

Solutions

2.1

- Phrenic nerve, C3–5 (“C3, 4, 5 keeps the diaphragm alive”).

2.2

- At the sternal angle, T4/5 disc level ✓.

2.3

- The fibrous bag cannot stretch: small volumes stop diastolic filling.

3.1

- Vagus posterior: left recurrent laryngeal under the arch → hoarseness; phrenic anterior: C4 referral to shoulder tip.
- Growing anteriorly irritates phrenic first (shoulder pain, then exam: palpate/tap the diaphragm); posteriorly, vagal/recurrent first (hoarseness, then exam: voice + laryngoscopy).

3.2

- Pericardium: closed, fibrous, no slack. Blood inside compresses the thin-walled right heart during diastole → falling output.
- Inspiration lowers intrathoracic pressure, pooling venous blood in the lungs; with the pericardium full, the septum shifts and the pulse volume drops (pulsus paradoxus).
- Needle below the xiphoid, aimed at the left shoulder – the route avoids the pleura and reaches the pericardial sac.