

FExNet 2026

Collated SAQs: Cardiology

ANSWER BOOKLET

Model answers for the 74 cardiology SAQs. References cited at the foot of each question. Items marked [core] are required for full marks; others are accepted alternatives or supplementary content. Mark allocations indicative.

74 questions • 979 marks

ACEM-aligned format. Sub-questions labelled a) b) c). Mark allocations indicative; references cited in the Answer Booklet. Question and answer indexes are clickable.

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Question 1 | AF — Cardioversion (19 marks)

A 65-year-old woman presents to ED with palpitations of 4 hours' duration. She is haemodynamically stable. Her ECG shows atrial fibrillation at 140 bpm with no ST changes. She has no significant past medical history.

a) List 4 criteria for cardioversion in atrial fibrillation. (4 marks)

- Onset clearly <48 hours OR therapeutic anticoagulation ≥ 3 weeks [core]
- Haemodynamic instability (hypotension, severe APO, acute ischaemia) — emergency DC cardioversion regardless of onset [core]
- Rapid ventricular rate causing haemodynamic compromise
- Patient preference / shared decision-making in low thromboembolic risk
- No contraindications (digoxin toxicity, severe hypokalaemia, intracardiac thrombus)

b) Name 3 drugs used for chemical cardioversion of AF, with dose and 1 contraindication for each. (9 marks)

Drug	Dose	Contraindication
Flecainide	2 mg/kg IV over 10 min (max 150 mg); or 200–300 mg PO ('pill in pocket')	Structural / ischaemic heart disease; pre-excitation; QRS >120 ms
Amiodarone	300 mg IV over 20–60 min, then 900 mg/24 h	Iodine allergy; severe sinus / AV node disease without pacing; pregnancy
Sotalol	1–1.5 mg/kg IV over 10 min	Long QT / QTc >500 ms; severe asthma; renal failure (CrCl <40)

c) State the scoring system used to assess thromboembolic risk and the threshold for anticoagulation. (6 marks)

CHA₂DS₂-VASc score. Components: Congestive HF (1), Hypertension (1), Age ≥ 75 (2), Diabetes (1), Stroke/TIA/TE (2), Vascular disease (1), Age 65–74 (1), Sex female (1).

Threshold: anticoagulate if score ≥ 2 in males or ≥ 3 in females (NHF/CSANZ 2023). Score 1 in males / 2 in females — consider on individual risk-benefit.

Bleeding risk assessed in parallel with **HAS-BLED** — high score does not preclude anticoagulation but prompts modifiable risk-factor optimisation (BP control, alcohol, NSAIDs).

Marker's note: a CHADS₂ answer is acceptable for older texts but CHA₂DS₂-VASc is the contemporary standard.

References: Tintinalli's Emergency Medicine 9e Ch 18 (AF) • NHF/CSANZ AF Guidelines 2018 (updated 2023) • eTG (Therapeutic Guidelines, current): Cardiovascular — AF

Question 2 | AF — Rate vs Rhythm Control (12 marks)

A 70-year-old man with hypertension and obstructive sleep apnoea presents with new-onset atrial fibrillation. Symptoms began 6 hours ago. He is haemodynamically stable with a ventricular rate of 130 bpm.

a) List 4 potential precipitants of AF in this patient. (4 marks)

- Ischaemic heart disease / silent MI
- Uncontrolled hypertension / hypertensive heart disease
- Obstructive sleep apnoea
- Thyrotoxicosis
- Pulmonary embolism
- Pneumonia / sepsis / systemic infection
- Alcohol (holiday heart)
- Electrolyte disturbance (hypokalaemia, hypomagnesaemia)
- Valvular heart disease (mitral)

b) List 4 factors that favour rate control over rhythm control. (4 marks)

- Longstanding (>1 year) or persistent AF
- Elderly patient
- Significant structural heart disease
- Previous failed cardioversion or ablation
- Asymptomatic / minimally symptomatic AF
- Patient preference for simplicity / no antiarrhythmic toxicity
- Severely dilated left atrium (low chance of sustained sinus)

c) List 4 factors influencing the decision to anticoagulate. (4 marks)

- CHA₂DS₂-VASc score (≥ 2 male / ≥ 3 female) **[core]**
- HAS-BLED score (bleeding risk)
- Renal and hepatic function (DOAC dose / choice)
- Patient preference and ability to comply with monitoring
- Concurrent medications (interactions, antiplatelets)
- Falls risk (assess but not an absolute contraindication)

References: Tintinalli's Emergency Medicine 9e Ch 18 • NHF/CSANZ AF Guidelines 2018 (updated 2023)

Question 3 | Anorexia Nervosa — Long QT (14 marks)

An 18-year-old female is brought to ED after a brief syncopal collapse. She has a 3-year history of anorexia nervosa with a current BMI of 14. Her ECG shows sinus rhythm at 50 bpm with QTc 540 ms. She is medically stable on arrival but cachectic.

a) State the MOST important ECG abnormality. (1 mark)

Prolonged QTc (540 ms; abnormal >460 ms in females, significantly elevated >500 ms) — substrate for Torsades de Pointes.

b) List 3 other ECG features associated with this condition. (3 marks)

- Sinus bradycardia (common in severe anorexia)
- T-wave flattening or inversion
- U waves (associated hypokalaemia)
- Low-voltage QRS
- First-degree AV block

c) List 4 key investigations and state the rationale for each. (8 marks)

Investigation	Rationale
UEC + Mg + PO ₄	Hypokalaemia, hypomagnesaemia and hypophosphataemia (refeeding) prolong QT and precipitate TdP
Blood glucose	Hypoglycaemia is common in severe anorexia and causes collapse / arrhythmia
Troponin	Cardiac muscle catabolism / myocarditis can occur in severe undernutrition
TFTs	Hypothyroidism (sick euthyroid) prolongs QT and lowers HR

d) List 2 statutory criteria for involuntary detention and treatment. (2 marks)

- Mental illness (eating disorder is recognised) AND lacks capacity for the relevant decision **[core]**
- Imminent risk of serious harm to self if untreated **[core]**
- Detention is the least restrictive option; treatment is available and beneficial

Marker's note: Mental Health Act criteria apply; capacity must be specifically assessed — eating disorder alone ≠ automatic incapacity.

References: Tintinalli's Emergency Medicine 9e Ch 287 (Eating Disorders) • ACEM clinical policies and statements • RANZCP guidance on involuntary treatment in eating disorders

Question 4 | Acute Pulmonary Oedema (12 marks)

A 78-year-old man with known ischaemic cardiomyopathy presents with acute breathlessness, orthopnoea and pink frothy sputum. RR 32, SpO₂ 90% on 6 L O₂, BP 160/95, HR 120. You suspect acute pulmonary oedema.

a) List 4 clinical findings that support a diagnosis of acute pulmonary oedema. (4 marks)

- Bilateral basal inspiratory crepitations
- Third heart sound (S₃ gallop)
- Elevated JVP
- Pink frothy sputum
- Tachypnoea, orthopnoea, paroxysmal nocturnal dyspnoea
- Diaphoresis with cool peripheries
- Tachycardia
- Peripheral / sacral oedema (if chronic component)

b) List 4 potential precipitants of acute pulmonary oedema. (4 marks)

- Acute coronary syndrome / STEMI
- Hypertensive emergency
- Tachyarrhythmia (fast AF, SVT)
- Acute valvular dysfunction (papillary muscle rupture, endocarditis)
- Medication non-compliance (diuretic, ACEi)
- Sepsis / severe pneumonia
- Severe anaemia / high-output failure
- Renal failure / fluid overload

c) Name 2 specific ED treatments. For each state the initial dose and a clinical end-point. (4 marks)

Treatment	Initial dose	End-point
GTN (sublingual / IV)	SL 300–600 mcg q5 min; or IV infusion 10–20 mcg/min, uptitrate by 10 mcg/min q5 min	Symptomatic relief; SBP >90 mmHg; ↓RR; ↑SpO ₂
NIV (CPAP / BiPAP)	CPAP 5–10 cmH ₂ O at FiO ₂ 0.6–1.0	SpO ₂ >94%; RR <25; intubation avoided; patient comfort
Furosemide IV	40–80 mg IV (double usual oral dose if on loop)	UO >1 mL/kg/h; reduced preload; weight loss / symptom relief

References: Tintinalli's Emergency Medicine 9e Ch 53 (Heart Failure) • NHF Guidelines for the prevention, detection and management of heart failure 2018 • eTG (Therapeutic Guidelines, current)

Question 5 | Severe APO with Hypotension (12 marks)

A 72-year-old man is brought to ED with severe acute pulmonary oedema. BP 95/60, RR 32, SpO₂ 88% on 15 L NRB, GCS 14. He is diaphoretic, distressed and speaks only single words.

a) List 4 precipitants you would actively seek on initial assessment. (4 marks)

- Acute coronary syndrome / STEMI (most critical to exclude) [core]
- Tachyarrhythmia (fast AF / SVT / VT)
- Acute mitral regurgitation (papillary muscle rupture)
- Severe aortic stenosis decompensation
- Sepsis-precipitated cardiac failure
- LVOT obstruction (HOCM / dynamic)

b) Name 2 key treatments. For each state the initial prescription, mechanism and end-point. (8 marks)

Treatment	Prescription	Mechanism	End-point
IV GTN	Start 10–20 mcg/min, ↑ by 10 mcg/min q5 min (max 200 mcg/min)	Venodilation → ↓preload; arterial dilation → ↓afterload; coronary vasodilation	SBP >90; subjective dyspnoea relief; ↓RR; ↓work of breathing
NIV (CPAP)	CPAP 5–10 cmH ₂ O, FiO ₂ 0.6–1.0	Positive pressure → alveolar recruitment, ↓preload/afterload, ↑FRC	SpO ₂ >94%; RR <25; intubation avoided

Marker's note: If SBP <90 throughout, GTN must be deferred and inotropic support / urgent reperfusion considered.

References: Tintinalli's Emergency Medicine 9e Ch 53 • NHF Heart Failure Guidelines 2018

Question 6 | APO — Radiological Features (14 marks)

A 68-year-old woman with known ischaemic cardiomyopathy presents with severe breathlessness over 6 hours. SpO₂ 85% on RA, RR 32, BP 170/100. Her chest X-ray is shown.

[CXR] AP erect mobile chest X-ray (insert image)

a) State the MOST likely diagnosis. (1 mark)

Acute decompensated heart failure with pulmonary oedema (acute on chronic).

b) List 4 chest X-ray features supporting this diagnosis. (4 marks)

- Cardiomegaly (CTR >0.5 on PA) **[core]**
- Upper-lobe blood diversion / cephalisation **[core]**
- Kerley B lines
- Bat-wing / perihilar alveolar opacities
- Bilateral pleural effusions (R > L)
- Peribronchial cuffing

c) List 5 potential causes of this presentation. (5 marks)

- Acute MI / ACS
- Hypertensive emergency
- Tachyarrhythmia (fast AF)
- Acute valvular failure (acute MR / acute AR)
- Medication non-compliance
- Renal failure / fluid overload
- Severe anaemia
- Myocarditis / Takotsubo

d) Name 2 main pharmacological treatments. For each state the dose and 1 contraindication. (4 marks)

Treatment	Dose	Contraindication
GTN IV	10–200 mcg/min IV, titrated to BP and symptoms	SBP <90; PDE-5 inhibitor in last 24–48 h; RV infarction; severe AS
Furosemide IV	40–80 mg IV (or 1.5–2× oral dose if loop-experienced)	Anuric renal failure; hypovolaemia; severe sulfonamide allergy

References: Tintinalli's Emergency Medicine 9e Ch 53 • NHF Heart Failure Guidelines 2018 • eTG (Therapeutic Guidelines, current)

Question 7 | Broad Complex Tachycardia — Unstable (16 marks)

A 64-year-old man with an AICD presents with palpitations. He is unstable: BP 80/50, K^+ 6.1 mmol/L, pCO_2 57 mmHg. His ECG shows a broad-complex tachycardia at 180 bpm.

[ECG] 12-lead ECG (insert image)

a) State the rhythm. (1 mark)

Ventricular tachycardia (broad-complex tachycardia in a patient with structural heart disease and AICD).

b) List 2 immediate treatments to institute while DC cardioversion is being prepared. (2 marks)

- Treat hyperkalaemia: calcium gluconate 10 mL 10% IV; insulin 10 U + 50 mL 50% dextrose IV; salbutamol 10–20 mg neb; sodium bicarbonate if acidotic **[core]**
- Optimise oxygenation/ventilation (hypercapnia 57): high-flow O_2 , prepare for intubation if persistent **[core]**
- IV fluid bolus 250–500 mL if pre-load deficient
- Apply magnet over AICD only if device is delivering inappropriate shocks; otherwise leave functioning

c) Name 4 sedation agents used for emergency DC cardioversion. For each state the dose, 1 advantage and 1 disadvantage. (8 marks)

Drug	Dose	Advantage	Disadvantage
Ketamine	1–1.5 mg/kg IV	Preserves airway reflexes; sympathomimetic supports BP	↑secretions; may worsen hypertension; emergence
Propofol	0.5–1 mg/kg IV (reduced if shocked)	Rapid onset/offset; antiemetic	Significant hypotension; myocardial depression
Midazolam	0.05–0.1 mg/kg IV	Familiar; reversible (flumazenil); amnestic	Respiratory depression; no analgesia
Fentanyl	1–2 mcg/kg IV (with sedative)	Analgesia; haemodynamically stable	Slow onset; no reliable amnesia; respiratory depression

d) State the defibrillator settings and pad position. (2 marks)

Mode: Synchronised cardioversion (R-wave sync). **Energy:** 150–200 J biphasic (200 J monophasic), escalating if unsuccessful.

Pad position: Anterior–lateral (right infraclavicular / left mid-axillary) OR anterior–posterior. If AICD present, position pads ≥ 8 cm from device — anterior–posterior preferred.

e) Name the post-cardioversion rhythm in the second ECG. (1 mark)

Sinus rhythm (or paced rhythm if AICD takes over). Marker's note: depends on shown ECG.

f) List 2 differential diagnoses for ongoing hypotension despite rhythm conversion. (2 marks)

- Cardiogenic shock from underlying ischaemia / LV dysfunction
- Persistent metabolic disturbance (hyperkalaemia, acidosis)
- Hypovolaemia / haemorrhage
- Tension pneumothorax / pericardial tamponade
- Drug effect from sedation
- Pulmonary embolism

References: Tintinalli's Emergency Medicine 9e Ch 19 (VT/VF) • ANZCOR Guidelines (current)

Question 8 | Broad Complex Tachycardia — ECG Analysis (11 marks)

A 58-year-old man presents with palpitations and lightheadedness. BP 110/70, GCS 15. The 12-lead ECG is shown.

[ECG] 12-lead ECG**a) Analyse the ECG, listing 5 features that support your rhythm diagnosis. (5 marks)**

- Broad QRS >120 ms (often >160 ms in VT)
- Rate 100–250 bpm, regular
- AV dissociation (independent P waves)
- Fusion or capture beats
- Concordance in precordial leads (all + or all –)
- RS interval >100 ms in any precordial lead (Brugada criterion)
- QRS morphology not matching typical LBBB / RBBB

b) State the anatomical origin. (1 mark)

RBBB-pattern VT → left ventricular focus. LBBB-pattern VT → right ventricular focus. Inferior axis → superior wall; superior axis → inferior wall. (Marker's note — answer depends on ECG.)

c) List 5 components of the initial treatment of haemodynamically stable VT. (5 marks)

- Oxygen, IV access × 2, monitoring, defibrillator to bedside, 12-lead ECG **[core]**
- Amiodarone 300 mg IV over 20–60 min (first-line in Australasia) **[core]**
- Lignocaine 1–1.5 mg/kg IV (alternative)
- Correct K⁺ (target >4.5) and Mg²⁺ (target >1.0)
- Identify and treat ischaemia (12-lead, troponin, consider cath lab)
- Synchronised DC cardioversion if unstable or pharmacological failure
- Cardiology referral for ongoing care

References: Tintinalli's Emergency Medicine 9e Ch 19 • ANZCOR Guidelines (current)

Question 9 | VT — Cause Identification (13 marks)

A 60-year-old man with prior anterior MI 2 years ago presents with palpitations and chest discomfort. Vital signs stable. The 12-lead ECG shows a regular broad-complex tachycardia at 170 bpm.

[ECG] 12-lead ECG

a) State the rhythm interpretation. (1 mark)

Monomorphic ventricular tachycardia.

b) List 4 ECG features supporting this interpretation. (4 marks)

- QRS >120 ms (often >160 ms)
- AV dissociation
- Fusion / capture beats
- Positive or negative precordial concordance
- Extreme axis (-90° to $\pm 180^\circ$)
- RS interval >100 ms in any precordial lead

c) List 3 underlying causes. For each name 1 supporting assessment feature. (6 marks)

Cause	Supporting feature
Ischaemic heart disease / scar-related VT	Prior MI history; troponin rise; ST changes
Cardiomyopathy (dilated / HCM)	Echocardiographic findings; family history of SCD
Electrolyte disturbance (hypoK ⁺ / hypoMg ²⁺)	Diuretic use, vomiting; bedside VBG
Drug-induced (digoxin, QT-prolonging agents)	Drug history; digoxin level; baseline QTc
Channelopathy (Brugada, LQTS, CPVT)	Young age, family history SCD, baseline ECG features

d) Name 2 medications used to treat haemodynamically stable VT, with dose. (2 marks)

- Amiodarone 300 mg IV over 20–60 min, then 900 mg/24 h
- Lignocaine 1–1.5 mg/kg IV bolus, then 1–4 mg/min infusion
- Procainamide 10–15 mg/kg IV over 20 min (alternative)
- MgSO₄ 2 g IV over 10 min if polymorphic / TdP component

References: Tintinalli's Emergency Medicine 9e Ch 19 • eTG (Therapeutic Guidelines, current)

Question 10 | Torsades de Pointes (12 marks)

A 35-year-old woman is brought in after a witnessed collapse at work. She has a history of depression and is taking citalopram. The rhythm strip shows polymorphic wide-complex tachycardia with a twisting axis.

[RHYTHM STRIP] Lead II rhythm strip

a) Name the rhythm. (1 mark)

Torsades de Pointes — polymorphic VT with a characteristic 'twisting' QRS axis around the isoelectric baseline, on a substrate of QT prolongation.

b) List 5 drugs that may precipitate this rhythm. (5 marks)

- Antiarrhythmics: sotalol, amiodarone, flecainide, procainamide
- Macrolide / quinolone antibiotics: erythromycin, azithromycin, moxifloxacin
- Antipsychotics: haloperidol, quetiapine, droperidol (high dose)
- Antiemetics: ondansetron (high-dose IV), domperidone
- Antidepressants: TCAs, citalopram (high dose), venlafaxine
- Methadone
- Hydroxychloroquine

c) List 3 non-pharmacological risk factors for TdP. (3 marks)

- Hypokalaemia, hypomagnesaemia, hypocalcaemia
- Female sex (longer baseline QTc)
- Bradycardia (pause-dependent onset)
- Congenital long QT syndrome
- Hypothyroidism
- Starvation / anorexia
- Hypothermia

d) List 3 treatment options for TdP. (3 marks)

- Magnesium sulphate 2 g IV over 2 min (first-line, even if Mg normal) **[core]**
- DC defibrillation 200 J biphasic if pulseless / haemodynamically unstable **[core]**
- Correct electrolytes ($K^+ >4.5$, $Mg^{2+} >1.0$)
- Withdraw causative QT-prolonging drug
- Overdrive pacing 90–110 bpm (transvenous or transcutaneous) for pause-dependent TdP
- Isoprenaline infusion 1–10 mcg/min (avoid in congenital LQTS)

References: Tintinalli's Emergency Medicine 9e Ch 19 • CredibleMeds.org QT drug list • ANZCOR Guidelines (current)

Question 11 | Brugada Algorithm — VT vs SVT (12 marks)

A 55-year-old patient presents with a regular broad-complex tachycardia at 160 bpm. BP 100/65, GCS 15. You are deciding whether the rhythm is VT or SVT with aberrancy.

a) List the 4 sequential steps of the Brugada algorithm. (4 marks)

Step	Question	If positive
1	Absence of an RS complex in ALL precordial leads?	Yes → VT
2	RS interval >100 ms in any precordial lead?	Yes → VT
3	AV dissociation present?	Yes → VT
4	Morphology criteria for VT in V_1 and V_6 ?	Yes → VT

Marker's note: Sensitivity ~98%, specificity ~96% for VT.

b) List 8 other ECG features that favour VT over SVT with aberrancy. (8 marks)

- QRS >160 ms with LBBB-like morphology / >140 ms with RBBB-like
- AV dissociation
- Fusion beats
- Capture beats
- Extreme axis deviation (-90° to $\pm 180^\circ$)
- Positive precordial concordance (all R in V_1 – V_6)
- Negative precordial concordance (all QS in V_1 – V_6)
- V_1 monophasic R or biphasic qR
- V_6 R/S ratio <1 (or QS pattern)
- Notching of S-wave nadir (Josephson sign)

References: Tintinalli's Emergency Medicine 9e Ch 19

Question 12 | Broad Complex Tachycardia — Treatment (12 marks)

A 67-year-old man with prior CABG presents with a broad complex tachycardia at 180 bpm. BP 90/60. The 12-lead ECG is provided.

[ECG] 12-lead ECG

a) List 3 relevant ECG abnormalities. (3 marks)

- Broad-complex tachycardia (QRS >120 ms)
- Rate 100–250 bpm
- AV dissociation if present
- Concordance / extreme axis
- Fusion / capture beats

b) List 3 possible causes. (3 marks)

- Ventricular tachycardia (most likely with structural disease)
- SVT with aberrant conduction (LBBB / RBBB)
- Pre-excited AF (WPW)
- Drug toxicity (TCA, Na-channel blocker, hyperkalaemia)
- Electrolyte disturbance with wide QRS

c) Name 3 treatments. For each state the dose and an end-point. (6 marks)

Treatment	Dose	End-point
Synchronised DC cardioversion	150–200 J biphasic after sedation	Return to sinus rhythm; haemodynamic stability
Amiodarone IV	300 mg over 20–60 min, then 900 mg/24 h	Cardioversion to sinus; rate <100; BP stable
MgSO ₄ IV (if polymorphic / TdP)	2 g IV over 2–10 min	Termination of polymorphic VT

References: Tintinalli's Emergency Medicine 9e Ch 19 • ANZCOR Guidelines (current)

Question 13 | VT — Electrical Cardioversion (14 marks)

A 70-year-old man with prior MI presents with palpitations and chest pain. ECG shows monomorphic broad-complex tachycardia at 180 bpm. BP 105/65.

a) List 6 ECG findings supporting a diagnosis of VT. (6 marks)

- QRS >120 ms (often >160 ms)
- AV dissociation
- Fusion beats
- Capture beats
- Precordial concordance (positive or negative)
- Extreme axis deviation
- RS interval >100 ms in any precordial lead
- V₁ monophasic R or biphasic qR
- V₆ QS or rS pattern

b) List 4 history features supporting VT over SVT with aberrancy. (4 marks)

- Prior MI / ischaemic heart disease **[core]**
- Known cardiomyopathy or structural heart disease
- Previous documented VT or ICD therapy
- Family history of SCD
- Onset during exercise / no recent stimulant use
- Age >35 with cardiovascular risk factors

c) List the 4 key steps for synchronised electrical cardioversion in stable VT. (4 marks)

- Preparation: O₂, IV access × 2, monitoring, defibrillator, anaesthetics / senior support, consent if time **[core]**
- Sedation/analgesia: e.g. ketamine 1 mg/kg + fentanyl 1 mcg/kg, or propofol 0.5–1 mg/kg (titrate) **[core]**
- Apply pads anterior–lateral or anterior–posterior; select SYNC mode; confirm sync markers on R-wave; charge 100–200 J biphasic
- Deliver shock; immediately reassess rhythm and pulse; escalate energy if persists; commence amiodarone for maintenance

References: Tintinalli's Emergency Medicine 9e Ch 19 • ANZCOR Guidelines (current)

Question 14 | Wide Complex Tachycardia — Management (10 marks)

A 60-year-old man presents with a regular wide complex tachycardia at 170 bpm. BP 100/60, GCS 15. He has a background of hypertension.

a) List 4 ECG features that favour VT. (2 marks)

- AV dissociation
- Fusion / capture beats
- Positive or negative precordial concordance
- QRS >160 ms / extreme axis deviation

b) List 2 alternative diagnoses to VT. (2 marks)

- SVT with aberrant conduction (LBBB / RBBB)
- Pre-excited AF (WPW)
- Antidromic AVRT (WPW)
- Drug-induced QRS broadening (TCA, Na-channel blocker, hyperkalaemia)

c) Name 3 treatment options. For each state 1 advantage and 1 disadvantage. (6 marks)

Option	Advantage	Disadvantage
Synchronised DC cardioversion 150–200 J	Definitive; effective for VT and SVT	Requires sedation; post-cardioversion hypotension
Amiodarone 300 mg IV over 20–60 min	Effective for VT and SVT; preserves BP	Slow onset; phlebitis; unsafe in pre-excited AF
Adenosine 6 → 12 mg IV (if uncertain VT vs SVT)	Diagnostic and therapeutic for SVT; very short $t_{1/2}$	Contraindicated in pre-excited AF; can worsen VT

References: Tintinalli's Emergency Medicine 9e Ch 19 • ANZCOR Guidelines (current)

Question 15 | BCT — Differential Diagnosis (17 marks)

A 55-year-old woman presents with palpitations. ECG shows a regular broad complex tachycardia. BP 110/70, GCS 15.

a) List 4 causes of broad complex tachycardia. (4 marks)

- Ventricular tachycardia
- SVT with aberrant conduction (functional or fixed BBB)
- Pre-excited tachycardia (WPW antidromic AVRT or AF)
- Drug / toxin (TCA, sodium channel blocker, hyperkalaemia, digoxin toxicity)

b) List 4 clinical features that favour VT. (4 marks)

- Age >35 with structural / ischaemic heart disease
- Haemodynamic instability or syncope at onset
- Previous MI or cardiomyopathy
- Cannon A-waves (AV dissociation)
- Variable intensity of S₁
- Prior ICD or VT history

c) List 6 ECG features that favour VT. (6 marks)

- AV dissociation
- Fusion beats
- Capture beats
- QRS >160 ms
- Positive or negative precordial concordance
- Extreme axis (−90 to ±180°)
- RS interval >100 ms in any precordial lead

d) Name 3 medications used for haemodynamically stable VT. (3 marks)

- Amiodarone 300 mg IV over 20–60 min
- Lignocaine 1–1.5 mg/kg IV
- Procainamide 10–15 mg/kg IV over 20 min
- Sotalol 1.5 mg/kg IV over 5 min

References: Tintinalli's Emergency Medicine 9e Ch 19

Question 16 | Bradycardia — AV Block & Pacing (16 marks)

An 80-year-old man presents with syncope. He was recently started on donepezil for early dementia and clarithromycin for a chest infection. The pre-hospital ECG shows complete AV block.

a) List 3 relevant 12-lead ECG findings. (3 marks)

- Complete (3°) AV block — AV dissociation; regular P-P and regular but slower R-R
- Slow ventricular escape (wide QRS <40 bpm if infranodal; narrow 40–60 if junctional)
- ST changes if ischaemia is the precipitant
- Prolonged PR interval / 1° block on baseline

b) List 3 likely contributing causes in this patient. (3 marks)

- Donepezil (acetylcholinesterase inhibitor) — vagal potentiation [core]
- Clarithromycin–donepezil interaction (CYP3A4 / QT prolongation) [core]
- Inferior MI (RCA → AV node)
- Hyperkalaemia
- Degenerative conduction disease

c) List 4 management priorities in the ED. (4 marks)

- IV access, continuous ECG, defibrillator/pacer to bedside, 12-lead ECG [core]
- Stop / review precipitating medications (donepezil, clarithromycin)
- Atropine 600 mcg IV (repeat to 3 mg max)
- Transcutaneous pacing if pharmacological therapy fails / haemodynamic compromise
- Treat reversible causes — UEC + K⁺; troponin / ECG for ACS

d) State the likely diagnosis. (1 mark)

Drug-induced complete AV block — donepezil potentiated by clarithromycin in an elderly patient.

e) List 5 steps for successful transcutaneous pacing. (5 marks)

- Apply hands-free pads anterior–posterior (preferred) or anterior–lateral
- Select demand mode; set rate 70–80 bpm
- Increase output in 5–10 mA increments until electrical capture (pacing spike + broad QRS)
- Confirm mechanical capture (palpable femoral / arterial line waveform with each paced beat)
- Provide analgesia/sedation (ketamine 0.5–1 mg/kg + fentanyl 1 mcg/kg); set output threshold + 10 mA safety margin; arrange transvenous pacing

References: Tintinalli's Emergency Medicine 9e Ch 17 • ANZCOR Guidelines (current)

Question 17 | Pre-excited AF (WPW) (13 marks)

A 28-year-old man presents with palpitations of sudden onset. The ECG shows an irregular broad-complex tachycardia at 220 bpm with variable QRS morphology and visible delta waves between rapid QRS complexes.

[ECG] 12-lead ECG**a) State the diagnosis and list 4 ECG features supporting it. (5 marks)**

Pre-excited atrial fibrillation (AF conducted via accessory pathway in WPW).

- Irregularly irregular rhythm
- Broad QRS >120 ms with delta waves (slurred upstroke)
- Variable QRS morphology / width (varying degrees of pre-excitation)
- Very rapid ventricular rate (often 200–300 bpm)
- Short RR intervals between consecutive pre-excited beats

b) List the 8 key components of management. (8 marks)

- Resuscitation: O₂, IV access, continuous monitoring, 12-lead ECG, pads on, prepare team **[core]**
- If UNSTABLE (hypotension, altered conscious state, chest pain, APO) → IMMEDIATE synchronised DC cardioversion 150–200 J after sedation **[core]**
- If STABLE: **procainamide 10–15 mg/kg IV over 20 min** (drug of choice; slows accessory pathway) OR flecainide 2 mg/kg IV **[core]**
- **AVOID AV-nodal blockers** (adenosine, verapamil, diltiazem, β-blockers, digoxin) — risk of accelerated AP conduction → VF **[core]**
- Correct precipitants (electrolytes, ischaemia, alcohol, thyrotoxicosis)
- Anticoagulation if AF ≥48 h or unclear duration
- Cardiology referral for EP study and definitive radiofrequency ablation
- Patient education on accessory pathway and avoidance of AV-nodal blocker drugs

References: Tintinalli's Emergency Medicine 9e Ch 18 • Heart Rhythm Society / EHRA WPW consensus statement • eTG (Therapeutic Guidelines, current)

Question 18 | VT — Hypotensive Patient (14 marks)

A 62-year-old man presents with palpitations and presyncope. BP 80/45, GCS 14. The ECG shows a regular broad-complex tachycardia at 200 bpm.

[ECG] 12-lead ECG

a) State the rhythm diagnosis. (1 mark)

Monomorphic ventricular tachycardia with haemodynamic compromise.

b) List 3 supportive ECG features. (3 marks)

- Broad QRS >120 ms
- AV dissociation
- Concordance / extreme axis
- Fusion / capture beats
- RS interval >100 ms

c) List 4 likely causes. (4 marks)

- Acute MI / ischaemic heart disease (commonest)
- Cardiomyopathy (dilated / hypertrophic)
- Electrolyte disturbance (hypokalaemia, hypomagnesaemia)
- Drug toxicity (antiarrhythmic, digoxin, TCA)
- Channelopathy (Brugada, LQTS)

d) List 3 management steps with details. (6 marks)

- Immediate synchronised DC cardioversion 150–200 J biphasic — patient is unstable; sedate with ketamine 1 mg/kg + fentanyl 1 mcg/kg **[core]**
- Post-cardioversion: amiodarone 300 mg IV over 1 h to prevent recurrence **[core]**
- Identify and treat reversible cause: 12-lead ECG for STEMI (consider urgent cath lab), troponin, K^+ / Mg^{2+} , bedside echo **[core]**

References: Tintinalli's Emergency Medicine 9e Ch 19 • ANZCOR Guidelines (current)

Question 19 | WPW — Haemodynamic Instability (11 marks)

A 32-year-old man presents with sudden palpitations and near-syncope. BP 75/45, GCS 14. The ECG shows an irregular broad-complex tachycardia at 250 bpm.

[ECG] 12-lead ECG

a) List 6 ECG abnormalities and the supporting evidence. (6 marks)

- Broad-complex tachycardia (QRS >120 ms)
- Irregularly irregular rhythm (consistent with pre-excited AF)
- Variable QRS morphology
- Delta waves (slurred QRS upstroke) on conducted beats
- Short PR / no P waves visible (AF substrate)
- Very rapid ventricular rate (often >220 bpm) — accessory pathway conduction
- Concordance may be present

b) List the 5 key management steps. (5 marks)

- Recognise haemodynamic instability — IMMEDIATE synchronised DC cardioversion 150–200 J biphasic **[core]**
- Sedate with ketamine 1 mg/kg + fentanyl 1 mcg/kg (BP-friendly) **[core]**
- DO NOT give adenosine, verapamil, diltiazem, β -blockers or digoxin (risk of VF) **[core]**
- Post-cardioversion: amiodarone 300 mg IV over 1 h
- Cardiology referral for EP study and ablation

References: Tintinalli's Emergency Medicine 9e Ch 18

Question 20 | ACS — ECG Interpretation (10 marks)

A 58-year-old man presents with central chest pain radiating to the left arm, lasting 1 hour. He is sweaty and pale. BP 140/85, HR 90. The ECG is provided.

[ECG] 12-lead ECG**a) List 4 ECG abnormalities you would look for in suspected STEMI. (4 marks)**

- ST elevation ≥ 1 mm in 2 contiguous leads (≥ 2 mm in V_2-V_3) **[core]**
- Hyperacute (tall, broad) T waves
- Reciprocal ST depression in opposing leads
- Q waves (established infarction)
- New LBBB (Sgarbossa criteria) — STEMI equivalent
- Posterior leads / right-sided leads if inferior changes

b) Name the coronary artery territories for ECG findings. (2 marks)

ECG leads	Coronary territory
II, III, aVF	RCA (or dominant LCx)
V_1-V_4	LAD
I, aVL, V_5-V_6	LCx / diagonal
V_1-V_2 tall R + ST depression	Posterior (RCA-PDA / LCx)

c) List 4 management priorities for confirmed STEMI. (4 marks)

- Activate cath lab — primary PCI within 90–120 min (door-to-balloon) **[core]**
- Dual antiplatelet: Aspirin 300 mg PO + Ticagrelor 180 mg PO (or clopidogrel 600 mg if older / fibrinolysis) **[core]**
- Anticoagulation: Heparin 60 U/kg IV bolus (max 4000 U) or enoxaparin
- Analgesia: fentanyl 25–50 mcg IV titrated; GTN SL 300–600 mcg if SBP >90 and no RV involvement
- O₂ only if SpO₂ <94%

References: NHF/CSANZ ACS Guidelines 2016 (updated) • Tintinalli's Emergency Medicine 9e Ch 49

Question 21 | Anterior STEMI (14 marks)

A 56-year-old man presents with crushing central chest pain for 90 minutes. He is diaphoretic. BP 130/80, HR 95. The 12-lead ECG shows ST elevation in V_1-V_4 .

[ECG] 12-lead ECG**a) List 5 ECG abnormalities with supporting evidence. (5 marks)**

- ST elevation ≥ 1 mm in V_1-V_4 (≥ 2 mm in V_2-V_3)
- Hyperacute T waves anteriorly
- Reciprocal ST depression inferiorly (II, III, aVF)
- Loss of R-wave progression / QS pattern
- New LBBB / Sgarbossa positive (STEMI equivalent)

b) State the clinical significance. (2 marks)

Proximal LAD occlusion causing anterior STEMI — the highest-mortality STEMI territory. Risk of large LV infarct, cardiogenic shock, ventricular arrhythmia, mechanical complications (VSD, free-wall rupture, papillary muscle rupture).

c) List 3 life-threatening complications. (3 marks)

- Acute LV failure / cardiogenic shock
- Ventricular arrhythmia (VF, VT)
- Complete AV block (LAD distribution to conducting system)
- Free-wall rupture
- Ventricular septal rupture (VSD)
- Acute mitral regurgitation (papillary muscle rupture)

d) List 4 factors determining disposition. (4 marks)

- Access to PCI (door-to-balloon achievable $<90-120$ min)
- Contraindications to fibrinolysis (if PCI unavailable)
- Haemodynamic stability — need for ITU/CCU
- Presence of complications (arrhythmia, shock, mechanical)
- Time from symptom onset (window for fibrinolysis <12 h)

References: NHF/CSANZ ACS Guidelines 2016 (updated) • Tintinalli's Emergency Medicine 9e Ch 49

Question 22 | STEMI with Cardiogenic Shock (12 marks)

A 70-year-old woman presents with chest pain for 2 hours. BP 75/45, HR 110, SpO₂ 92% RA. The ECG shows anterolateral ST elevation. Bedside echo demonstrates anterior wall akinesis.

[ECG] 12-lead ECG

a) List 4 ECG abnormalities. (4 marks)

- ST elevation in V₂–V₆ (anterolateral)
- Reciprocal ST depression inferiorly
- Hyperacute T waves
- Sinus tachycardia
- Loss of R-wave progression

b) State the diagnosis. (2 marks)

Anterolateral STEMI complicated by cardiogenic shock (Killip class IV).

c) List 6 management steps. (6 marks)

- Activate cath lab IMMEDIATELY — cardiogenic shock + STEMI mandates emergency primary PCI regardless of symptom duration **[core]**
- Aspirin 300 mg PO + Ticagrelor 180 mg PO (or prasugrel 60 mg if no prior stroke and PCI planned)
- Heparin 60 U/kg IV bolus (max 4000 U)
- Vasopressor: noradrenaline 0.05–0.5 mcg/kg/min IV (preferred over dopamine in cardiogenic shock)
- Inotrope: dobutamine 5–20 mcg/kg/min if low CO and adequate MAP
- Mechanical support consideration (IABP / VA-ECMO) — discuss with ICU/cardiology
- Intubation if respiratory failure or declining GCS; target SpO₂ 94–98%

References: NHF/CSANZ ACS Guidelines 2016 (updated) • Tintinalli's Emergency Medicine 9e Ch 49 • ANZICS shock guidelines

Question 23 | Pleuritic Chest Pain — Pericarditis vs PE (14 marks)

A 32-year-old woman recently returned from a long-haul flight presents with sharp pleuritic chest pain and dyspnoea. BP 120/75, HR 110, SpO₂ 95% RA. The 12-lead ECG is shown.

[ECG] 12-lead ECG

a) List 3 ECG abnormalities. (3 marks)

- Sinus tachycardia
- Widespread saddle-shaped ST elevation (concave-up) — pericarditis
- PR depression in limb / precordial leads, PR elevation in aVR
- Or — S₁Q₃T₃, RBBB, T inversion V₁–V₄ (PE)
- Low voltage / electrical alternans (effusion)

b) State the most likely diagnosis with 2 supporting features. (3 marks)

Acute pericarditis (or PE — depending on ECG). Supporting features: pleuritic pain worse lying down, ECG saddle ST + PR depression, recent viral URTI, friction rub on auscultation. Context of long-haul flight raises PE — must exclude with CTPA.

c) List 3 additional investigations. (3 marks)

- Bedside echocardiogram — effusion, RV dilation, tamponade
- CTPA — exclude PE (Wells / PERC justified given travel)
- Troponin — myopericarditis vs ACS
- CRP / ESR — inflammatory markers
- Viral serology (Coxsackie, EBV, CMV, influenza)

d) List 5 aetiological categories of pericarditis with 1 example each. (5 marks)

Category	Example
Viral	Coxsackie B, enterovirus, EBV, CMV
Bacterial	TB; staph aureus (purulent)
Autoimmune / connective tissue	SLE, RA, sarcoidosis
Neoplastic	Lung, breast, lymphoma
Metabolic	Uraemia, hypothyroidism
Post-cardiac injury	Dressler's, post-cardiotomy, post-ablation
Idiopathic	Most common after viral exclusion

References: Tintinalli's Emergency Medicine 9e Ch 54 (Pericardial Disease) • ESC Guidelines on the Diagnosis and Management of Pericardial Diseases 2015

Question 24 | Posterior STEMI / RV Infarct (12 marks)

A 55-year-old man presents with severe chest pain. BP 100/60. The ECG shows ST depression in V_1 – V_3 with tall R waves, and ST elevation in II, III, aVF.

[ECG] 12-lead ECG

a) List 2 significant ECG findings and state your interpretation. (3 marks)

- ST depression V_1 – V_3 with tall R waves = posterior STEMI (mirror image)
- ST elevation II, III, aVF = inferior STEMI
- Look for RV involvement — V_3R , V_4R ST elevation
- Diagnosis: **inferior + posterior STEMI**, likely RCA occlusion, possible RV infarction

b) State the criteria for posterior STEMI. (3 marks)

ST depression ≥ 0.5 mm in V_1 – V_3 with tall, broad R waves (R/S ratio >1 in V_2) — OR ST elevation ≥ 0.5 mm in posterior leads V_7 – V_9 when applied. Right-sided leads (V_3R – V_4R) ST elevation ≥ 1 mm = RV involvement.

c) List 6 management priorities. (6 marks)

- Activate cath lab — primary PCI for RCA occlusion **[core]**
- Aspirin 300 mg + Ticagrelor 180 mg PO; heparin IV
- **CAUTION with nitrates** — preload-dependent in RV infarction; AVOID or use very cautiously
- IV fluid bolus 250–500 mL crystalloid for hypotension (preload optimisation)
- Right-sided leads V_3R – V_4R to confirm RV involvement
- Avoid morphine, β -blockers in shock; analgesia with fentanyl

References: NHF/CSANZ ACS Guidelines 2016 (updated) • Tintinalli's Emergency Medicine 9e Ch 49

Question 25 | Chest Pain — High-Risk ECG Patterns (10 marks)

A 60-year-old man presents with intermittent chest pain. Pain has resolved on arrival but his ECG shows biphasic T waves in V_2-V_3 .

[ECG] 12-lead ECG

a) Analyse the ECG, listing 3 positive findings and the most likely diagnosis. (3 marks)

Biphasic / deeply inverted T waves V_2-V_3 = **Wellens syndrome** Type A (biphasic) or Type B (symmetric T inversion). Indicates critical proximal LAD stenosis. Associated findings: preserved R wave; minimal/no ST elevation; usually present pain-free; positive troponin in ~25%.

b) List 4 differential diagnoses for these ECG changes. (4 marks)

- Wellens syndrome (proximal LAD stenosis) — must exclude
- Acute / recovering NSTEMI / unstable angina
- Pulmonary embolism (right heart strain pattern)
- Cardiomyopathy (HCM, apical / Takotsubo)
- CNS event with neurogenic T-wave changes (SAH, ICH)
- Persistent juvenile T-wave pattern (in young patients)

c) List 3 features determining disposition. (3 marks)

- Serial ECG changes (dynamic ST/T changes mandate admission)
- High-sensitivity troponin trajectory (0 h and 1–3 h)
- Clinical risk score (HEART, GRACE)
- Access to invasive coronary angiography
- Patient comorbidities and goals of care

References: NHF/CSANZ ACS Guidelines 2016 (updated) • Tintinalli's Emergency Medicine 9e Ch 49

Question 26 | ACS Risk Stratification & Troponin (12 marks)

A 65-year-old man presents with intermittent chest pain over 24 hours. His ECG is unremarkable. You are working him up for ACS in line with NHF/CSANZ pathways.

a) List 4 NHF/CSANZ high-risk features for ACS, excluding ST elevation and elevated troponin. (4 marks)

- Recurrent ischaemic chest pain despite anti-anginal therapy
- Dynamic ST-segment changes (≥ 0.5 mm depression or new T-wave inversion ≥ 2 mm)
- Haemodynamic instability (hypotension, syncope)
- Heart failure / new pulmonary congestion
- Sustained ventricular tachycardia / VF
- Known left ventricular dysfunction (LVEF $< 40\%$)
- Diabetes mellitus
- Renal insufficiency (eGFR < 60)
- Prior MI, PCI or CABG
- High GRACE / TIMI risk score

b) List 4 components of low-risk criteria suitable for early discharge. (4 marks)

- Two undetectable / unchanged high-sensitivity troponins (0 h and 1–3 h) below the 99th percentile delta
- Normal serial 12-lead ECGs
- Pain-free at the time of assessment
- No high-risk features (see above)
- Low validated risk score (HEART ≤ 3 , EDACS < 16)
- Adequate follow-up arranged

c) List 8 causes of elevated troponin other than type 1 MI. (4 marks)

Cardiac causes	Non-cardiac causes
Myocarditis	Pulmonary embolism
Heart failure (acute decompensation)	Sepsis / critical illness
Takotsubo cardiomyopathy	Stroke / SAH (neurogenic)
Arrhythmia (sustained VT/VF, fast AF)	Chronic renal failure
Cardiac contusion	Severe anaemia / hypoxia
Post-cardioversion / ablation	Strenuous exercise (rare)

References: NHF/CSANZ ACS Guidelines 2016 (updated) • Fourth Universal Definition of Myocardial Infarction 2018 • Tintinalli's Emergency Medicine 9e Ch 49

Question 27 | Pericardial Effusion / Tamponade — Part 1 (16 marks)

A 45-year-old woman 6 weeks post-cardiac surgery presents with pleuritic chest pain, dyspnoea and presyncope. JVP is elevated, BP 95/70 with a 15 mmHg pulsus paradoxus, HR 120.

a) List 5 differential diagnoses for this presentation. (5 marks)

- Cardiac tamponade (post-cardiotomy effusion / Dressler's) [core]
- Pulmonary embolism
- Pneumonia / pleurisy
- Acute coronary syndrome
- Aortic dissection
- Tension pneumothorax
- Acute heart failure

b) List 3 immediate investigations and the rationale for each. (6 marks)

Investigation	Rationale
Bedside echocardiography (POCUS)	Diagnose pericardial effusion and tamponade physiology (RA/RV diastolic collapse, IVC plethora, septal bounce)
12-lead ECG	Electrical alternans, sinus tachycardia, low voltage; exclude ischaemia
CT pulmonary angiogram	Exclude PE; visualise effusion, aortic dissection, mediastinal pathology

c) List 5 echocardiographic features supporting cardiac tamponade. (5 marks)

- Pericardial effusion (anechoic space) [core]
- Right atrial systolic collapse (early, sensitive) [core]
- Right ventricular diastolic collapse (more specific)
- IVC plethora — IVC >2.1 cm with <50% inspiratory collapse
- Septal shift / 'D-sign' with respiration
- Swinging heart in large effusions

References: Tintinalli's Emergency Medicine 9e Ch 54 • ESC Pericardial Diseases Guidelines 2015

Question 28 | Infective Endocarditis — IVDU (10 marks)

A 28-year-old IVDU presents with fever, bibasal crackles, and a new tricuspid regurgitation murmur. He has multiple track marks. Vital signs: T 39.0, HR 120, BP 105/65.

a) State the most likely diagnosis. (1 mark)

Right-sided infective endocarditis (tricuspid valve) with septic pulmonary emboli.

b) List 4 components of the modified Duke criteria. (4 marks)

- **Major** — Positive blood cultures (typical organism × 2 separate sets, OR persistent bacteraemia)
- **Major** — Endocardial involvement on echo (vegetation, abscess, new prosthetic dehiscence) OR new valvular regurgitation
- **Minor** — Predisposing condition (IVDU, prosthetic valve)
- **Minor** — Fever $\geq 38^{\circ}\text{C}$
- **Minor** — Vascular phenomena (septic emboli, Janeway lesions, mycotic aneurysm)
- **Minor** — Immunological phenomena (Osler nodes, Roth spots, glomerulonephritis, RF+)
- **Minor** — Microbiology not meeting major

c) Name the 2 most common causative organisms in IVDU. (2 marks)

- *Staphylococcus aureus* (including MRSA)
- Streptococcal species (viridans group, β -haemolytic)
- Coagulase-negative staphylococci
- *Candida* species (in immunocompromised / shared needles)
- *Enterococcus* species

d) Name the empiric antibiotic regimen with dose. (3 marks)

Vancomycin 25–30 mg/kg IV loading, then 15–20 mg/kg q8–12 h (target trough 15–20 mg/L) — covers MSSA, MRSA, streptococci, enterococci.

+ Gentamicin 1 mg/kg IV q8 h (synergy for enterococcal cover) — adjust per renal function and infectious diseases input.

Review per culture results; ID consultation; 4–6 weeks minimum IV course.

References: Tintinalli's Emergency Medicine 9e Ch 154 (Endocarditis) • eTG (Therapeutic Guidelines, current): Antibiotic • ESC Guidelines on Endocarditis 2023

Question 29 | Pericarditis — ECG and Diagnosis (16 marks)

A 25-year-old man presents with sharp central chest pain worse on inspiration and lying flat. He had a viral URTI 1 week ago. The ECG shows widespread ST elevation.

[ECG] 12-lead ECG

a) List 3 ECG abnormalities. (3 marks)

- Widespread saddle-shaped (concave-up) ST elevation
- PR depression (limb and precordial leads); PR elevation in aVR
- Sinus tachycardia
- Low voltage QRS (if effusion)
- Spodick sign — downsloping T-P segment

b) List 2 features that favour benign early repolarisation over pericarditis. (2 marks)

- ST elevation localised to V_2-V_5 only (not widespread)
- Notching / slurring at the J-point ('fishhook')
- No PR depression
- Stable on serial ECGs
- ST/T ratio in V_6 <0.25 (Spodick ratio)

c) List 5 causes of pericarditis. (5 marks)

- Viral (Coxsackie B, EBV, CMV, influenza, COVID-19)
- Bacterial (TB, purulent — staph, strep)
- Post-MI (early Dressler's days 2–4; late at 2–8 weeks)
- Autoimmune (SLE, RA, sarcoidosis)
- Uraemic
- Malignant (lung, breast, lymphoma)
- Idiopathic (most common after exclusion)

d) List 3 investigations for pericardial effusion. For each name a positive finding. (6 marks)

Investigation	Positive finding
Bedside echo (POCUS)	Anechoic fluid surrounding heart; RA/RV collapse if tamponade
Chest X-ray	Enlarged 'water-bottle' cardiac silhouette $>50\%$ CTR
CT chest	Pericardial fluid (HU <20 = serous, >20 = haemorrhage / exudate); pericardial thickening
Cardiac MRI	Late gadolinium enhancement of pericardium; characterises constrictive vs effusive

References: Tintinalli's Emergency Medicine 9e Ch 54 • ESC Pericardial Disease Guidelines 2015

Question 30 | Post-CABG Chest Pain (13 marks)

A 70-year-old man presents with chest pain 5 days post-CABG. BP 90/60, HR 110, JVP elevated, muffled heart sounds. He has completed enoxaparin prophylaxis.

a) List 5 differential diagnoses. (5 marks)

- Pericardial effusion / tamponade (post-cardiotomy) [core]
- Graft occlusion / perioperative MI
- Pulmonary embolism (post-op hypercoagulable)
- Mediastinal haematoma
- Pleural effusion / pneumonia / atelectasis
- Post-pericardiotomy syndrome (Dressler's variant)
- Cardiac arrhythmia (post-op AF)

b) List 3 bedside investigations with justification. (6 marks)

Investigation	Justification
Bedside echo (POCUS)	Tamponade physiology, regional wall motion abnormality, graft compromise
12-lead ECG	Ischaemic changes, electrical alternans, arrhythmia
VBG with lactate and Hb	Lactate / acid-base for end-organ perfusion; Hb for occult bleeding / haemothorax

c) List 2 end-points of haemodynamic resuscitation. (2 marks)

- MAP ≥ 65 mmHg (cerebral and renal perfusion)
- Lactate clearance and / or trend < 2 mmol/L
- Urine output ≥ 0.5 mL/kg/h
- Resolution of clinical shock features

References: Tintinalli's Emergency Medicine 9e Ch 53 • Cameron's Textbook of Adult Emergency Medicine 5e

Question 31 | CHF — LVH / Aortic Stenosis (11 marks)

A 78-year-old man presents with exertional syncope, breathlessness and a slow-rising carotid pulse. The ECG shows voltage criteria for LVH with strain pattern. A harsh ejection systolic murmur radiates to the carotids.

a) List 2 ECG abnormalities. (2 marks)

- Left ventricular hypertrophy (Sokolow–Lyon: $S V_1 + R V_5/V_6 > 35$ mm)
- ST depression / T-wave inversion in lateral leads (strain pattern)
- Left atrial enlargement (P-mitrale)
- Left axis deviation

b) State the clinical significance. (2 marks)

LVH with strain in the context of exertional syncope, breathlessness and a carotid-radiating murmur is highly concerning for **severe symptomatic aortic stenosis**. Once symptomatic (syncope / angina / dyspnoea), median survival without intervention is ~2–3 years.

c) List 4 differential diagnoses for the ECG findings. (4 marks)

- Aortic stenosis (pressure overload — most likely)
- Hypertensive heart disease
- Hypertrophic obstructive cardiomyopathy (HCM)
- Aortic regurgitation (volume-overload LVH)
- Coarctation of the aorta

d) Name 3 cardiac investigations with justification. (3 marks)

Investigation	Justification
Transthoracic echocardiogram	Quantify aortic valve area (severe < 1 cm ²), mean gradient (> 40 mmHg severe), LV function
Coronary angiography	Required pre-AVR / TAVI to identify concomitant CAD
BNP / NT-proBNP	Severity stratification and prognosis

References: Tintinalli's Emergency Medicine 9e Ch 53 • NHF Heart Failure Guidelines 2018

Question 32 | VF / Polymorphic VT (16 marks)

A 60-year-old man collapses in the waiting room. CPR is underway. The defibrillator monitor shows a chaotic, irregular wide-complex rhythm with no organised QRS.

[RHYTHM STRIP] Lead II rhythm strip

a) State the diagnosis. (1 mark)

Ventricular fibrillation (or polymorphic VT).

b) List 3 ECG features. (3 marks)

- Chaotic, irregular QRS with varying morphology and amplitude
- No identifiable P waves, no organised QRS
- Rate >300 bpm if polymorphic VT
- Preceding long QTc if TdP component

c) List 5 potential causes. (5 marks)

- Acute MI / ischaemic heart disease (commonest)
- Cardiomyopathy (dilated, hypertrophic, ARVC)
- Long QT syndrome (congenital or acquired)
- Electrolyte disturbance (hypokalaemia, hypomagnesaemia)
- WPW with rapid AF degenerating to VF
- Brugada syndrome
- Hypothermia
- Drug toxicity (TCA, digoxin, cocaine)

d) List the 3 immediate management priorities. (3 marks)

- High-quality CPR (100–120/min, depth 5 cm, full recoil) with minimal interruption **[core]**
- Defibrillation 200 J biphasic (or device-specific) as soon as available — repeat every 2 min **[core]**
- Adrenaline 1 mg IV after 2nd shock; amiodarone 300 mg IV after 3rd shock; address 4Hs/4Ts **[core]**

e) List 2 subsequent management options post-ROSC, with rationale. (4 marks)

Option	Rationale
Targeted temperature management 32–36°C × 24 h	Neuroprotection in unconscious post-cardiac arrest patient (per ANZCOR / TTM trials)
Coronary angiography ± PCI	Identify and treat coronary occlusion, especially if STEMI on post-ROSC ECG or shockable rhythm with presumed cardiac cause

References: ANZCOR Guidelines (current) • Tintinalli's Emergency Medicine 9e Ch 17 & 19

Question 33 | Dizziness — AV Block (13 marks)

A 65-year-old man presents with exertional dizziness. The 12-lead ECG shows AV dissociation with regular P waves at 85 bpm and an independent ventricular escape rhythm at 38 bpm.

[ECG] 12-lead ECG**a) State the diagnosis with 3 supporting ECG findings. (4 marks)**

Complete (third-degree) AV block.

- P waves and QRS complexes are dissociated
- Regular P-P at faster rate than R-R
- Slow ventricular escape (wide QRS <40 bpm = ventricular origin; narrow 40–60 = junctional)
- Atrial rate exceeds ventricular rate

b) List 4 possible causes. (4 marks)

- Inferior MI (RCA → AV node)
- Drug-induced (β -blocker, CCB, digoxin, amiodarone)
- Degenerative conduction disease (Lev / Lenègre)
- Hyperkalaemia
- Lyme disease / viral myocarditis
- Infiltrative (sarcoid, amyloid)
- Post-cardiac surgery / ablation
- Congenital (maternal SLE)

c) List 3 clinical indications for urgent pacing. (3 marks)

- Haemodynamic instability (hypotension, syncope, $\downarrow$ GCS)
- Symptoms (presyncope, dyspnoea) refractory to atropine
- Escape rate <40 with symptoms
- Need to administer further AV-blocking drugs for another indication

d) Name 2 chemical pacing agents with dose. (2 marks)

- Atropine 600 mcg IV (repeat q3–5 min, max 3 mg)
- Isoprenaline infusion 1–10 mcg/min IV
- Adrenaline infusion 2–10 mcg/min IV
- Glucagon 5–10 mg IV (β -blocker / CCB toxicity)

References: Tintinalli's Emergency Medicine 9e Ch 17 • ANZCOR Guidelines (current)

Question 34 | ECHO — Tamponade & Pericardiocentesis (13 marks)

A 70-year-old woman with metastatic breast cancer presents with severe dyspnoea. JVP elevated, BP 95/70, pulsus paradoxus 18 mmHg. Bedside echo is performed.

[ECHO IMAGE] Subcostal 4-chamber view

a) Name the cardiac window shown. (1 mark)

Subxiphoid (subcostal) 4-chamber view — preferred for pericardiocentesis guidance.

b) List 3 echocardiographic findings of tamponade. (3 marks)

- Right atrial systolic collapse (early, sensitive) **[core]**
- Right ventricular diastolic collapse (specific) **[core]**
- IVC plethora (>2.1 cm with <50% inspiratory collapse)
- Septal 'D-sign' / paradoxical septal motion
- Swinging heart in large effusion

c) List 5 causes of pericardial effusion. (5 marks)

- Malignancy (lung, breast, lymphoma)
- Viral pericarditis / idiopathic
- Uraemia (renal failure)
- Bacterial / TB pericarditis
- Autoimmune (SLE, RA)
- Post-MI (Dressler's) / post-cardiotomy
- Trauma (blunt / penetrating)
- Hypothyroidism

d) List 4 key technical steps for pericardiocentesis. (4 marks)

Step	Detail
Patient position	Semi-recumbent at 30–45° to pool fluid anteriorly
Equipment	18 G 10-cm spinal needle on syringe; ultrasound; ECG monitoring; pericardial drain kit
Insertion site	Subxiphoid — 1 cm below xiphoid, 1 cm left of midline; OR apical 5th ICS anterior axillary line under US
Needle direction	Aim for left shoulder at 30–45°; aspirate continuously; advance under real-time US guidance; stop on ST elevation (myocardial contact)

References: Tintinalli's Emergency Medicine 9e Ch 54 • ACEM Position Statement on POCUS • ESC Pericardial Disease Guidelines 2015

Question 35 | Hypertensive Emergency (11 marks)

A 55-year-old man presents with acute symptoms and BP 220/130. He has a chronic background of poorly controlled hypertension.

a) Define hypertensive emergency. (1 mark)

Severe BP elevation (typically SBP >180 mmHg or DBP >120 mmHg) **WITH evidence of acute end-organ damage**. Distinguished from hypertensive urgency (no end-organ damage), where management approach is different.

b) Name 6 end organs. For each state a manifestation, investigation and drug of choice. (6 marks)

Organ	Manifestation	Investigation	Drug of choice
Brain	Headache, ↓GCS, focal deficit, encephalopathy	CT head ± CTA	Labetalol or nicardipine IV
Eye	Papilloedema, flame haemorrhages, blurred vision	Fundoscopy	Labetalol IV
Heart	ACS, APO, S ₃	ECG, troponin, CXR	GTN IV (APO); labetalol (ACS)
Aorta	Tearing chest/back pain, unequal BPs	CT aortogram	Labetalol IV (target SBP <120)
Kidney	Oliguria, haematuria, ↑Cr	UEC, urinalysis	Nicardipine IV
Pregnancy	Pre-eclampsia / eclampsia (seizures, proteinuria)	Urinalysis, FBC, LFT, UEC, urate	MgSO ₄ + hydralazine or labetalol IV

c) Name 4 drug classes with example, dose and route. (4 marks)

Class	Example	Dose
α/β-blocker	Labetalol	20 mg IV bolus → repeat q10 min (max 300 mg) OR 0.5–2 mg/min infusion
Dihydropyridine CCB	Nicardipine	5 mg/h IV, ↑ by 2.5 mg/h q5 min, max 15 mg/h
Nitrate	GTN	5–200 mcg/min IV (preferred for APO / ACS)
Vasodilator	Hydralazine	5–10 mg IV q20 min (pre-eclampsia)

Marker's note: Reduce MAP ≤25% in the first hour to avoid ischaemic complications, except in aortic dissection (more aggressive).

References: Tintinalli's Emergency Medicine 9e Ch 57 (Hypertensive Emergencies) • eTG (Therapeutic Guidelines, current)

Question 36 | Hypertensive Encephalopathy (12 marks)

A 60-year-old man presents with BP 240/140, severe headache, vomiting, and reduced GCS (E3 V4 M6 = 13). He has no focal neurology.

a) State the most likely diagnosis. (1 mark)

Hypertensive encephalopathy. Intracranial haemorrhage (hypertensive ICH, SAH) MUST be excluded by CT before aggressive BP lowering.

b) List 3 investigations. For each state the justification. (6 marks)

Investigation	Justification
Non-contrast CT head	Exclude ICH / SAH BEFORE aggressive BP lowering; identify cerebral oedema or PRES
12-lead ECG + troponin	LVH, ischaemia (hypertension may be precipitated by ACS or vice versa)
UEC + urinalysis	Hypertensive nephropathy, hypokalaemia (renovascular / Conn's), proteinuria / haematuria

c) List 5 management priorities. (5 marks)

- CT head FIRST — exclude ICH before BP lowering **[core]**
- Reduce MAP by no more than 20–25% in the first hour **[core]**
- IV antihypertensive: labetalol 20 mg IV bolus or nicardipine 5 mg/h IV infusion
- Airway protection if GCS ≤ 8 (intubation with appropriate induction agents)
- Investigate for secondary cause (renovascular, Conn's, pheochromocytoma, drug exposure)
- Admit to monitored bed (HDU/CCU); arterial line for BP titration

References: Tintinalli's Emergency Medicine 9e Ch 57 • eTG (Therapeutic Guidelines, current)

Question 37 | Murmur — Trainee in Difficulty (14 marks)

A junior registrar presents a 78-year-old man with exertional syncope, breathlessness, and a mid-systolic murmur radiating to the carotids. The registrar wants to discharge the patient. You are also concerned that this registrar has been struggling for several weeks.

a) List 3 differential diagnoses for the murmur. For each state 1 auscultation feature and the clinical significance. (6 marks)

Diagnosis	Auscultation feature	Significance
Aortic stenosis	Harsh crescendo-decrescendo, RUSB, radiates to carotids; soft/absent A ₂ ; slow-rising pulse	Symptomatic = surgical emergency; ~50% 3-yr mortality without AVR
Hypertrophic obstructive cardiomyopathy	↑ with Valsalva / standing; ↓ with squatting; S ₄	Risk of SCD, especially exertional; restrict activity
Mitral regurgitation	Pansystolic at apex, radiates to axilla	Acute MR (papillary rupture) = emergency

b) State the disposition advice. (2 marks)

Do not discharge. Admit for urgent cardiology review and inpatient TTE. Exertional syncope + breathlessness + carotid-radiating mid-systolic murmur strongly suggests severe symptomatic aortic stenosis with ~50% 3-year mortality without AVR / TAVI.

c) List 4 early warning signs of a trainee in difficulty. (2 marks)

- Failure to progress (repeated competency / assessment failures)
- Avoidance behaviour (missed shifts, swapped duties, late)
- Interpersonal difficulties (conflict with nurses / colleagues; failure to escalate)
- Clinical errors or near-misses
- Poor time management / disorganisation
- Signs of physical or psychological distress (presenteeism, appearance change)

d) List 4 components of a structured performance plan. (4 marks)

- Clear, evidenced concerns documented with specific examples
- Achievable SMART goals with defined timelines
- Regular check-ins / progress reviews (frequency stated)
- Defined support structures (DEMT, ES, mentor, EAP)
- Agreed outcomes if targets not met (extension, escalation, fitness-to-practise pathway)
- Notification to College / training supervisor as required

References: Tintinalli's Emergency Medicine 9e Ch 53 • ACEM Trainee Wellbeing and Performance Guidance • AMA Code of Ethics — colleague support

Question 38 | AF — Rate vs Rhythm + Anticoagulation (16 marks)

A 76-year-old woman with hypertension on irbesartan presents with palpitations. The ECG shows AF with ventricular rate 120 bpm. She is haemodynamically stable. Symptom onset is uncertain.

[ECG] 12-lead ECG

a) State the main ECG finding. (2 marks)

Atrial fibrillation with rapid ventricular response (~120 bpm). Irregularly irregular narrow-complex rhythm; absent organised P waves; fibrillatory baseline.

b) List 4 factors favouring rate control AND 4 factors favouring rhythm control. (8 marks)

Favours rate control	Favours rhythm control
Elderly (age >65)	Younger / active lifestyle
Longstanding / persistent AF	First episode or onset clearly <48 h
Asymptomatic / minimally symptomatic	Highly symptomatic despite rate control
Significant structural heart disease	Minimal / no structural heart disease
Multiple failed cardioversion attempts	Reversible precipitant (e.g. infection treated)

c) List 6 factors that influence the anticoagulation decision in this patient. (6 marks)

- CHA₂DS₂-VASc score: HTN (1) + age ≥75 (2) + female (1) = 4 → anticoagulation strongly indicated [core]
- HAS-BLED score (bleeding risk)
- Renal function (drives DOAC choice and dose)
- Hepatic function
- Falls risk (assess but not absolute contraindication)
- Patient preference and ability to comply
- Drug interactions (antiplatelets, CYP3A4)
- DOAC vs warfarin (DOAC preferred for non-valvular AF)

References: NHF/CSANZ AF Guidelines 2018 (updated 2023) • Tintinalli's Emergency Medicine 9e Ch 18

Question 39 | AF — Rate Control & Risk Stratification (10 marks)

A 65-year-old man presents with palpitations and 3 days of exertional dyspnoea. ECG shows AF with rate 130 bpm. He has controlled hypertension on perindopril.

[ECG] 12-lead ECG

a) State your ECG interpretation. (2 marks)

Atrial fibrillation with rapid ventricular response ~130 bpm. Irregularly irregular narrow-complex rhythm; no organised P waves; fibrillatory baseline.

b) List 4 possible underlying causes. (4 marks)

- Hypertension / hypertensive heart disease (most common)
- Pulmonary embolism (3-day SOB)
- Pneumonia / sepsis
- Thyrotoxicosis
- Ischaemic heart disease
- Electrolyte disturbance
- Alcohol / sleep apnoea

c) Name 2 rate-control medications with dose. (2 marks)

- Metoprolol 2.5–5 mg IV q5 min (max 15 mg) — first-line if normal LV and no asthma
- Diltiazem 0.25 mg/kg IV over 2 min, then 5–15 mg/h infusion — preferred if β -blocker contraindicated
- Digoxin 500 mcg IV (slow), then 250 mcg q4–6 h — preferred if heart failure or hypotension

d) State the risk stratification approach. (2 marks)

CHA₂DS₂-VASc: age 65 (1) + HTN (1) = score 2 → anticoagulation recommended (DOAC). If >48 h or unknown duration and rhythm control considered: TOE or 3 weeks therapeutic anticoagulation before cardioversion.

References: NHF/CSANZ AF Guidelines 2018 (updated 2023)

Question 40 | Out-of-Hospital Cardiac Arrest — Post-ROSC (14 marks)

A 70-year-old woman has ROSC after a witnessed VF arrest with bystander CPR. She remains intubated. Her medication list includes warfarin, digoxin, frusemide and spironolactone. She requires aeromedical transfer to a PCI-capable centre 200 km away.

[ECG] Post-ROSC 12-lead ECG

a) List 3 main ECG findings to look for post-ROSC. (3 marks)

- ST elevation suggesting STEMI (mandates cath lab)
- QTc prolongation (post-arrest, drug-induced)
- Digoxin effect (sagging ST, reverse-tick)
- AF (consistent with anticoagulation)
- Bradycardia / heart block

b) List 3 likely contributors to dysrhythmia in this patient. (3 marks)

- Digoxin toxicity (potentiated by frusemide-induced hypokalaemia, renal impairment)
- Hypokalaemia / hypomagnesaemia (loop diuretics)
- Acute coronary ischaemia
- Post-arrest myocardial stunning

c) List 4 minimum monitoring parameters required for aeromedical transfer. (4 marks)

- Continuous 3- or 5-lead ECG with defibrillation capability
- End-tidal CO₂ (capnography) — intubated patient
- Continuous SpO₂
- Non-invasive BP (preferably arterial line)
- Temperature monitoring (TTM target 36°C)
- Two functional IV lines confirmed

d) List 2 transport-related hazards in helicopter transfer and an effect on management for each. (4 marks)

Hazard	Management impact
Noise & vibration	Cannot auscultate; ECG / SpO ₂ artefact; rely on capnography and arterial pressure
Limited space	Difficult to perform CPR / procedures; pre-position kit; intubate before flight if borderline
Altitude / pressurisation	Gas expansion (deflate ETT cuff with saline; pneumothorax expands)
Temperature / motion sickness	Antiemetics; secure warming; sedation as needed

References: ANZCOR Guidelines (current) • ANZCOR Post-Resuscitation Guidelines • RFDS / aeromedical transfer SOP

Question 41 | Post-OHCA — SAH on Imaging (18 marks)

A 55-year-old woman has ROSC after a witnessed VF arrest. Her post-ROSC ECG shows widespread T-wave inversion and QTc 520 ms. CT head shows extensive subarachnoid haemorrhage.

[ECG AND CT HEAD] 12-lead ECG + non-contrast CT head

a) List 3 ANZCOR indications for emergent cardiac catheterisation post-OHCA. (3 marks)

- ST elevation on post-ROSC ECG (STEMI pattern)
- Haemodynamic instability with suspected cardiac cause
- Suspected acute coronary cause based on history / risk factors / pre-arrest symptoms

b) List 2 key ECG abnormalities in this case. (2 marks)

- Widespread deep T-wave inversion (cerebral T waves)
- QTc prolongation (520 ms)

c) State the clinical significance. (2 marks)

Neurogenic ECG changes due to massive sympathetic surge from SAH — can mimic STEMI or Wellens. Avoiding unnecessary PCI / fibrinolysis is critical because anticoagulation will worsen ICH. Cardiology and neurosurgical input together.

d) State the CT diagnosis. (1 mark)

Subarachnoid haemorrhage — hyperdense blood in basal cisterns, Sylvian fissures, or sulci.

e) List 4 CT findings portending poor prognosis in SAH. (4 marks)

- High Fisher / modified Fisher grade (thick clot, IVH)
- Intraventricular haemorrhage with hydrocephalus
- Cerebral oedema / loss of grey-white differentiation (post-arrest hypoxic injury)
- Midline shift / herniation
- Large haematoma volume

f) List 3 differential causes for cardiac arrest with intracranial pathology, with assessment finding and key intervention for each. (6 marks)

Cause	Assessment	Intervention
Aneurysmal SAH	Sentinel headache; CT pattern; Hunt-Hess grade	Neurosurgical referral; nimodipine 60 mg q4 h; BP control SBP <140; coiling/clipping
Concurrent STEMI / ACS	ST elevation post-ROSC; risk factors; troponin	Primary PCI (caveat: balance bleeding risk vs ischaemia with neurosurg input)
Hypoxic-ischaemic brain injury	GCS 3 post-ROSC; absent brainstem reflexes	Targeted Temperature Management 36°C × 24 h; neuroprotection; avoid hypoxia / hyperglycaemia

References: ANZCOR Guidelines (current) • Tintinalli's Emergency Medicine 9e Ch 167 (SAH) • ANZCOR Post-Resuscitation Care 2024

Question 42 | DDD Pacemaker Dysfunction (10 marks)

A 75-year-old man with a DDD pacemaker presents with palpitations. The ECG shows a regular wide-complex tachycardia at 130 bpm with pacemaker spikes preceding each QRS.

[ECG] 12-lead ECG

a) State the function of a DDD pacemaker. (2 marks)

DDD: **D**ual chamber paced (atrium AND ventricle), **D**ual chamber sensed, **D**ual mode response (inhibition of pacing if intrinsic activity sensed; ventricular pacing triggered by sensed atrial activity). Maintains AV synchrony; tracks atrial rate up to a programmed upper rate limit.

b) Analyse the ECG: list 2 features. (2 marks)

- Pacing spikes preceding each QRS (ventricular pacing)
- Wide QRS with LBBB-like morphology (RV apex pacing)
- Regular rhythm at 130 bpm (at programmed upper rate limit)

c) List 2 differential diagnoses. (2 marks)

- Pacemaker-mediated tachycardia (PMT) — re-entrant via retrograde V→A conduction
- Atrial tachycardia / flutter / AF tracked at upper rate limit
- Ventricular tachycardia coincident with paced rhythm
- Sensor-driven tachycardia (rate-responsive trigger)

d) List 4 management steps. (4 marks)

- 12-lead ECG and rhythm strip; compare with prior pacing ECGs
- Apply magnet briefly to convert to asynchronous (DOO) — interrupts PMT re-entry
- Treat reversible causes (electrolytes, ischaemia, sepsis)
- Pacemaker interrogation by cardiology / cardiac technician
- If unstable → synchronised DC cardioversion (anterior-posterior pads ≥8 cm from device)

References: Tintinalli's Emergency Medicine 9e Ch 20

Question 43 | Pacemaker Failure — Slow AF (12 marks)

A 78-year-old pacemaker-dependent patient presents with lightheadedness. ECG shows pacing spikes without capture and an underlying slow AF at 35 bpm. BP 90/60.

[ECG] 12-lead ECG

a) List 4 ECG findings with their clinical relevance. (4 marks)

ECG Finding	Clinical Relevance
Pacing spikes without capture	Failure to capture — lead displacement, fracture, or threshold rise
Slow underlying AF (~35 bpm)	No reliable native rhythm; pacemaker-dependent
No retrograde conducted P waves	Loss of AV synchrony
Hypotension (BP 90/60)	Haemodynamic compromise from inadequate cardiac output

b) List 6 immediate management priorities. (6 marks)

- IV access × 2, O₂, monitoring, defibrillator/pacer to bedside **[core]**
- Atropine 600 mcg IV (limited efficacy in pacemaker dependence but trial)
- Transcutaneous pacing — anterior-posterior pads, demand mode, 70–80 bpm; titrate mA to capture; sedate **[core]**
- Identify reversible causes (electrolytes, ischaemia, sepsis, drug interactions raising threshold)
- Urgent cardiology / pacing service input — interrogate device; CXR for lead position
- Prepare transvenous pacing if TCP fails

c) State the role of a magnet in pacemaker dysfunction. (2 marks)

A magnet over a pacemaker switches it to **asynchronous mode (DOO/AOO/VOO)** — fixed-rate pacing regardless of intrinsic activity. Useful for: (1) **oversensing** causing inappropriate inhibition, and (2) **pacemaker-mediated tachycardia** to interrupt re-entry. NOT useful for failure to capture (hardware/lead problem).

References: Tintinalli's Emergency Medicine 9e Ch 20

Question 44 | Complete Heart Block — Diabetic with CKD (12 marks)

A 72-year-old diabetic with chronic kidney disease (eGFR 28) presents with bradycardia and pre-syncope. ECG shows complete heart block with a wide ventricular escape at 32 bpm. K^+ on VBG is 6.5 mmol/L.

[ECG] 12-lead ECG**a) List 5 ECG abnormalities and state your interpretation. (5 marks)**

- Complete (3°) AV block — independent P and QRS
- Slow ventricular escape (<40 bpm, wide QRS = ventricular origin)
- Peaked T waves (hyperkalaemia)
- Widened QRS / loss of P waves (hyperkalaemia progression)
- Possible inferior ischaemia (RCA territory)

b) List 7 ED treatment steps in order. (7 marks)

- IV access, O_2 , monitoring, defibrillator / pacer to bedside, 12-lead ECG **[core]**
- Calcium gluconate 10 mL 10% IV (membrane stabilisation) — repeat if persistent ECG changes **[core]**
- Insulin 10 U IV + 50 mL 50% dextrose IV (intracellular K^+ shift); salbutamol 10–20 mg neb **[core]**
- Atropine 600 mcg IV (likely ineffective in distal block)
- Transcutaneous pacing — demand mode 70–80 bpm; titrate to capture; sedation
- Isoprenaline 1–10 mcg/min IV infusion (bridge to transvenous pacing)
- Urgent dialysis / cardiology referral; arrange transvenous pacing

References: Tintinalli's Emergency Medicine 9e Ch 17 • eTG (Therapeutic Guidelines, current) • ANZCOR Guidelines (current)

Question 45 | Paediatric SVT (10 marks)

A 5-year-old child presents with palpitations following salbutamol nebulisers for an asthma exacerbation. HR 240, narrow complex, regular. BP 90/50, alert.

[ECG] Paediatric 12-lead ECG**a) List 4 ECG features. (4 marks)**

- Narrow complex tachycardia (QRS <80 ms in this age)
- Regular rhythm
- Rate 200–300 bpm (typical paediatric SVT, faster than salbutamol-driven sinus tachycardia)
- P waves absent or retrograde (after QRS)
- No delta wave (excludes WPW)

b) State the most likely diagnosis. (1 mark)

Supraventricular tachycardia — most likely AVNRT or AVRT (with concealed accessory pathway). Salbutamol may have precipitated.

c) List 5 components of escalating management. (5 marks)

- Vagal manoeuvres: ice pack to face (diving reflex) in young; Valsalva in older child **[core]**
- Adenosine 0.1 mg/kg IV rapid push via large antecubital cannula with 5–10 mL flush; if fails 0.2 mg/kg (max 12 mg) **[core]**
- Synchronised DC cardioversion 0.5–1 J/kg (max 2 J/kg) if unstable or adenosine fails
- Sedate as required (ketamine 1 mg/kg IV for cardioversion)
- Admit for monitoring; paediatric cardiology referral; consider ECHO and Holter

References: Tintinalli's Emergency Medicine 9e Ch 119 (Paediatric Arrhythmias) • Cameron's Paediatric EM • Royal Children's Hospital Melbourne — SVT guideline

Question 46 | Paediatric Syncope (12 marks)

A 12-year-old presents with a syncopal episode. He is well on arrival with normal vital signs. Family history reveals an uncle who died suddenly at age 30.

a) List 4 history features concerning for cardiac cause. (4 marks)

- Exertional syncope / during exercise [core]
- Sudden onset without prodrome
- Family history of sudden cardiac death / inherited arrhythmia
- Palpitations immediately preceding syncope
- Seizure-like activity at onset (hypoxic convulsion)
- Prior episodes of structural / arrhythmic concern
- Younger age, male sex, episodes at rest

b) List 4 history features consistent with vasovagal syncope. (4 marks)

- Identifiable trigger (prolonged standing, heat, pain, venepuncture, emotional stress)
- Prodrome of nausea, diaphoresis, pallor, tunnel vision
- Rapid recovery within 1–2 minutes
- Upright position at onset
- No post-event confusion
- Recurrent in similar circumstances

c) List 4 investigations with clinical indication. (4 marks)

Investigation	Indication
12-lead ECG (mandatory)	Long QT, WPW, HCM, Brugada, heart block
Transthoracic echocardiogram	If exertional, murmur, abnormal ECG, or family history
Holter monitor / event recorder	Recurrent or palpitation-associated syncope
Tilt-table test	Recurrent vasovagal suspected
BSL, FBC, UEC	Metabolic / anaemic mimics

References: Tintinalli's Emergency Medicine 9e Ch 22 (Syncope) • Cameron's Paediatric EM

Question 47 | AF — Pharmacological Management (12 marks)

A 60-year-old man presents with palpitations and 8 hours of AF. He has known mild LV dysfunction (LVEF 45%). BP 130/80, HR 130, no chest pain.

[ECG] 12-lead ECG

a) List 2 most important ECG features. (2 marks)

- Irregularly irregular narrow-complex rhythm
- Absent P waves with fibrillatory baseline
- Rate ~130 bpm (RVR)

b) Name 5 drugs used in this patient. For each state the dose and clinical circumstance. (10 marks)

Drug	Dose	Circumstance
Metoprolol	2.5–5 mg IV q5 min (max 15 mg)	Rate control if BP and LV function adequate
Digoxin	500 mcg IV slow, then 250 mcg q4–6 h to max 1.5 mg	Rate control if reduced LV function (preferred here)
Amiodarone	300 mg IV over 20–60 min, then 900 mg/24 h	Rate or rhythm control with structural heart disease; WPW alternative
Flecainide	2 mg/kg IV over 10 min OR 200–300 mg PO	Chemical cardioversion ONLY if NO structural / ischaemic disease and onset <48 h
Heparin / DOAC	Heparin 5000 U IV bolus then infusion; or apixaban 5 mg PO BD	Anticoagulation per CHA ₂ DS ₂ -VASc

References: NHF/CSANZ AF Guidelines 2018 (updated 2023) • eTG (Therapeutic Guidelines, current)

Question 48 | Acute Rheumatic Fever — System Factors (11 marks)

An 11-year-old Aboriginal child presents with a 2-week history of migratory polyarthrititis, fever, and a new apical pansystolic murmur. ESR 80, CRP 110, ASO titre elevated.

a) List the 5 major Jones criteria. (5 marks)

- Carditis (clinical or subclinical on ECHO; new murmur, pericarditis, heart failure) **[core]**
- Polyarthrititis (migratory, large joints — knee, ankle, wrist, elbow) **[core]**
- Chorea (Sydenham's — late presentation)
- Subcutaneous nodules (firm, painless, over bony prominences)
- Erythema marginatum (transient, pink, evanescent rings)

Marker's note: Diagnosis: 2 major OR 1 major + 2 minor + evidence of preceding GAS. Australian high-risk population criteria are more sensitive (RHD Australia 2020).

b) List 2 contributing factors at each of System, Process and Individual / Patient levels. (6 marks)

Level	Contributory factor
System	Lack of culturally safe primary care; housing overcrowding driving streptococcal transmission
System	Inadequate ARF/RHD register coverage and recall systems
Process	Sore throat not swabbed for GAS at presentation
Process	No secondary prophylaxis pathway after index ARF event
Individual / Patient	Limited health literacy; provider anchoring on 'viral URTI'
Individual / Patient	Delayed presentation due to access / cost barriers

References: Australian guideline for prevention, diagnosis and management of acute rheumatic fever and rheumatic heart disease (RHD Australia 2020) • Tintinalli's Emergency Medicine 9e Ch 154

Question 49 | STEMI Differential — LVH/AS (17 marks)

A 75-year-old man presents with chest pain and a harsh ejection systolic murmur radiating to the carotids. The ECG shows ST elevation and high QRS voltages.

[ECG] 12-lead ECG**a) List 4 ECG abnormalities. (4 marks)**

- LVH (Sokolow-Lyon: $S V_1 + R V_{5/6} > 35 \text{ mm}$)
- ST elevation (may be secondary to LVH or true STEMI)
- Lateral ST depression / T-wave inversion (LVH strain)
- Left axis deviation
- Left atrial enlargement

b) List 5 causes of ST elevation other than acute MI. (5 marks)

- Pericarditis (widespread saddle ST + PR depression)
- Benign early repolarisation (J-point elevation, fishhook)
- Left ventricular hypertrophy (strain pattern)
- Left bundle branch block (discordant ST elevation)
- Brugada syndrome (coved ST V_1-V_2)
- Myocarditis
- Takotsubo cardiomyopathy
- Hyperkalaemia (sine-wave)
- Hypothermia (J/Osborn waves)

c) List 4 differential diagnoses for a systolic murmur. (4 marks)

- Aortic stenosis
- Aortic sclerosis
- Hypertrophic obstructive cardiomyopathy
- Mitral regurgitation
- Tricuspid regurgitation
- Pulmonary stenosis
- Ventricular septal defect

d) List 2 physical signs of severe aortic stenosis. (2 marks)

- Slow-rising, low-volume (pulsus parvus et tardus) carotid pulse
- Soft / absent A_2
- Late-peaking systolic murmur
- Heaving, sustained, non-displaced apex
- S_4 gallop
- Narrow pulse pressure

e) State the concern with nitrates in this patient. (2 marks)

Severe AS is a fixed outflow obstruction — nitrate-induced vasodilation decreases preload and afterload **without** compensatory $\uparrow \text{CO}$, causing precipitous hypotension and cardiovascular collapse. **Avoid or use cautiously** with continuous BP monitoring.

Question 50 | Pericarditis vs Myocarditis (8 marks)

A 30-year-old man presents with chest pain and ST elevation post viral URTI. Troponin is elevated.

[ECG] 12-lead ECG

a) Name the 2 leading differential diagnoses. For each list 2 ECG features and 2 echocardiographic features. (8 marks)

Diagnosis	ECG features	Echo features
Acute pericarditis	Widespread saddle-shaped ST elevation; PR depression (PR elevation in aVR)	Pericardial effusion (anechoic); preserved LV function
Myocarditis	Diffuse ST elevation or T-wave inversion in multiple territories; AV block / BBB	Regional wall motion abnormalities; reduced LVEF; $\pm$ effusion

Marker's note: Cardiac MRI is the gold standard for differentiation. Pericarditis often has friction rub, pleuritic pain, modest troponin; myocarditis has progressive LV dysfunction and significantly elevated troponin.

References: Tintinalli's Emergency Medicine 9e Ch 54 • ESC Pericardial Disease Guidelines 2015

Question 51 | Inferior STEMI + Complete Heart Block (16 marks)

A 65-year-old man presents with chest pain and bradycardia. BP 95/65. The ECG shows ST elevation in II, III, aVF with AV dissociation and a slow ventricular escape at 38 bpm.

[ECG] 12-lead ECG

a) State the primary pathology and list 3 supporting ECG findings. (4 marks)

Inferior STEMI (RCA occlusion).

- ST elevation ≥ 1 mm in II, III, aVF (≥ 2 contiguous)
- Reciprocal ST depression in I, aVL (and anterior leads)
- Hyperacute T waves inferiorly

b) Name the most important complication and list 4 ECG findings. (5 marks)

Complete (3°) AV block from RCA territory AV nodal ischaemia.

- AV dissociation
- Slow ventricular escape (<40 bpm if ventricular)
- Regular P-P at faster rate than R-R
- Junctional escape with narrow QRS (more common in inferior MI than infranodal)

c) List 5 treatments for this inferior STEMI. (5 marks)

- Activate cath lab — primary PCI (RCA intervention) **[core]**
- Aspirin 300 mg + Ticagrelor 180 mg PO
- Heparin 60 U/kg IV (max 4000 U)
- **CAUTION with nitrates** — check V_3R / V_4R for RV involvement; avoid if RV infarct
- Analgesia (fentanyl); SpO_2 >94%

d) Name 2 pharmacological options for the heart block. (2 marks)

- Atropine 600 mcg IV (effective in AV nodal block)
- Isoprenaline 1–10 mcg/min IV infusion
- Glucagon if β -blocker contributing

References: NHF/CSANZ ACS Guidelines 2016 (updated) • ANZCOR Guidelines (current)

Question 52 | STEMI — Fibrinolysis Decision (14 marks)

A 60-year-old man presents to a rural ED with chest pain. ECG confirms anterior STEMI. The nearest PCI centre is 3 hours away by road. Symptom onset 90 minutes ago.

[ECG] 12-lead ECG

a) List 4 critical ECG abnormalities to confirm STEMI. (4 marks)

- ST elevation ≥ 1 mm in 2 contiguous limb leads OR ≥ 2 mm in V_2-V_3
- New LBBB / Sgarbossa positive (STEMI equivalent)
- Hyperacute T waves
- Reciprocal ST depression in opposing leads
- Posterior STEMI (V_7-V_9) or RV involvement (V_3R-V_4R)

b) List 4 components of pre-hospital advice for paramedics. (4 marks)

- Aspirin 300 mg PO chewed
- GTN SL 300–600 mcg if SBP >90 and no inferior STEMI / RV involvement
- 12-lead ECG transmitted to receiving ED for cath lab pre-activation
- Continuous cardiac monitoring; defibrillator pads on; IV access
- Pre-hospital fibrinolysis if protocols allow and PCI >120 min away

c) Name 2 fibrinolytic agents with full dosing. (4 marks)

Agent	Dose
Tenecteplase (TNK)	Single weight-based IV bolus: <60 kg = 30 mg; 60–69 = 35 mg; 70–79 = 40 mg; 80–89 = 45 mg; ≥ 90 = 50 mg. Halve for age ≥ 75 .
Alteplase (tPA)	15 mg IV bolus; then 0.75 mg/kg over 30 min (max 50 mg); then 0.5 mg/kg over 60 min (max 35 mg). Total max 100 mg.

d) State the peri-fibrinolysis anticoagulation regimen. (2 marks)

Enoxaparin: age $<75 \rightarrow 30$ mg IV bolus + 1 mg/kg SC q12 h; age $\geq 75 \rightarrow$ no bolus, 0.75 mg/kg SC q12 h; CrCl $<30 \rightarrow 1$ mg/kg SC q24 h. Continue minimum 48 h or until revascularisation.

References: NHF/CSANZ ACS Guidelines 2016 (updated) • Tintinalli's Emergency Medicine 9e Ch 49

Question 53 | STEMI — Pharmacoinvasive Strategy (17 marks)

A 55-year-old man presents with epigastric pain. ECG shows inferior STEMI. The nearest PCI centre is 90 minutes by road; symptom onset 60 minutes ago.

[ECG] 12-lead ECG

a) Analyse the ECG and state your interpretation. (4 marks)

Inferior STEMI: ST elevation ≥ 1 mm in II, III, aVF with reciprocal ST depression in I, aVL (and V_1-V_4). Likely RCA occlusion. Right-sided leads (V_3R / V_4R) needed to exclude RV infarction. Posterior leads (V_7-V_9) needed if posterior extension suspected.

b) List 4 immediate pharmacological treatments with justification. (4 marks)

Drug	Justification
Aspirin 300 mg PO	Antiplatelet — irreversible TXA_2 inhibition; reduces mortality and reinfarction
Ticagrelor 180 mg PO	$P2Y_{12}$ inhibitor; faster onset than clopidogrel; reduces MACE
Heparin 60 U/kg IV (max 4000 U)	Required adjunct to reperfusion; inhibits thrombus propagation
Fentanyl 25–50 mcg IV titrated	Analgesia (avoid morphine where possible — slows oral antiplatelet absorption)

c) State your reperfusion plan. (3 marks)

Pharmacoinvasive strategy: Administer fibrinolysis now (tenecteplase weight-based IV bolus) — PCI cannot be achieved within 120 minutes. Transfer urgently to PCI centre. If successful lysis ($\geq 50\%$ ST resolution at 60–90 min, symptoms resolved): elective angiography 3–24 h. If failed: **rescue PCI immediately**.

d) List 5 absolute contraindications to fibrinolysis. (5 marks)

- Prior intracranial haemorrhage (any time) [core]
- Ischaemic stroke within 3 months [core]
- Significant closed head / facial trauma within 3 months
- Known intracranial neoplasm, AVM or aneurysm
- Suspected aortic dissection
- Active internal bleeding (excluding menstruation)

e) State 1 criterion for failure of fibrinolysis. (1 mark)

- $<50\%$ resolution of ST elevation (in lead with maximal elevation) at 60–90 min post-fibrinolytic
- Persistent / recurrent chest pain
- Haemodynamic / electrical instability
- Cardiogenic shock

References: NHF/CSANZ ACS Guidelines 2016 (updated)

Question 54 | Inferior STEMI with Cardiogenic Shock (12 marks)

A 68-year-old man presents hypotensive (BP 80/40) with chest pain. ECG shows inferior ST elevation. He has cool peripheries, raised JVP and clear lungs.

[ECG] 12-lead ECG

a) State the rate, rhythm and axis (interpret the ECG). (3 marks)

Marker's note: depends on ECG. Typical answer — Sinus bradycardia (~50–60 bpm) with normal axis, OR junctional rhythm with AV block. Look for evolving Q waves inferiorly.

b) State the main pathology and 2 supporting features. (3 marks)

Inferior STEMI with cardiogenic shock and likely RV infarction. Supporting features: hypotension with raised JVP and clear lungs (preload-dependent state), inferior ST elevation, RCA occlusion implied. Right-sided leads (V_3R / V_4R) MUST be obtained.

c) List 6 treatment steps with drugs and doses. (6 marks)

- Activate cath lab — emergency primary PCI (mandated in shock + STEMI regardless of symptom duration) **[core]**
- Aspirin 300 mg PO + Ticagrelor 180 mg PO; heparin 60 U/kg IV
- Volume loading: 250–500 mL crystalloid IV (preload-dependent RV infarct); reassess after each bolus
- Vasopressor: noradrenaline 0.05–0.5 mcg/kg/min IV
- **AVOID nitrates and morphine** (preload-reducing)
- **AVOID β -blockers** in shock
- Inotrope: dobutamine 5–20 mcg/kg/min if $\downarrow$ CO and adequate MAP

References: NHF/CSANZ ACS Guidelines 2016 (updated)

Question 55 | Rural STEMI with LBBB (14 marks)

A patient in a rural ED presents with chest pain. The 12-lead ECG shows LBBB which is not present on a previous ECG 2 months ago. Tertiary PCI centre is 3 hours away.

[ECG] 12-lead ECG

a) List 4 pathological possibilities. For each describe the key ECG features. (8 marks)

Pathology	ECG features
Lateral STEMI	ST elevation ≥ 1 mm in I, aVL, V_5 - V_6 ; reciprocal ST depression inferiorly
New (or presumed new) LBBB	Broad QRS ≥ 120 ms; dominant S in V_1 ; monophasic R in lateral leads; discordant ST-T changes
Sgarbossa-positive STEMI in LBBB	Concordant ST elevation ≥ 1 mm in any lead; concordant ST depression ≥ 1 mm in V_1 - V_3 ; or discordant ST elevation/S-wave depth ≥ 0.25 (Smith)
Old LBBB (no acute occlusion)	Identical to prior ECG; no concordant changes; troponin trends ground decision

b) List 6 key treatment steps in this rural setting. (6 marks)

- Treat as STEMI equivalent: activate cath lab at tertiary centre; pharmaco-invasive strategy with fibrinolysis given 3-h transfer time **[core]**
- Tenecteplase weight-based IV bolus (single dose) + heparin 60 U/kg IV bolus then infusion
- Aspirin 300 mg + Ticagrelor 180 mg PO (or clopidogrel 300 mg if age ≥ 75)
- Analgesia: fentanyl 25–50 mcg IV titrated; GTN SL 300–600 mcg if SBP >90 and no RV involvement
- Monitor: aim for $\geq 50\%$ ST resolution at 90 min — if failed, expedite emergency transfer for rescue PCI
- Maintain monitoring, serial ECGs, defibrillation readiness throughout transfer

References: NHF/CSANZ ACS Guidelines 2016 (updated) • Tintinalli's Emergency Medicine 9e Ch 49 • Smith-modified Sgarbossa criteria

Question 56 | NSTEMI / Unstable Angina (12 marks)

A 65-year-old man presents with intermittent retrosternal chest pain. ECG shows ST depression and T-wave inversion in V_4-V_6 . Initial troponin is mildly elevated.

[ECG] 12-lead ECG

a) Analyse the ECG and state your interpretation. (4 marks)

NSTEMI / unstable angina. Findings: ST depression ≥ 0.5 mm in V_4-V_6 with T-wave inversion (subendocardial ischaemia, lateral territory). No ST elevation. Note any Q waves, LVH, or new conduction defect.

b) List 4 investigations that clarify extent of disease. (4 marks)

Investigation	How it helps
High-sensitivity troponin (0 h and 1–3 h)	Confirms infarction; serial delta differentiates NSTEMI from UA; magnitude correlates with infarct burden
Echocardiogram	LV function, regional wall motion abnormalities, complications (MR, VSD, effusion)
Coronary angiography (invasive)	Definitive — identifies culprit lesion; allows immediate PCI
CT coronary angiography	Non-invasive alternative if low–intermediate risk

c) Name 4 medications with dose and route. (4 marks)

- Aspirin 300 mg PO loading, then 100 mg PO daily
- Ticagrelor 180 mg PO loading (or clopidogrel 600 mg PO)
- Heparin 60 U/kg IV bolus then infusion (or enoxaparin 1 mg/kg SC q12 h)
- GTN SL 300–600 mcg PRN; or IV GTN infusion 5–200 mcg/min for ongoing ischaemia (SBP >90)
- Statin (high-intensity, e.g. atorvastatin 80 mg PO daily)

References: NHF/CSANZ ACS Guidelines 2016 (updated)

Question 57 | Inferior STEMI + RV Infarction (16 marks)

A 70-year-old man presents with chest pain. He develops hypotension after sublingual GTN. The ECG shows inferior ST elevation.

[ECG] 12-lead ECG

a) List 4 ECG abnormalities and state the significance of each. (8 marks)

Abnormality	Significance
ST elevation in II, III, aVF	Inferior STEMI — RCA occlusion
ST elevation in V ₃ R / V ₄ R	RV infarction — preload-dependent; AVOID nitrates / diuretics; volume-load
ST depression in I, aVL	Reciprocal change supporting inferior STEMI
Bradycardia / AV block	RCA supplies AV node — inferior MI commonly causes bradyarrhythmia

b) List 8 ED management measures. (8 marks)

- Activate cath lab — primary PCI for RCA territory **[core]**
- Aspirin 300 mg + Ticagrelor 180 mg PO
- Heparin 60 U/kg IV (max 4000 U)
- Volume loading 500 mL Normal Saline IV (RV is preload-dependent) **[core]**
- AVOID nitrates / diuretics / morphine in excess (preload-reducing) **[core]**
- Atropine 600 mcg IV for symptomatic bradycardia / heart block; pacing pads on standby
- Analgesia: fentanyl 25–50 mcg IV titrated
- Vasopressor (noradrenaline 0.05–0.5 mcg/kg/min) if refractory hypotension despite fluid loading

References: NHF/CSANZ ACS Guidelines 2016 (updated)

Question 58 | Failed Fibrinolysis + Heart Block (16 marks)

A patient given tenecteplase 105 minutes ago has ongoing chest pain, BP 80/40, and complete heart block. ECG shows persistent ST elevation in II, III, aVF.

[ECG] 12-lead ECG

a) State the main pathology. (1 mark)

Failed fibrinolysis in the setting of inferior STEMI with complete AV block — RCA territory not reperfused, complicated by AV nodal ischaemia.

b) List 4 ECG features of failed reperfusion. (4 marks)

- Persistent $\geq 50\%$ ST elevation 60–90 min post-fibrinolytic
- Ongoing hyperacute T waves
- Q waves developing (established infarction)
- AV block / arrhythmia complicating
- No reperfusion arrhythmia (accelerated idioventricular)

c) List 3 management steps with justification. (6 marks)

Step	Justification
Rescue PCI — emergency angiography and intervention	Failed lysis with ongoing pain, ST elevation and haemodynamic instability — rescue PCI reduces mortality vs repeat fibrinolysis or conservative care
Vasopressor support — noradrenaline 0.05–0.5 mcg/kg/min	BP 80/40 = cardiogenic shock; maintain MAP for coronary and cerebral perfusion during transfer
Airway / O ₂ optimisation; low threshold for intubation	Cardiogenic shock impairs O ₂ delivery; protect airway if GCS declining

d) List 5 steps for successful transcutaneous pacing. (5 marks)

- Apply pads anterior–posterior (preferred) or anterior–lateral
- Connect to pacer; demand mode; rate 70–80 bpm; output 0 mA
- Increase output in 5–10 mA increments until electrical capture (pacing spike + broad QRS)
- Confirm mechanical capture (palpable femoral / arterial line waveform); confirm haemodynamic improvement
- Provide analgesia/sedation (ketamine 0.5–1 mg/kg + fentanyl 1 mcg/kg); set output threshold + 10 mA safety margin

References: NHF/CSANZ ACS Guidelines 2016 (updated) • ANZCOR Guidelines (current)

Question 59 | Anterior STEMI — RSI Modifications (11 marks)

A type-2 diabetic presents with anterior STEMI: BP 75/40, GCS 13, SpO₂ 88% on NRB with widespread bibasal crackles. You plan to intubate prior to transfer for PCI.

[ECG] 12-lead ECG

a) List 4 key ECG findings. (4 marks)

- ST elevation V₁–V₄ (anterior territory)
- Reciprocal ST depression inferiorly
- Hyperacute T waves
- Possible QS pattern / loss of R waves (established infarct)
- Possible AV block / arrhythmia complicating

b) State the clinical interpretation. (2 marks)

Anterior STEMI complicated by cardiogenic shock and acute pulmonary oedema (Killip IV). Intubation indicated for respiratory failure and to facilitate PCI, but must not delay reperfusion; cath lab activated.

c) List 5 modifications to RSI in cardiogenic shock. (5 marks)

- Reduce induction-agent dose: ketamine 0.5–1 mg/kg IV (catecholamine release supports BP) — avoid propofol / thiopentone in shock **[core]**
- Pre-oxygenate via NRB or NIV; head up 20–30°; BVM standby; minimise apnoeic time
- Pre-induction vasopressor: noradrenaline infusion running BEFORE induction to blunt post-intubation haemodynamic collapse **[core]**
- Suxamethonium 1.5 mg/kg IV or rocuronium 1.2 mg/kg IV (sugammadex available)
- Lung-protective ventilation post-tube: TV 6 mL/kg IBW; PEEP 8–10 to recruit alveoli; avoid auto-PEEP

References: NHF/CSANZ ACS Guidelines 2016 (updated) • ANZICS / ANZCA airway guidelines

Question 60 | SVT — Prep & Refractory Management (18 marks)

Paramedics call ahead with a 35-year-old in stable SVT. Vagal manoeuvres and 2 doses of adenosine have failed. ETA 5 minutes.

[ECG] Pre-hospital rhythm strip**a) List 6 preparations for the patient's arrival. (6 marks)**

- Pre-alert team: senior, nursing lead, airway nurse
- Resus bay: defibrillator/cardioverter checked, sync mode tested, pads on patient on arrival
- Two IV lines patent; cardiac monitoring; SpO₂; BP cuff
- Drugs drawn: adenosine 6 mg + 12 mg + 18 mg syringes; verapamil 5 mg; metoprolol 5 mg; sedation (ketamine, fentanyl)
- Defibrillator charged in SYNC mode; 50–100 J biphasic ready
- Airway equipment (BVM, suction, intubation kit) and RSI drugs
- Anaesthetics / ICU notified if cardioversion required

b) List 6 important ECG features of SVT. (6 marks)

- Heart rate 150–250 bpm
- Narrow complex QRS (<120 ms) unless aberrancy
- Regular rhythm (irregular suggests AF / atrial flutter with variable block)
- P waves: absent, retrograde, or buried in QRS
- Sudden onset / offset (paroxysmal)
- No delta wave (excludes manifest WPW)
- Response to vagal manoeuvres (slowing or termination)

c) List 3 differentials for the rhythm. (3 marks)

- AVNRT (most common AVNRT)
- AVRT (concealed accessory pathway — orthodromic)
- Atrial flutter with 2:1 block (classic 150 bpm)
- Atrial tachycardia
- Sinus tachycardia (consider sepsis, PE, thyrotoxicosis)

d) Name the alternative drug after failed vagal + adenosine, with dose. (3 marks)

- Verapamil 5 mg IV over 2 min, repeat 5 mg in 5 min if needed (max 15 mg) — AVOID in WPW, BB use, wide-complex tachycardia
- Metoprolol 5 mg IV (alternative if verapamil contraindicated)
- Synchronised DC cardioversion 50–100 J biphasic if haemodynamic compromise

References: Tintinalli's Emergency Medicine 9e Ch 18 • ANZCOR Guidelines (current)

Question 61 | Syncope — Brugada Pattern (14 marks)

A 25-year-old man presents with syncope at rest. ECG shows coved ST elevation ≥ 2 mm in V_1-V_2 with T-wave inversion.

[ECG] 12-lead ECG

a) State the most significant ECG finding and the diagnosis of MOST CONCERN. (2 marks)

Coved ST elevation ≥ 2 mm in V_1-V_2 with T-wave inversion = Brugada Type 1 pattern. Diagnosis of concern: **Brugada syndrome** — high risk of VF and sudden cardiac death.

b) List 4 differential diagnoses for this ECG pattern. (4 marks)

- Brugada syndrome (Type 1, spontaneous)
- Drug-induced Brugada pattern (Na-channel blockers, TCA, cocaine)
- Fever-unmasked Brugada
- RBBB with early repolarisation (benign)
- Arrhythmogenic right ventricular cardiomyopathy (ARVC)
- RVOT ischaemia / strain
- Hypothermia (Osborn waves)

c) List 4 history questions you would ask. (4 marks)

- Family history of SCD or Brugada (autosomal dominant)
- Prior unexplained syncope or resuscitated cardiac arrest
- Symptoms during fever, at rest, or nocturnally
- Current medications / recreational drugs (Na-channel blockers, cocaine)
- Nocturnal agonal breathing (typical of Brugada)

d) List 4 components of disposition and ongoing management. (4 marks)

- Admit for continuous cardiac monitoring (telemetry)
- Treat any fever aggressively with antipyretics (fever unmasks pattern)
- Urgent cardiology / EP referral — risk stratification, EP study, ICD if symptomatic
- Genetic testing (SCN5A) and cascade family screening
- Provide drug-avoidance list (BrugadaDrugs.org reference)

References: Tintinalli's Emergency Medicine 9e Ch 19 • HRS/EHRA Brugada Consensus 2013/2019

Question 62 | Syncope — Non-arrhythmic Cardiogenic Shock (13 marks)

A 60-year-old man presents with syncope and shock. ECG is non-diagnostic. BP 80/45, HR 110, JVP elevated, lungs clear.

[ECG] 12-lead ECG

a) List 5 ECG features that would suggest arrhythmia as the cause of syncope. (5 marks)

- Bifascicular block (RBBB + LAFB / LPFB)
- Complete or high-degree AV block; sinus pauses ≥ 3 s
- Prolonged QTc > 500 ms
- Brugada pattern V_1-V_2
- Pre-excitation (delta wave) — WPW
- Significant LVH or HCM pattern
- Q waves of prior MI (substrate for VT)
- ARVC pattern (epsilon wave, T inversion V_1-V_3)

b) Name 4 causes of non-arrhythmic cardiogenic shock. For each name a specific management. (8 marks)

Cause	Specific management
Cardiac tamponade	Emergency pericardiocentesis; fluid for preload; AVOID vasodilators; surgical drainage if haemopericardium
Acute valvular failure (acute MR / acute AR)	Urgent echo; emergency cardiac surgery; bridge with IABP if available; AVOID vasodilators in acute AR
Massive PE (obstructive shock)	Systemic fibrinolysis (alteplase 100 mg over 2 h) or catheter-directed thrombolysis; anticoagulation
RV infarction	Volume loading; AVOID nitrates / diuretics; vasopressor support; urgent PCI

References: Tintinalli's Emergency Medicine 9e Ch 22 • ANZCOR Guidelines (current)

Question 63 | Syncope — Complete AV Block / Collapse (15 marks)

A 75-year-old presents with recurrent syncope and bradycardia. BP 80/50, GCS 12. ECG shows complete AV block with a wide ventricular escape at 30 bpm.

[ECG] 12-lead ECG

a) State the diagnosis with 4 supporting ECG findings. (5 marks)

Complete (3°) AV block with ventricular escape and haemodynamic collapse.

- AV dissociation — independent P and QRS
- Slow regular ventricular escape <40 bpm (ventricular origin)
- Regular P-P at faster rate than R-R
- Wide QRS (LBBB- or RBBB-like) — ventricular focus
- No retrograde P waves linked to QRS

b) List 10 sequential management steps. (10 marks)

- ABC: IV access × 2, O₂, monitoring, defibrillator/pacer to bedside, 12-lead ECG **[core]**
- Atropine 600 mcg IV (often ineffective in distal block but trial appropriate) **[core]**
- Transcutaneous pacing — anterior-posterior pads, demand mode 70–80 bpm, ↑ mA to capture **[core]**
- Confirm mechanical capture (femoral / arterial line waveform); analgesia/sedation (ketamine + fentanyl)
- IV fluid 250–500 mL crystalloid if hypotensive (non-obstructive cause)
- Isoprenaline 1–10 mcg/min IV infusion as bridge
- Identify reversible causes: K⁺, drug review (β-blocker, CCB, digoxin), 12-lead for inferior STEMI
- Transvenous pacing — femoral / IJV / subclavian approach; RV apex placement; confirm capture
- Cardiology referral — permanent pacemaker implantation
- Disposition to monitored bed (CCU / HDU)

References: Tintinalli's Emergency Medicine 9e Ch 17 • ANZCOR Guidelines (current)

Question 64 | Syncope — VT / Haemodynamic Compromise (13 marks)

A 65-year-old presents with syncope, BP 82/55, SpO₂ 84% on RA. The 12-lead ECG shows a regular broad-complex tachycardia at 180 bpm.

[ECG] 12-lead ECG**a) List 4 ECG findings of importance. (4 marks)**

- Broad QRS >120 ms; rate 180 bpm
- AV dissociation if present
- Concordance / extreme axis
- ST changes suggesting ischaemia
- QTc prolongation

b) State the likely diagnosis. (1 mark)

Sustained ventricular tachycardia with haemodynamic compromise.

c) List 3 reversible precipitants. (3 marks)

- Electrolyte disturbance (hypoK⁺, hypoMg²⁺)
- Drug toxicity (QT-prolonging, antiarrhythmic, digoxin)
- Acute ischaemia (plaque rupture)
- Hypoxia / acidosis
- Hypo-/hyperthyroidism

d) List 5 management steps. (5 marks)

- Immediate synchronised DC cardioversion 150–200 J biphasic — patient is unstable **[core]**
- Sedate with ketamine 1 mg/kg + fentanyl 1 mcg/kg
- Post-cardioversion: amiodarone 300 mg IV over 1 h to prevent recurrence
- Treat reversible cause: K⁺, Mg²⁺, troponin, ECG for STEMI, bedside echo
- Disposition to CCU; ICD evaluation if recurrent VT with structural disease

References: Tintinalli's Emergency Medicine 9e Ch 19 • ANZCOR Guidelines (current)

Question 65 | Syncope — High-Degree AV Block (14 marks)

A 70-year-old presents with syncope. BP 70/40, GCS 13. 12-lead ECG shows a high-degree AV block with a slow escape rhythm.

[ECG] 12-lead ECG

a) State the ECG interpretation. (2 marks)

Complete (3°) or high-degree (Mobitz II) AV block with slow escape rhythm and haemodynamic compromise.

b) List 3 ECG features supporting your interpretation. (3 marks)

- P waves at regular fast rate, no fixed relationship to QRS
- QRS at slow regular rate (escape) — wide if ventricular, narrow if junctional
- No constant PR interval
- Ventricular rate <40 bpm (ventricular escape) or 40–60 (junctional)

c) List 4 possible causes. (4 marks)

- Inferior STEMI (RCA territory)
- Drug toxicity (β -blocker, CCB, digoxin)
- Degenerative conduction disease (Lev / Lenègre)
- Lyme disease / viral myocarditis
- Sarcoidosis / amyloidosis
- Hyperkalaemia (renal failure)
- Post-cardiac surgery / ablation

d) List 5 steps for successful transcutaneous pacing. (5 marks)

- Apply pads anterior-posterior (preferred) or anterior-lateral
- Demand mode; rate 70–80 bpm; output 0 mA
- Increase output 5–10 mA increments until electrical capture
- Confirm mechanical capture (femoral / arterial line)
- Provide analgesia/sedation; output threshold + 10 mA safety margin

References: Tintinalli's Emergency Medicine 9e Ch 17 • ANZCOR Guidelines (current)

Question 66 | Syncope — Complete AV Block Management (12 marks)

A 78-year-old on metoprolol presents with syncope. ECG shows complete AV block with junctional escape at 45 bpm.

[ECG] 12-lead ECG

a) List 4 ECG abnormalities. (4 marks)

- Complete AV block with AV dissociation
- Slow junctional escape (~45 bpm, narrow QRS)
- Regular P-P at faster rate than R-R
- Possible ST changes (review for STEMI)

b) List 2 reversible causes of bradycardia. (2 marks)

- Drug toxicity (β -blocker, CCB, digoxin) — consider here **[core]**
- Hyperkalaemia (renal failure)
- Acute inferior STEMI
- Hypothyroidism
- Hypothermia

c) List 6 management steps. (6 marks)

- IV access, O₂, continuous monitoring, defibrillator to bedside
- Atropine 600 mcg IV (effective in nodal block)
- Transcutaneous pacing if pharmacological therapy fails
- Treat reversible: review medications; check K⁺; 12-lead for STEMI; digoxin level
- Glucagon 5–10 mg IV if β -blocker toxicity suspected; or calcium chloride 10 mL 10% IV for CCB toxicity
- Isoprenaline 1–10 mcg/min infusion as bridge
- Cardiology referral — transvenous pacing / permanent pacemaker

References: Tintinalli's Emergency Medicine 9e Ch 17 • eTG (Therapeutic Guidelines, current)

Question 67 | Syncope — ECG-Guided Admission (16 marks)

A 65-year-old presents with syncope. You are deciding on disposition based on ECG findings.

a) Name 6 ECG findings warranting telemetry admission. For each state the clinical significance. (12 marks)

ECG finding	Significance
Bifascicular block (RBBB + LAFB / LPFB)	Risk of progression to complete AV block; consider PPM
Prolonged QTc >500 ms	Risk of TdP — identify drug / electrolyte cause; consider ICD
Brugada Type 1 pattern	Risk of VF / SCD; EP study; ICD if symptomatic
Pre-excitation (WPW delta wave)	Risk of fast pre-excited AF degenerating to VF; EP and ablation
2° (Mobitz II) or 3° AV block	Risk of haemodynamic instability; pacing required
LBBB (new or unknown age)	Often indicates structural heart disease; STEMI equivalent in chest pain
Non-sustained VT	Substrate for sustained VT; risk stratify
Significant LVH / HCM pattern	Substrate for VT; outflow obstruction

b) List 4 investigations with clinical indication. (4 marks)

Investigation	Indication
Chest X-ray	Cardiomegaly, heart failure, widened mediastinum (dissection)
FBC	Anaemia as cause; infection screen
UEC + Mg ²⁺	Electrolyte arrhythmia substrate; renal function
CT head	Focal neurology, head injury, elderly with first syncope

References: Tintinalli's Emergency Medicine 9e Ch 22 • Canadian Syncope Risk Score validation

Question 68 | Young Athlete with Syncope — HCM (16 marks)

A 17-year-old male athlete presents with exertional syncope on the football field. His mother is at the bedside. He wants to leave to attend the game presentation.

a) Analyse the ECG (assume HCM-pattern). List 5 features. (5 marks)

- LVH voltage criteria
- Deep septal Q waves in lateral leads (I, aVL, V₅–V₆) from septal hypertrophy
- ST changes / T-wave inversion in lateral leads (strain)
- Left axis deviation
- Possible LV outflow tract gradient murmur

b) List 5 history questions about symptoms. (5 marks)

- Has this happened before? Previous syncope or palpitations?
- Did it happen during exercise (high-risk in HCM, AS, Brugada)?
- Warning symptoms — chest pain, palpitations, lightheadedness?
- Family history of SCD, HCM, or unexplained death in young relatives?
- Medications, supplements or recreational drugs (stimulants, anabolic steroids)?

c) List 3 initial investigations with justification. (3 marks)

Investigation	Justification
12-lead ECG	Identify HCM pattern, Brugada, LQTS, WPW, heart block
Transthoracic echocardiogram	Diagnose HCM (asymmetric septal hypertrophy ≥15 mm; LVOT gradient, SAM); risk-stratify
Bloods (troponin, UEC, glucose)	Myocardial injury; electrolyte arrhythmia substrate; metabolic cause

d) List 3 priorities if patient wants to leave AMA. (3 marks)

- Capacity assessment in a 17-year-old (Gillick competence); for an under-18 minor, parental authority supports retention if best-interests criteria met **[core]**
- Communicate the life-threatening nature of suspected HCM with exertional syncope (~50% 5-yr SCD risk untreated); involve mother in shared decision
- If patient leaves with capacity: document informed refusal; safety net (immediate return for symptoms); restrict exertion; cardiology follow-up arranged
- Notify treating consultant; consider Mental Health Order only if criteria met (rare for medical refusal)

References: Tintinalli's Emergency Medicine 9e Ch 22 • AHA / ESC HCM Guidelines • ACEM consent and capacity statements

Question 69 | Young Female — Syncope + Abdominal Pain (12 marks)

A 22-year-old woman presents with syncope and lower abdominal pain. BP 95/60, HR 110, pale and diaphoretic.

a) List 4 features that favour syncope over seizure. (4 marks)

- Brief loss of consciousness (<1 min) with rapid full recovery — no post-ictal confusion
- Prodrome: nausea, diaphoresis, pallor, visual greying (typical vasovagal)
- Identifiable precipitant (pain, prolonged standing, heat)
- Upright position at onset
- No tongue biting, no urinary incontinence
- Short duration of unconsciousness

b) List 4 most likely diagnoses, with 1 supporting examination finding for each. (8 marks)

Diagnosis	Supporting examination
Ruptured ectopic pregnancy	Adnexal tenderness; cervical motion tenderness; peritonism / shoulder-tip pain (haemoperitoneum)
Haemorrhagic ovarian cyst rupture	Tachycardia; postural hypotension; localised RIF/LIF tenderness; free fluid on bedside US
Ovarian torsion	Localised adnexal tenderness; palpable mass; voluntary guarding
Vasovagal syncope (with abdominal pain trigger)	Marked pallor and bradycardia at onset; resolution supine; otherwise normal exam

Marker's note: Always check urine β -hCG in any woman of reproductive age presenting with syncope and abdominal pain — rule out ectopic immediately.

References: Tintinalli's Emergency Medicine 9e Ch 100 (Ectopic Pregnancy) • Cameron's Textbook of Adult Emergency Medicine 5e

Question 70 | Syncope — Systematic Approach (10 marks)

Outline a systematic approach to a patient presenting with syncope.

a) List 5 history features and what each suggests. (5 marks)

History feature	Suggests
During or after exercise	Structural heart disease (HCM, AS, CAD)
Prolonged standing / heat / pain / venepuncture, with prodrome	Vasovagal (neurally mediated)
With micturition / cough / swallowing	Situational syncope
Sudden, no prodrome, palpitations preceding	Arrhythmic (VT, SVT, AV block)
On standing / postural change	Orthostatic hypotension (drugs, dehydration, autonomic failure)

b) List 4 physical signs to examine for. (2 marks)

- Postural BP/HR (lying, sitting, standing — orthostatic drop ≥ 20 mmHg SBP within 3 min)
- Cardiac murmur (AS, HCM, MR)
- Carotid bruit (avoid carotid sinus massage if present)
- Heart-failure signs (JVP, oedema, crepitations)
- Focal neurological deficit (TIA, vertebrobasilar insufficiency)

c) List 5 investigations with justification. (3 marks)

Investigation	Justification
12-lead ECG	Mandatory; LQTS, Brugada, WPW, heart block, LVH
Blood glucose	Hypoglycaemia is a common reversible mimic
UEC, FBC	Electrolyte arrhythmia substrate; anaemia
Echocardiogram	Structural cause if exertional syncope or murmur
Holter / event recorder	Recurrent unexplained syncope

References: Tintinalli's Emergency Medicine 9e Ch 22 • ESC Syncope Guidelines 2018

Question 71 | Syncope — SFSR & ECG (15 marks)

A 62-year-old presents with syncope. ECG shows sinus rhythm with QTc 510 ms. You are using the San Francisco Syncope Rule (SFSR) for risk stratification.

[ECG] 12-lead ECG

a) State the rhythm and 2 differential diagnoses for the QTc finding. (3 marks)

Sinus rhythm with prolonged QTc (510 ms). Differential: (1) acquired LQTS — drug-induced (antiarrhythmics, macrolides, antipsychotics, antiemetics, methadone); electrolyte ($\downarrow K^+$, $\downarrow Mg^{2+}$, $\downarrow Ca^{2+}$); hypothyroidism; bradycardia; (2) congenital LQTS.

b) List 3 ECG abnormalities and the mechanism by which each may cause syncope. (6 marks)

Abnormality	Mechanism
Prolonged QTc >500 ms	Substrate for TdP → polymorphic VT → transient global hypoperfusion
Complete / high-degree AV block	Insufficient ventricular rate → $\downarrow CO$ → cerebral hypoperfusion
Pre-excitation (delta wave, WPW)	Pre-excited rapid AF via accessory pathway (>250 bpm) → haemodynamic collapse

c) State the components of the San Francisco Syncope Rule and its utility. (6 marks)

SFSR — CHESS mnemonic:

- **C** — Congestive heart failure history
- **H** — Haematocrit <30%
- **E** — Abnormal ECG (any new change or non-sinus)
- **S** — Shortness of breath
- **S** — Systolic BP <90 at triage

Any one positive criterion = high risk of 7-day serious outcome. Sensitivity ~96%, specificity ~62%. Decision aid only — does not replace clinical judgement; consider Canadian Syncope Risk Score for 30-day prediction.

References: Quinn et al. SFSR original validation (Ann Emerg Med 2004) • Tintinalli's Emergency Medicine 9e Ch 22

Question 72 | Syncope — WPW Diagnosis (13 marks)

A 24-year-old woman presents with syncope. ECG shows short PR interval, delta waves, and broad QRS. She is asymptomatic on arrival, BP 110/70.

[ECG] 12-lead ECG

a) State the ECG diagnosis. (2 marks)

Wolff-Parkinson-White syndrome — short PR interval (<120 ms), delta wave (slurred QRS upstroke), broad QRS (>120 ms), secondary ST-T changes.

b) List 5 history questions. (5 marks)

- Prior syncope, palpitations, or documented arrhythmia?
- Did palpitations precede the syncope (sudden onset)?
- Family history of WPW, SCD, or unexplained death?
- Exercise-induced or at rest?
- Current medications or recreational drugs?
- Pregnancy status / urine β -hCG (rule out other causes)

c) List 5 bedside investigations with justification. (5 marks)

Investigation	Justification
12-lead ECG	Confirm WPW; baseline for comparison
Bedside echo (POCUS)	Structural disease (Ebstein's associated with WPW); LV function
Blood glucose	Metabolic mimic of syncope
Urine β -hCG	Exclude pregnancy / ectopic in young woman
Vital signs / postural BP	Haemodynamic stability; orthostatic component

d) State the disposition. (1 mark)

Admit for continuous cardiac monitoring; urgent cardiology / electrophysiology referral. WPW + syncope = high-risk for fast pre-excited AF / VF; EP study and almost certainly radiofrequency ablation.

References: Tintinalli's Emergency Medicine 9e Ch 18 • EHRA expert consensus on WPW

Question 73 | Syncope Causes — Neurally Mediated, Orthostatic, Arrhythmogenic (11 marks)

Discuss the categorical causes of syncope.

a) List 3 causes of neurally mediated syncope. (3 marks)

- Vasovagal (neurocardiogenic) — most common; pain, venepuncture, prolonged standing, emotional
- Situational — cough, micturition, defecation, swallowing
- Carotid sinus hypersensitivity (tight collar, head turning)

b) List 3 causes of orthostatic hypotension. (3 marks)

- Volume depletion (dehydration, blood loss, diarrhoea)
- Medication-induced (antihypertensives, α -blockers, diuretics, nitrates, TCAs)
- Autonomic failure (Parkinson's, MSA, diabetes, alcoholic neuropathy)
- Adrenal insufficiency
- Prolonged bed rest / deconditioning

c) List 5 ECG findings suggesting arrhythmogenic syncope. (5 marks)

- Persistent sinus bradycardia <40 bpm or sinoatrial pauses
- Mobitz type II or 3° AV block
- QTc >500 ms
- Brugada Type 1 (V_1-V_2)
- Pre-excitation (WPW delta wave)
- LBBB (especially new)
- Non-sustained VT
- ARVC pattern (epsilon wave, T inversion V_1-V_3)

References: Tintinalli's Emergency Medicine 9e Ch 22 • ESC Syncope Guidelines 2018

Question 74 | Syncope — Long QT and Torsades (14 marks)

A 45-year-old female presents with syncope. ECG shows QTc 540 ms. The rhythm strip captured during her episode shows polymorphic VT with twisting QRS.

[ECG AND RHYTHM STRIP] 12-lead ECG and rhythm strip

a) State the primary ECG abnormality. (1 mark)

Prolonged QTc (540 ms; abnormal >460 ms in females, significantly elevated >500 ms) — substrate for early afterdepolarisations and TdP.

b) List 5 pharmacological causes from different drug classes. (5 marks)

Class	Example
Class Ia antiarrhythmic	Quinidine, procainamide
Class III antiarrhythmic	Sotalol, amiodarone
Macrolide / quinolone antibiotic	Erythromycin, azithromycin, moxifloxacin
Antipsychotic	Haloperidol, quetiapine, ziprasidone
Antiemetic	Ondansetron (high-dose IV), domperidone, droperidol
TCA / antidepressant	Amitriptyline, citalopram (high dose)
Methadone	Opioid agonist with QT effect

c) List 3 non-pharmacological causes / risk factors. (3 marks)

- Congenital LQTS (LQT1–3 — KCNQ1, KCNH2, SCN5A mutations)
- Electrolyte: hypoK⁺, hypoMg²⁺, hypoCa²⁺
- Female sex (longer baseline QTc)
- Bradycardia (pause-dependent QT)
- Hypothyroidism
- Hypothermia
- Starvation / anorexia

d) Name the rhythm strip abnormality. (1 mark)

Torsades de Pointes — polymorphic VT with twisting QRS axis around the isoelectric baseline.

e) List 4 management steps. (4 marks)

- Magnesium sulphate 2 g IV over 2 min (first-line, even if Mg normal) **[core]**
- DC defibrillation 200 J non-synchronised if pulseless / unstable (TdP can be sustained) **[core]**
- Correct electrolytes: K⁺ >4.5, Mg²⁺ >1.0
- Withdraw ALL QT-prolonging medications
- Overdrive pacing (transvenous 90–110 bpm) for pause-dependent recurrent TdP
- Isoprenaline 1–10 mcg/min infusion (avoid in congenital LQTS)
- ICD for congenital LQTS (definitive)

References: Tintinalli's Emergency Medicine 9e Ch 19 • CredibleMeds.org QT drug list