Multiple choice questions

Question 1
A 15:2 compression:ventilation ratio is recommended for resuscitation of:

a. adults, if the rescuer is trained
b. adults, if the rescuer is untrained
c. children less than 8 years old, if the rescuer is untrained
d. children less than 8 years old, if the rescuer is trained
e. adult drowning victims.

Question 2
Which of the following are correct doses for paediatric cardiac arrest?

a. atropine 10 µg/kg
b. adrenaline (epinephrine) 10 µg/kg
c. amiodarone 10 µg/kg
d. defibrillation (monophasic defibrillator) 4 J/kg
e. defibrillation (biphasic defibrillator) 2 J/kg.

Question 3
Which of the following statements are correct?

a. in an adult male (70–80 kg), the endotracheal tube should be 26 cm length at the lips
b. a size 4 laryngeal mask airway (LMA) is suitable for most adults
c. a size 9.0 mm nasopharyngeal airway is suitable for most adults
d. the size of an endotracheal tube, e.g. 7.0 mm, refers to its external diameter
e. a size 2 or 3 oropharyngeal airway is generally suitable for an 8-year-old patient.

Question 4
Which of the following drugs cause pupillary dilation?

a. atropine
b. adrenaline
c. amiodarone
d. lignocaine
e. sodium bicarbonate.

Question 5
With regard to cardiac arrest:

a. the commonest cause in adults is ischaemic heart disease
b. home defibrillators for high-risk patients double survival rates
c. paediatric cardiac arrest is usually due to a final common pathway causing hypoxaemia
d. bystander cardiopulmonary resuscitation (CPR) doubles the survival rate
e. sudden cardiac death accounts for about 15% of all deaths in Western countries.

Question 6
With regard to amiodarone:

a. hypotension results from histamine release
b. should be administered if the patient remains in VF after the second shock
c. the initial adult dose is 300 mg IV
d. may cause optic neuritis with prolonged use
e. precipitates with adrenaline.

Question 7
In diagnosing heat stroke in a pyrexial patient, the following differential diagnoses should be considered:

a. neuroleptic malignant syndrome
b. phaeochromocytoma
c. hypothyroidism
d. anaphylaxis
e. CNS infection.

Question 8
Noradrenaline (norepinephrine):

a. is principally an α-agonist
b. has some β-agonist action
c. may cause a reflex bradycardia
d. is synthesized primarily in the adrenal cortex
e. is broken down primarily into various metabolites that include adrenaline.
Question 9
ECG changes of hypothermia include:
   a. shortened PR interval
   b. flattened T wave
   c. J wave
   d. movement artefact from shivering
   e. VF.

Question 10
Suitable positions for self-adhesive pad placement for defibrillation of VF include:
   a. biaxillary
   b. anterior (right sternal edge) and left axilla
   c. anterior (left sternal edge) and left axilla
   d. anterior (left sternal edge) and posterior
   e. anterior (right sternal edge) and posterior.

Question 11
The following drugs cause hypotension through histamine release:
   a. atracurium
   b. fentanyl
   c. morphine
   d. amitriptyline
   e. midazolam.

Question 12
With regard to O₂:
   a. the concentration in exhaled breath is 18%
   b. 30% O₂ doubles the rate of combustion
   c. in most tissues of the body, the response to hypoxia is vasodilatation
   d. in the lungs, the response to hypoxia is vasoconstriction
   e. hyperventilation increases O₂ uptake.

Question 13
Pulse oximetry:
   a. the presence of carbon monoxide in the blood (COHb) results in an overestimation of oxygen saturation of haemoglobin (SaO₂)
   b. the presence of methaemoglobin in the blood (MetHb) results in an overestimation of SaO₂
   c. fetal Hb results in an overestimation of SaO₂
   d. a poor pulse oximetry trace may result in an underestimation of SaO₂
   e. diathermy may interfere with waveform detection.

Question 14
With regard to capnography:
   a. normal range is approximately 4.5–6.0 kPa
   b. absence of endotracheal end-tidal CO₂ during a cardiac arrest is diagnostic of oesophageal intubation
   c. end-tidal CO₂ that does not rise above 1.4 kPa (10 mmHg) during a resuscitation attempt is associated with a poor prognosis
   d. cooling increases end-tidal CO₂
   e. PaCO₂ is equal to end-tidal CO₂.

Question 15
With regard to severe local anaesthetic toxicity associated with cardiovascular collapse:
   a. lignocaine is the commonest local anaesthetic implicated in this condition
   b. may benefit from administration of Intralipid 20%
   c. propofol (an intralipid emulsion) is a suitable alternative to Intralipid
   d. the maximum recommended safe dose of bupivacaine is 2 mg/kg IV
   e. survival is uncommon.

Question 16
How should chest compressions be performed on an infant?
   a. with the heel of one hand and the other hand on top of the first
   b. with the heel of one hand only
   c. with 4 fingers of one hand
   d. with 2 fingers of one hand
   e. with the thumb of one hand.

Question 17
If an AED is available, but adult self-adhesive pads are available, how should you manage a 5-year-old child in cardiac arrest with a shockable rhythm?
   a. AED use is unnecessary as shockable rhythms are rare in this age group
   b. use the AED, but apply only one of the pads
   c. use the AED with adult pads
   d. perform CPR, but do not use the AED
   e. use the AED for a single shock only.
Question 18
With regard to drug doses:

a. 1 ml 1:1000 adrenaline = 1 mg adrenaline
b. 10 ml 0.25% bupivacaine = 25 mg bupivacaine
c. 100 µg (mcg) adrenaline = 1 ml 1:10 000 adrenaline
d. 1 mg IV adrenaline has the same efficacy as
   ~2 mg IO (intraosseous) adrenaline
e. 10 ml 50% dextrose = 100 ml 5% dextrose.

Question 19
A pacemaker programmed to:

a. AOO paces and senses the atrium only
b. VVI paces and senses the atrium only
c. DDD paces and senses both the atrium and ventricle
d. DDDR has the capability to defibrillate
e. DDD may be inhibited by diathermy current.

Question 20
With regard to haemorrhage:

a. circulating blood volume in an adult is
   approximately 4% of body mass
b. patients who have an impaired level of
   consciousness due to blood loss have generally
   lost at least 40% of their circulating blood volume
c. β-blockers may mask the early signs of
   hypovolaemic shock
d. the management of catastrophic haemorrhage
   should take priority over airway management
e. venous bleeding is generally less serious than
   arterial bleeding.
Photograph questions

Question 1

a. What is this?
b. What is the function of the reservoir?
c. What O₂ flow rate delivers 100% O₂ to the patient?

Question 2

a. What is the percentage of O₂ in the atmosphere?
b. What volume of gas is discharged from this CD size cylinder?
c. Why does the cylinder become cold during use?

Question 3

a. What is this?
b. How is this device powered?
c. What hazards may be associated with its use during defibrillation?

Question 4

a. What class of medication is this solution?
b. What ECG changes does it cause when taken as an overdose?
c. How is this overdose treated?

Question 5

This device can be placed over implanted pacemakers or cardioverter-defibrillators.

a. What is it?
b. What is its effect on an implantable pacemaker?
c. What is its effect on an automated implantable cardioverter-defibrillator (AICD)?
Diagnostic questions

Question 1

a. What is this image?
b. Name structures 1–3.

Question 2

This is a paced ECG. What mode is the pacemaker set to?

Question 3

The following results have been obtained:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Na⁺</td>
<td>135 mmol/l</td>
</tr>
<tr>
<td>K⁺</td>
<td>7.2 mmol/l</td>
</tr>
<tr>
<td>urea</td>
<td>33.4 mmol/l</td>
</tr>
<tr>
<td>creatinine</td>
<td>488 mmol/l</td>
</tr>
<tr>
<td>glucose</td>
<td>18.9 mmol/l</td>
</tr>
</tbody>
</table>

a. What is the most immediate priority in this patient?
b. Which organ system is failing?
c. What is the likely cause of this failure?

Question 4

An arterial blood gas sample (on air) is taken from an unresponsive patient, with the following results:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.21</td>
</tr>
<tr>
<td>PaO₂</td>
<td>11.0 kPa</td>
</tr>
<tr>
<td>PaCO₂</td>
<td>8.8 kPa</td>
</tr>
<tr>
<td>HCO₃⁻</td>
<td>15 mmol/l</td>
</tr>
</tbody>
</table>

a. What metabolic derangement is seen in this blood gas?
b. Name three likely causes.

Question 5

a. What rhythm does this ECG show?
b. What non-pharmacological methods may be used to terminate the arrhythmia?
c. What pharmacological methods may be used to terminate the arrhythmia?
Short answer questions

Question 1
Draw the algorithm for paediatric ALS.

Question 2
Explain why dextrose-containing solutions are contraindicated as resuscitation fluids.

Question 3
How quickly does manual external chest compression fatigue? How often should rescuers change?

Question 4
What are the risks of performing a needle pericardiocentesis? How may these risks be minimized?

Question 5
Draw a cross-section of the heart to show the right atrium and ventricle, left atrium and ventricle and pulmonary artery and aorta. Label each with normal values for O₂ saturation (on air).
MCQ answers

Answer 1
a. False. 30:2 is recommended in adults, irrespective of whether the rescuer is trained or untrained.
b. False.
c. False. 30:2 is recommended in children if the rescuer is untrained.
d. False. Trained rescuers should use 15:2.
e. True.

Answer 2
a. False. Atropine is not recommended for routine use. When it is given, the correct dose is 20 µg/kg.
b. True. 100 µg/kg should be considered in children with cardiac arrest associated with severe vasodilation, e.g. sepsis.
c. False. Amiodarone 5 mg/kg for both the first and, if given, the second dose.
d. True.
e. False. The recommended energy level for biphasic defibrillators is also 4 J/kg for all shocks.

Answer 3
a. False. For a 70–80 kg adult, the endotracheal tube should be 22–24 cm at the lips.
b. True.
c. False. A size 6.0–7.0 mm airway is adequate for most adults.
d. False. The size refers to the internal diameter.
e. True.

Answer 4
a. True.
b. True.
c. False.
d. False.
e. False.

Answer 5
a. True. Among adults, ischaemic heart disease is the predominant cause of arrest, with 30% of people at autopsy showing signs of recent myocardial infarction.
b. False. Home defibrillators have not been shown to improve outcome from cardiac arrest.
c. True.

d. True.
e. False. 30%.

Answer 6
a. False. Hypotension is thought to be caused by the solvent in which amiodarone is dissolved.
b. False. Amiodarone is indicated immediately after the third shock.
c. True.
d. True.
e. True.

Answer 7
a. True.
b. True.
c. False. Hyperthyroidism.
d. False.
e. True.

Answer 8
a. True.
b. True.
c. True.
d. False. Is synthesized primarily in the adrenal medulla.
e. True.

Answer 9
b. True.
c. True.
d. True.
e. True. Asystole and VF may begin spontaneously at core temperatures below 25–28°C.

Answer 10
a. True.
b. True.
c. False.
d. True.
e. True.

Answer 11
a. True.
b. False.
c. True.
d. False.
e. False.
Answer 12
a. False. 15%.
b. False. 24% O\textsubscript{2} doubles the rate of combustion. 30% increases the rate 10-fold.
c. True.
d. True. This is known as hypoxic pulmonary vasoconstriction.
e. False.

Answer 13
a. True. At 660 nm (used by the pulse oximeter), COHb absorbs light in a similar manner to HbO\textsubscript{2}.
b. False. At 660 nm, MetHb has similar absorption to reduced Hb. Sao\textsubscript{2} decreases with increasing MetHb levels, towards a Sao\textsubscript{2} of 85%. Below 85%, the presence of MetHb will, therefore, result in an increase in Sao\textsubscript{2} towards 85%.
c. False. Fetal Hb has no significant effect on pulse oximetry values.
d. True.
e. False.

Answer 14
a. True.
b. False. Also occurs with no cardiac output.
d. False. Cooling reduces metabolic rate and cardiac output, subsequently reducing end-tidal CO\textsubscript{2}.
e. False. When ventilation and perfusion are equal, Paco\textsubscript{2} is equal to end-tidal CO\textsubscript{2}. In practice, however, there is always a degree of shunting within the lungs, resulting in less-efficient gas transfer. In conditions such as cardiac arrest, chronic obstructive pulmonary disease or adult respiratory distress syndrome, an even greater ventilation/perfusion abnormality occurs and high CO\textsubscript{2} gradients result.

Answer 15
b. True. Some animal studies and human case reports suggest that Intralipid may be of benefit in these patients (Soar J \textit{et al. Resuscitation}, 2010;81:1400–1433).
c. False. Propofol is dissolved in Intralipid, but at inadequate dose to be in the therapeutic range.
d. True.
e. True. Bupivacaine is thought to bind strongly to myocardial tissue and its effects are difficult to reverse.

Answer 16
a. False.
b. False.
c. False.
d. True.
e. False.

Answer 17
a. False.
b. False.
c. True.
d. False.
e. False.

Answer 18
a. True.
b. True. A 1% solution contains 10 mg/ml.
c. True.
d. False. IV and IO routes have the same bioavailability and, therefore, efficacy.
e. True.

Answer 19
a. False. AOO paces the atrium only and is not inhibited by atrial or ventricular activity.
b. False. VVI paces the ventricle and is inhibited by ventricular activity.
c. True.
d. False. ‘R’ means that the device is rate responsive and can vary its rate.
e. True. Electrical activity from diathermy devices can be sensed by pacemakers, which then mistakenly inhibit output.

Answer 20
a. False. 7%.
b. True.
c. True. Tachycardia may be masked by \(\beta\)-blockers.
d. True. The traditional ABC approach has been superseded by cABC, where the initial priority is to stop any torrential haemorrhage (e.g. from limb amputation) prior to moving on to ABC.
e. False.
**Photograph answers**

**Answer 1**

a. Oxygen rebreathing mask.
b. The reservoir fills with O₂ to provide additional O₂ to that delivered when the patient inhales.
c. A rate of 15 l/min O₂ results in the patient inhaling approximately 85–90% O₂; 100% O₂ is only possible with sealed systems.

**Answer 2**

a. 21%.
b. This is a CD size O₂ cylinder, which stores 460 litres.
c. Pressure of a gas (P) is related to its volume (V), given by the equation \( P/V = k \), where \( k \) is a constant. Also, \( P \) is proportional to the absolute temperature (\( T \); measured in Kelvin) of the gas. Therefore, as gas escapes from a pressurized cylinder (137 bar when full), the pressure falls and the gas remaining in the cylinder expands. This fall in pressure results in a proportional temperature decrease.

**Answer 3**

b. The device is powered by compressed O₂ at >100 l/min. Later devices (LUCAS2) are powered by battery.
c. The exhaust O₂ gas discharged from the device results in high ambient O₂ concentrations, particularly in confined spaces. High ambient O₂ concentrations are a risk for fire or explosion.

**Answer 4**

a. Tricyclic antidepressant.
b. Prolonged QTc, widened QRS complex, ventricular fibrillation (VF).
c. In patients with a metabolic acidosis, sodium bicarbonate (IV) is recommended. The postulated mechanism of action is two-fold:
   - tricyclics are protein bound but less so in acidic conditions; reversing the acidosis increases protein binding and decreases bioavailability of the drug
   - sodium load may help to reverse the sodium channel blocking effects of the tricyclic drug
   - treatment is otherwise supportive.

**Answer 5**

a. Ring magnet.
b. The magnet inhibits sensing by the pacemaker, converting to a fixed output mode (e.g. AOO) at a preset rate (usually 50/min).
c. The magnet will have the same effect on the pacing function of an AICD as for an implantable pacemaker (b). It will also inhibit the defibrillation function of the device.
**Diagnostic answers**

**Answer 1**
a. Structures are:
   (1) left ventricle
   (2) mitral valve
   (3) left atrium.

The figure shows the orientation:

```
  RV  LV
  RA  LA
       ● Left
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**Answer 2**

DDD. Both atrial (red arrows) and ventricular (blue arrows) pacing spikes can be seen.

**Answer 3**
a. The immediate priority in this patient is the treatment of hyperkalaemia (normal range 3.5–5.0 mmol/l).
b. The urea (normal range 3.0–7.0 mmol/l) and creatinine (normal range 50–118 mmol/l) are both significantly elevated, suggesting renal failure; the likely cause of this is hyperkalaemia.
c. The high glucose level (normal range 3.0–7.0 mmol/l) is suggestive of diabetes, a common cause of chronic renal failure.

**Answer 4**
a. Acute respiratory acidosis.
b. Respiratory depression, respiratory failure, airway obstruction, hypoventilation from a low minute volume of any cause.

**Answer 5**
a. Supraventricular tachycardia (with a rate approximately 300/min).
b. Carotid sinus massage, sucking ice, cold flannel over the face.
c. Adenosine 3–6 mg IV; verapamil 2.5–5 mg IV boluses are an alternative if adenosine is not available.