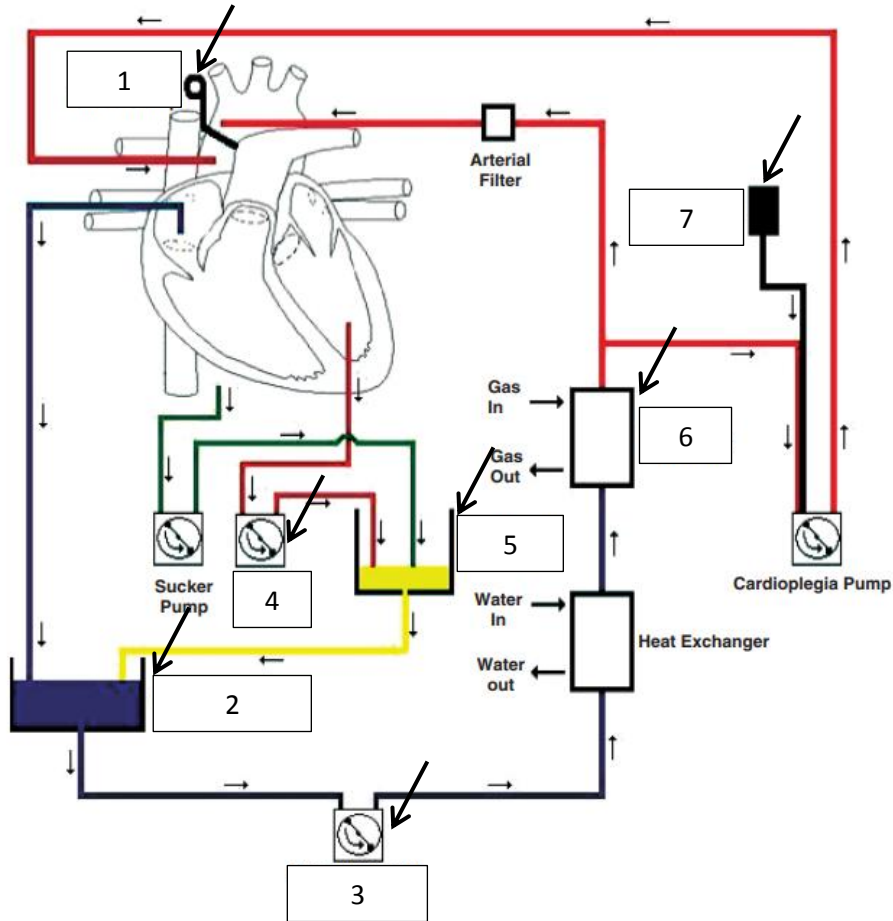


Syllabus	CT_IK_02
Topic	Cardiopulmonary bypass

leuan is a 65 year-old gentleman listed for coronary artery bypass grafting. He has triple vessel disease that is not amenable to stenting.

a)  
Complete the labels on the following diagram (7 marks)



1. ....
2. ....
3. ....
4. ....
5. ....
6. ....
7. ....

**b)**

The surgeons are using cardioplegia for myocardial protection. What is the typical concentration of potassium in a cardioplegic solution to induce cardiac arrest? And describe the physiological action of potassium in this solution. (3 marks)

Typical concentration of potassium: .....

Physiological action of potassium: .....

.....

**c)**

By which 2 routes can solutions of cardioplegia be administered? And where are the cannulae ideally inserted with each route? (4 marks)

Route 1: .....

Ideal cannula insertion site: .....

Route 2: .....

Ideal cannula insertion site: .....

**d)**

Name 3 potential advantages of blood cardioplegia over crystalloid cardioplegia (3 marks)

1. ....

2. ....

3. ....

**e)**

Other than complications associated with cannula insertion. List 3 possible complications of cardioplegia administration (3 marks)

1. ....

2. ....

3. ....

Syllabus	CT_IK_02
Topic	Cardiopulmonary bypass

Q	Answer	Mark	Guidance
a)	<ol style="list-style-type: none"> <li>1. Aortic cross-clamp</li> <li>2. Venous reservoir</li> <li>3. Systemic blood pump</li> <li>4. Vent pump</li> <li>5. Cardiotomy reservoir</li> <li>6. Gas-exchanger-oxygenator</li> <li>7. Cardioplegia solution</li> </ol>	7	
b)	<p><u>Typical composition:</u></p> <ul style="list-style-type: none"> <li>• 20mmol</li> </ul> <p><u>Action:</u></p> <ul style="list-style-type: none"> <li>• Causes cardiac arrest in <b>diastole</b></li> <li>• High extracellular potassium <b>prevents repolarisation</b> of myocytes. Causes <b>inactivation of fast inward voltage sensitive sodium channels</b> important in phase 0 of action potential</li> </ul>	1 1 1	
c)	<ul style="list-style-type: none"> <li>• Anterograde – ascending aorta or coronary ostia</li> <li>• Retrograde – coronary sinus</li> </ul>	4	
d)	<ul style="list-style-type: none"> <li>• Blood cardioplegia thought to offer advantage of delivery oxygen at cellular level via Hb content</li> <li>• Blood cardioplegia also provides other benefits: <ul style="list-style-type: none"> <li>○ Hydrogen ion buffering</li> <li>○ Free radical scavenging</li> <li>○ Reduced myocardial oedema</li> <li>○ Improved micro-vascular flow</li> </ul> </li> </ul>	Any 3	
e)	<ul style="list-style-type: none"> <li>• Failure to attain widespread cardiac perfusion with cardioplegia – most common in retrograde route</li> <li>• Fluid overload</li> <li>• Myocardial oedema, haemorrhage and injury resulting from high infusing pressures</li> <li>• Postoperative electrolyte derangement with risk of arrhythmia</li> <li>• Air bubbles in cardioplegia solution can cause air emboli in coronary arteries</li> </ul>	Any 3	<p><i>This leaves area of myocardium warm and active whilst ischaemic</i></p> <p><i>Bubble trap used</i></p>

## References:

- 1) Machin D, Allsager C. Principles of cardiopulmonary bypass. CEACCP (2006) 6(5)176-181 <https://academic.oup.com/bjaed/article/6/5/176/337119>
- 2) Jameel S, Colah S, Klein AA. Recent advances in cardiopulmonary bypass techniques. CEACCP (2010) 10(1)20-23 <https://academic.oup.com/bjaed/article/10/1/20/266470>
- 3) Conolly S, Arrowsmith JE, Klein AA. Deep hypothermic arrest. CEACCP (2010) 10(5)138-142 <https://academic.oup.com/bjaed/article/10/5/138/274654>