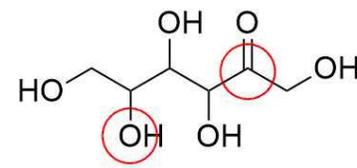
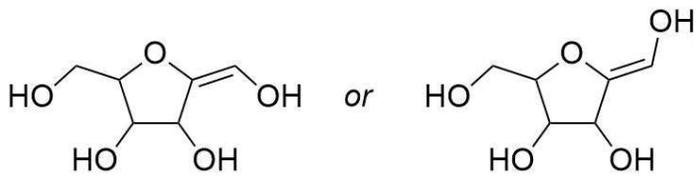
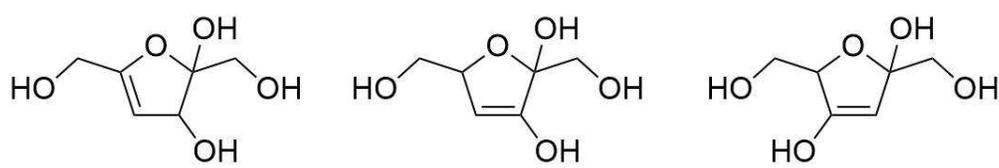
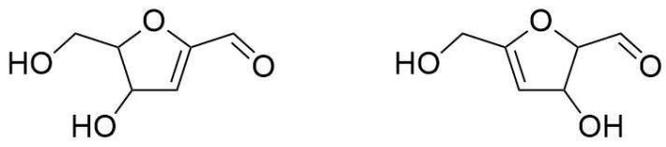
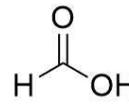


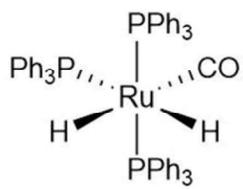
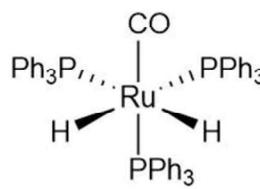
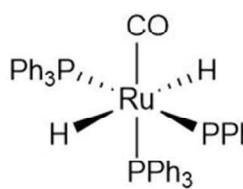
3.	This question is about levulinic acid	Mark
(a)	<div style="display: flex; justify-content: space-around; text-align: center;"> <div>ester</div> <div>aldehyde</div> <div>✓ ketone</div> <div>acetal</div> </div> <div style="display: flex; justify-content: space-around; text-align: center; margin-top: 10px;"> <div>✓ carboxylic acid</div> <div>alkene</div> <div>alcohol</div> <div>hemiacetal</div> </div> <p style="color: blue; font-style: italic; margin-top: 10px;">Must tick both carboxylic acid and ketone only for the mark.</p>	<input checked="" type="checkbox"/>
(b)	C ₅ H ₈ O ₃	<input checked="" type="checkbox"/>
(c)	<div style="text-align: center;">  </div> <p style="color: blue; font-style: italic; margin-top: 10px;">Must circle both C and O atoms for mark.</p>	<input checked="" type="checkbox"/>
(d) (i)	<p style="text-align: center;">Alkene A</p> <div style="text-align: center;">  </div> <p style="color: blue; font-style: italic; margin-top: 10px;">Either cis or trans isomer for mark.</p>	<input checked="" type="checkbox"/>
(d) (ii)	<p style="text-align: center;">Other trisubstituted alkenes</p> <div style="text-align: center;">  </div> <p style="color: blue; font-style: italic; margin-top: 10px;">Three correct structures scores two marks. Two correct structures with up to one incorrect structure scores one mark. All other answers score zero marks.</p>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
(e)	<p style="text-align: center;">Compounds C and D</p> <div style="text-align: center;">  </div> <p style="color: blue; font-style: italic; margin-top: 10px;">Both must be correct for mark. Students do not have to identify which one is which.</p>	<input checked="" type="checkbox"/>
(f)	<p style="text-align: center;">Compound F</p> <div style="text-align: center;">  </div>	<input checked="" type="checkbox"/>

(g)

+2

Accept 2, 2+ or II.

(h)

Catalyst			
			
Has enantiomer		Has enantiomer	
Yes	No <input checked="" type="checkbox"/>	Yes	No <input checked="" type="checkbox"/>
			
Has enantiomer		Has enantiomer	
Yes	No <input checked="" type="checkbox"/>	Yes	No



Two marks are available for the two correct structures. Two correct structures and no incorrect or duplicated structures is worth two marks. If they have drawn at least one correct structure but there are also incorrect structures or duplicates then answer is worth one mark. One mark is available for the correct ticking. This mark is only available if students have drawn at least one correct structure themselves. All structures (including the catalyst structure given) must be ticked as 'No' for this mark. If any structures are not octahedral or have the wrong ligand set then automatically no marks for ticking.

(i)

one singlet
one doublet
one triplet
two singlets
two doublets
two triplets

one doublet and one singlet
one triplet and one singlet
 one triplet and one doublet
three singlets
three doublets
three triplets



(j)

H^J-H^K 6 Hz	H^K-P^W 28 Hz
H^J-P^W 31 Hz	H^K-P^X 28 Hz
H^J-P^X 31 Hz	H^K-P^Y 74 Hz
H^J-P^Y 15 Hz	



All seven correct scores three marks. Five or six correct scores two marks. Three or four correct scores one mark. Two, one or zero correct scores no marks.

Total out of 16

16