i>	2
6.	c	i	hydrolysis ✓		1
6.	c	ii	<p>compare <math>R_f</math> with known amino acids <b>OR</b> compare distance moved with known amino acids ✓</p>	<i>Accept "from <math>R_f</math>".</i>	1

7.	a	i	<p>hydrolytic «rancidity» ✓ ester group ✓</p>	<i>Accept a formula for ester group.</i>	2
7.	a	ii	<p>«presence of» moisture/water <b>OR</b> «increase in» temperature <b>OR</b> «presence of» enzymes/bacteria/fungi/mould <b>OR</b> low pH/«presence of» acid ✓</p>	<i>Accept "heat".</i>	1

Question			Answers	Notes	Total
7.	b		<p>«stearic acid» straight chain/chain has no kinks/more regular structure  <b>OR</b>                      «stearic acid» saturated/no «carbon-carbon» double bonds ✓                        «stearic acid» chains pack more closely together ✓                      stronger London/dispersion/instantaneous induced dipole-induced dipole forces                      «between molecules» ✓</p>	<p><i>Accept “«stearic acid» greater surface area/electron density”.</i></p>	3
7.	c	i	<p>lowers risk of heart disease/atherosclerosis  <b>OR</b>                      lowers LDL cholesterol  <b>OR</b>                      increases HDL cholesterol  <b>OR</b>                      aids brain/neurological development «in children»  <b>OR</b>                      relieves rheumatoid arthritis ✓</p>		1
7.	c	ii	<p>soluble <b>AND</b> non-polar hydrocarbon chain ✓</p>	<p><i>Accept as reasons “«predominantly» non-polar” OR “long hydrocarbon chain”.</i></p>	1

(continued)

(Question 7c continued)

Question			Answers	Notes	Total
7.	c	iii	not biodegradable <b>OR</b> stored/accumulate in fat ✓  biomagnification occurs <b>OR</b> concentration increases along food chain ✓	Accept "stored/accumulate in bodies of prey/animals eaten". Accept "not excreted".	2
7.	c	iv	add starch/cellulose/carbohydrates/additives/catalysts «to plastic during manufacture to allow digestion by micro-organisms» <b>OR</b> replace traditional plastics with polylactic acid/PLA-based ones <b>OR</b> blend traditional and polylactic acid/PLA-based plastics ✓	Accept reference to biodegradable plastics other than PLA; for example polyhydroxyalkanoates (PHA), poly(butylene succinate) (PBS), polybutylene adipate terephthalate (PBAT) and polycaprolactone (PCL).	1

Question		Answers	Notes	Total
8.	a	«α-1,4-»glycosidic ✓	Accept «α-1,4-»glycoside. Accept "ether".	1
8.	b	<p><i>Glucose:</i> readily passes through intestine wall/dissolves in blood <b>OR</b> is immediately available for energy/respiration <b>OR</b> transported rapidly around body ✓</p> <p><i>Starch:</i> must be hydrolysed/broken down «into smaller molecules» first ✓</p>		2

Option C — Energy

Question		Answers	Notes	Total								
9.	a	<table border="1"> <thead> <tr> <th>Gas</th> <th>Source</th> </tr> </thead> <tbody> <tr> <td>methane/CH<sub>4</sub> ✓</td> <td>animals <b>OR</b> anaerobic decomposition of organic waste <b>OR</b> bogs/marshes/rice paddies ✓</td> </tr> <tr> <td>nitrogen(I) oxide/dinitrogen monoxide/N<sub>2</sub>O ✓</td> <td>bacterial action <b>OR</b> combustion of biomass ✓</td> </tr> <tr> <td>ozone/O<sub>3</sub> ✓</td> <td>effect of <u>UV</u> light on oxygen/O<sub>2</sub> ✓</td> </tr> </tbody> </table>	Gas	Source	methane/CH <sub>4</sub> ✓	animals <b>OR</b> anaerobic decomposition of organic waste <b>OR</b> bogs/marshes/rice paddies ✓	nitrogen(I) oxide/dinitrogen monoxide/N <sub>2</sub> O ✓	bacterial action <b>OR</b> combustion of biomass ✓	ozone/O <sub>3</sub> ✓	effect of <u>UV</u> light on oxygen/O <sub>2</sub> ✓	<p>Accept "nitrous oxide".</p> <p>Accept "electrical discharges/lightning".</p>	2 max
		Gas	Source									
		methane/CH <sub>4</sub> ✓	animals <b>OR</b> anaerobic decomposition of organic waste <b>OR</b> bogs/marshes/rice paddies ✓									
nitrogen(I) oxide/dinitrogen monoxide/N <sub>2</sub> O ✓	bacterial action <b>OR</b> combustion of biomass ✓											
ozone/O <sub>3</sub> ✓	effect of <u>UV</u> light on oxygen/O <sub>2</sub> ✓											
9.	b	<p>CO<sub>2</sub> (aq) + H<sub>2</sub>O (l) ⇌ H<sup>+</sup> (aq) + HCO<sub>3</sub><sup>-</sup> (aq) ✓</p> <p><b>OR</b></p> <p>CO<sub>2</sub> (aq) + H<sub>2</sub>O (l) ⇌ H<sub>2</sub>CO<sub>3</sub> (aq) <b>AND</b> H<sub>2</sub>CO<sub>3</sub> (aq) ⇌ H<sup>+</sup> (aq) + HCO<sub>3</sub><sup>-</sup> (aq) ✓</p>	<p>Accept CO<sub>2</sub> (aq) + H<sub>2</sub>O (l) ⇌ 2H<sup>+</sup> (aq) + CO<sub>3</sub><sup>2-</sup> (aq).</p> <p>Accept equations with single arrow.</p>	1								
9.	c	no change in polarity/dipole «moment when molecule vibrates» ✓	Do <b>not</b> accept "non-polar" or "no dipole moment" – idea of change must be there.	1								

Question		Answers	Notes	Total
10.	a	nitrogen/N <b>OR</b> oxygen/O <b>OR</b> sulfur/S ✓	Accept "phosphorus/P".	1
10.	b	Any three of: different molar masses <b>OR</b> different strengths of intermolecular forces ✓  different boiling points ✓  temperature in «fractionating» column decreases upwards ✓  «components» condense at different temperatures/heights <b>OR</b> «component with» lower boiling point leaves column first ✓		3 max



Question			Answers	Notes	Total
10.	c	i	$\text{specific energy} \llcorner = \frac{\text{energy released}}{\text{mass consumed}} = \frac{5470 \text{ kJ mol}^{-1}}{114.26 \text{ g mol}^{-1}} \llcorner = 47.9 \llcorner \text{kJ g}^{-1} \llcorner \checkmark$ $\text{energy density} \llcorner = \frac{\text{energy released}}{\text{volume consumed}} = \text{specific energy} \times \text{density} = 47.9 \text{ kJ g}^{-1} \times 0.703 \text{ g cm}^{-3} \llcorner = 33.7 \llcorner \text{kJ cm}^{-3} \llcorner \checkmark$	<p><i>Do not accept “-47.9 «kJ g<sup>-1</sup>»”.</i></p> <p><i>Do not accept “-33.7 «kJ cm<sup>-3</sup>»” unless “-47.9 «kJ g<sup>-1</sup>»” already penalized.</i></p>	2
10.	c	ii	<p>energy is lost «to the surroundings» as heat/sound/friction</p> <p><b>OR</b></p> <p>energy is lost to the surroundings «as heat/sound/friction»</p> <p><b>OR</b></p> <p>incomplete combustion <math>\checkmark</math></p>	<p><i>Do not accept just “energy is lost”.</i></p>	1
11.	a	i	<p>viscosity «of vegetable oils is too high» <math>\checkmark</math></p> <p>transesterification</p> <p><b>OR</b></p> <p>«conversion into» alkyl/methyl/ethyl esters <math>\checkmark</math></p>		2
11.	a	ii	<p>R-CO-O-CH<sub>3</sub> / RCOOMe</p> <p><b>OR</b></p> <p>R-CO-O-C<sub>2</sub>H<sub>5</sub> / RCOOEt <math>\checkmark</math></p>		1

Question			Answers	Notes	Total
11.	b		<p>«growing oil producing» plants absorbs carbon dioxide from the atmosphere  <b>OR</b>                      «combustion of» petroleum based fuels releases carbon stored «for millions of years» ✓</p>	<p>Accept “biofuels renewable” <b>OR</b>                      “petroleum based fuels non-renewable”.</p> <p>Accept “waste vegetable oils can be converted to biofuels/biodiesel”.</p> <p>Accept “biofuels do not contain sulfur”.</p>	1

12.	a	i	mass spectrometry/mass spectroscopy/MS ✓	Accept “analysis of radiation emitted”.	1
12.	a	ii	<p><i>critical mass</i>: mass required so that «on average» each fission/reaction results in a further fission/reaction ✓</p> <p><i>Any two for [2 max]:</i>                      neutron captured by «<sup>235</sup>U» nucleus ✓                      fission/reaction produces many neutrons/more than one neutron ✓                      if these cause further fission/reaction a chain reaction occurs ✓</p>	<p>Accept “minimum mass of fuel needed for the reaction to be self-sustaining”.</p> <p>Accept answers in the form of suitable diagrams/equations.</p>	3 max
12.	b		<p>produce long lived/long half-life radioisotopes/radioactivity  <b>OR</b>                      could be used to produce nuclear weapons  <b>OR</b>                      «nuclear» accidents/meltdowns can occur ✓</p>	Accept “long lived/long half-life radioactive waste”.	1

Option D — Medicinal chemistry

Question			Answers	Notes	Total
13.	a		<p>Any one of:</p> <p>anticoagulant ✓</p> <p>lower risk of heart attack/strokes ✓</p> <p>prevent recurrence of heart attack/stroke ✓</p> <p>prevents cancer of colon/oesophagus/stomach ✓</p>	<p>Accept “prevents/reduces blood clots”  <b>OR</b> “blood thinner”.</p>	<p><b>1 max</b></p>
13.	b	i	<p>fraction/proportion/percentage «of administered dosage» that reaches target                      «part of human body»  <b>OR</b>                      fraction/ proportion/percentage «of administered dosage» that reaches blood                      «plasma»/systemic circulation ✓</p>	<p>Accept “the ability of the drug to be absorbed by the body” <b>OR</b> “the extent to which the drug is absorbed by the body”.</p> <p>Do <b>not</b> accept “the amount/quantity of the drug absorbed”.</p>	<p><b>1</b></p>
13.	b	ii	<p>«intravenous» injection/IV ✓</p>	<p>Accept “parenterally”.</p> <p>Accept “react with alkali/NaOH” <b>OR</b>                      “convert to ionic form/salt”.</p>	<p><b>1</b></p>
13.	c	i	<p>One absorption found in both spectra:</p> <p>Any one of:</p> <p>1050–1410 cm<sup>-1</sup> «C–O in alcohols, esters, ethers» ✓</p> <p>1700–1750 cm<sup>-1</sup> «C=O in carboxylic acids, esters» ✓</p> <p>2500–3000 cm<sup>-1</sup> «O–H in carboxylic acids» ✓</p> <p>2850–3090 cm<sup>-1</sup> «C–H in alkanes, alkenes, arenes» ✓</p> <p>One absorption found in only one of the spectra:</p> <p>3200–3600 cm<sup>-1</sup> «O–H in alcohols, phenols» ✓</p>	<p>Award [<b>1 max</b>] if candidate states bonds (C=O in both, O–H in salicylic acid only) but doesn’t quote wavelength ranges.</p> <p>Accept a second/additional absorption at 1700–1750 cm<sup>-1</sup> from the C=O in ester.</p>	<p><b>2 max</b></p>

(continued...)

(Question 13c continued)

Question			Answers	Notes	Total
13.	c	ii	<p>Any two of:</p> <p>ring is «sterically» strained</p> <p><b>OR</b></p> <p>ring breaks up/opens/reacts «easily»</p> <p><b>OR</b></p> <p>amide/amido group «in ring» is «highly» reactive ✓</p> <p>«irreversibly» binds/bonds to enzyme/transpeptidase</p> <p><b>OR</b></p> <p>inhibits enzyme/transpeptidase «in bacteria» that produces cell walls</p> <p><b>OR</b></p> <p>prevents cross-linking of bacterial cell walls ✓</p> <p>cells absorb water <b>AND</b> burst</p> <p><b>OR</b></p> <p>cells cannot reproduce ✓</p>	<p>Award <b>[1 max]</b> for “interferes with cell wall production”.</p> <p>Do <b>not</b> accept “cell membrane” instead of “cell wall”.</p>	<p><b>2 max</b></p>

(continued...)

(Question 13c continued)

Question			Answers	Notes	Total
13.	c	iii	<p>Any two of:</p> <p>leads to «bacterial» resistance/proportion of resistant bacteria increases</p> <p><b>OR</b></p> <p>leads to penicillinase-producing bacteria ✓</p> <p>damage to/contamination of bodies of water/ecosystems ✓</p> <p>destroys useful/beneficial bacteria ✓</p> <p>destroyed bacteria replaced by more harmful bacteria ✓</p>	<p>Accept “endocrine disruptor”.</p> <p>Do <b>not</b> accept “increased cost of developing antibiotics”.</p>	2 max
13.	c	iv	<p>modify side chain ✓</p>		1
13.	d	i	<p>temporarily bind to/block/interfere with receptor sites in brain</p> <p><b>OR</b></p> <p>prevent transmission of pain impulses within CNS/central nervous system ✓</p>		1
13.	d	ii	<p>codeine has a wider therapeutic window ✓</p>	<p>Accept “codeine has lower activity” <b>OR</b> “codeine has lower risk of overdose” <b>OR</b> “codeine is less potent” <b>OR</b> “codeine has less side-effects”.</p> <p>Do <b>not</b> accept “lower abuse potential for codeine” <b>OR</b> “less addictive «than morphine»” <b>OR</b> “codeine has a lower bioavailability” <b>OR</b> “available without prescription” <b>OR</b> “cheaper”.</p>	1

Question			Answers	Notes	Total
14.	a	i	$\text{MgCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) + \text{MgCl}_2(\text{aq}) \checkmark$	Do <b>not</b> accept " $\text{H}_2\text{CO}_3$ ".	1
14.	a	ii	$n(\text{HCl}) = 2 n(\text{CaCO}_3) + 2 n(\text{MgCO}_3)$ <b>OR</b> $n(\text{HCl}) = \frac{2 \times 0.680 \text{ «g»}}{100.09 \text{ «g mol}^{-1}\text{»}} + \frac{2 \times 0.080 \text{ «g»}}{84.32 \text{ «g mol}^{-1}\text{»}} \checkmark$ $\ll n(\text{HCl}) = 0.0136 \text{ mol} + 0.0019 \text{ mol} \Rightarrow 0.016 \text{ «mol»} \checkmark$	Award <b>[2]</b> for correct final answer. Award <b>[1 max]</b> for correctly calculating amount of acid neutralized by just $\text{CaCO}_3$ (0.014 «mol») or $\text{MgCO}_3$ (0.002 «mol»).	2
14.	b		inhibits the secretion of stomach acid/ $\text{H}^+$ $\checkmark$ «active metabolites» bind «irreversibly» to «receptors of the» proton pump $\checkmark$	Accept "PPI/proton pump inhibitor". Do <b>not</b> award mark for "binds to $\text{H}_2$ /histamine receptors". (Ranitidine mode of action.) Accept " $\text{H}^+/\text{K}^+$ ATPase" for "proton pump".	2
15.	a		blocks/inhibits neuraminidase/NA/«viral» enzyme which allows viruses to pass through cell membrane $\checkmark$ prevent virus from leaving/escaping host cell «thus it cannot infect other cells» $\checkmark$		2
15.	b		Any one of: limited supply of star anise/plant $\checkmark$ «star anise» takes time to grow $\checkmark$ time-consuming/multi-step extraction $\checkmark$ low concentration in plant $\checkmark$	Accept "low yield for extraction/conversion" <b>OR</b> "requires environmentally damaging solvents".	1 max