Physiology Study Guide

Physiology Unit 1:

Important:

- Body fluid compartments (particularly volumes and how they are measured).
- Diffusion and Fick’s Law.
- Osmolality.
- Gibbs-Donnan effect.
- Membrane potentials.

Definitions:

- Transcellular fluid.
- Moles vs. Osmoles.
- pH.
- Buffer.
- Diffusion.
- Osmosis.
- Osmotic pressure
- Osmolarity vs. Osmolality.
- Tonicity.
- Oncotic pressure.

Physiology Unit 2:

- Transport across cell membranes
- $\text{Na}^+ / \text{K}^+$ ATP-ase.
- Know fundamentals of Intercellular Communication and $2^{nd}$ messengers (some overlap with Pharmacology).

Physiology Unit 3:

- Axonal transport
- Resting membrane potential. (Fig 4-6)
• Ion fluxes during action potential.

• Changes in excitability

• Saltatory conduction.

• Nerve fibre types and function. (Table 4-1 = MCQ, NNB!!!)

• Table 4-3 = MCQ

**Physiology Unit 4:**

• Morphology of skeletal muscle. (Fig 5-3)
• Molecular basis of contraction (Fig 5-5, Fig 5-6)
• Types of contraction
• Tetany
• Length-tension (Fig 5-11)

• Morphology of cardiac muscle (contrast with skeletal).
• Cardiac muscle action potential. (Fig 5-16)
• Contractile response
• Length-tension relationship for cardiac muscle.

• Smooth muscle morphology
• Contraction (Fig 5-21)

**Physiology Unit 5:**

• EPSP
• IPSP
• Generation of the action potential in the postsynaptic neuron
• Inhibition & Facilitation
• Neuro-muscular transmission

• Ach. & receptors
• Adr. / NorAdr. & receptors
• Serotonin (Important because of SSRIs etc.)
• GABA
Physiology Unit 6:
Revision Week

Physiology Unit 7:

- Route of spread of cardiac excitation.
- Pacemaker potentials
  
  **How are they generated?**
  - Fig. 30-1.
  - Fig. 30-2.
  - Fig. 30-3.

- Table 30-1 could generate an MCQ
- Read ECG once (you know this anyway).
- Arrhythmias.
- Most of the ECG / arrhythmia content is likely to be seen in MCQs only.

Physiology Unit 8:

- The cardiac cycle - Phases.
  - Fig. 31-3.
- JVP waves (a,c,v) - what causes them.
- Heart sounds (including S3, S4) - what causes them.
- Cardiac output - How to measure it.
  - Fick principle (**different from Fick’s law).
  - Factors controlling cardiac output (Fig. 31.5)
  - Preload / afterload / contractility
  - Length-Tension relationship in cardiac muscle.
    (i.e. Frank-Starling law).
  - Factors affecting EDV (preload).
  - Pressure-volume loop for left ventricle (Fig. 31.7).
  - Factors affecting contractility (Fig. 31.8).
**Physiology Unit 9:**

- Platelets.
- Red cells
- Haemoglobin.
- Blood types (especially ABO, Rhesus).
- Plasma proteins & their functions
- Haemostasis.
- Anticlotting mechanisms.

**Physiology Unit 10:**

- Table 32-10 (MCQ)
- Flow = Pressure
  Resistance
- Laminar flow / turbulent flow.
- Reynold's number
- Poiseuille’s Law -know formula (popular question).
  -explain physiological significance.
  (e.g. “what is the effect on resistance of a 50% reduction in the
  diameter of a blood vessel?”)
- Laplace’s Law $P = \frac{2T}{R}$ (also a popular question).
- Resistance vs capacitance vessels.
- Fig. 32-27 is a collection of MCQs waiting to happen.
- Measurement of BP - what the different Korotkov sounds mean.
- Capillary circulation -Starling forces & their values.
  -Fig. 32-33.

**Physiology Unit 11:**

- Neural regulation: -innervation of blood vessels.
  -innervation of the heart.
  -the vasomotor centre.
  -Tables 31-2 & 31-3
- Baroreceptors. -site / action
  -other sites of receptors
- atrial / LV / pulmonary.

- Reflexes mentioned in the text: - Bainbridge.
  - Bezold-Jarisch.
  - Cushing.
  - Valsalva manoeuvre.

- Autoregulation: - definition.
  - theories of how it works.

- Prostacyclin / Thromboxane A₂.

- EDRF (NO): - factors which release it.
  - actions.

- Endothelins: - actions.
  - Table 31-1 for an MCQ.

- Hormones: - Kinins / ANP / ADH / NA / Angiotensin II.

**Physiology Unit 12:**

- Table 34-2 is a potential MCQ

- Cerebral circulation:
  * CSF
    - Volume.
    - Where produced, where absorbed.
    - Composition
    - Function.
    - Fig. 34-3.
  * Blood-brain barrier.
    - Penetration of substances into brain.
    - Function.
  * Circumventricular organs.
  * Regulation of cerebral blood flow (Important):
    - Monroe-Kellie doctrine.
    - Fig. 34-8.
    - Autoregulation (Fig. 34-9.)
  * Brain metabolism and O₂ requirements.

- Coronary circulation.

- Skin circulation:
  * Triple response.

- Placental and foetal circulation:
  * Changes at birth.
Physiology Unit 13:
Revision Week

Physiology Unit 14

- Ideal gas equation. / Properties of gases.
- Lung volumes & Fig. 35-7. (Important ++).
- Compliance.
- Pressure-volume curves. Fig 35-11
- Surfactant.
- Work of breathing (basic). Fig 35-15
- Regional differences in ventilation and blood flow.
- Dead space: -Anatomical.
  -Physiological.

Physiology Unit 15:

- Gas exchange.
- Bohr’s equation (best shown in West).

- Diffusion in the lungs.
- Review Fick’s law.
- Perfusion-limited & diffusion-limited gas uptake. (and examples). Fig. 35-19.

- Pulmonary circulation
- Read West chapter 4 for blood flow and metabolism

- Other functions of the respiratory system:
  - defence.
  - metabolic / endocrine functions.

Physiology Unit 16:

- Reaction between Hb and O₂.
- O₂ - Hb dissociation curve: (This is important). Fig 36-2
  * Be able to draw it and **plot in some values**
  * Effect of H⁺, CO₂, 2,3-DPG, ↑ temp. Fig 36-3
- Be able to draw dissociation curves for Myoglobin and foetal Hb.
  (superimposed on the Hb-O₂ curve). Fig 36-5
• CO₂ transport. Fig 36-7

• Buffers: Definition / main buffers in vivo.
• Acidosis and alkalosis. Fig 36-10

• Hypoxia (NB) - 4 types (and examples)
• Hypoxic hypoxia - diseases causing it.
• Effects of ↑ barometric pressure

• V/Q mismatch – read West Chapter 5 for this topic.

**Physiology Unit 17:**

• The control of ventilation. (a very popular question)
  ** Fig. 8.1 in West for the arrangement of respiratory control.**

• Centres for respiratory drive

• Different stimuli affecting respiratory drive (Table 37-1)

• Cheyne-Stokes breathing and why it occurs.

• Aortic and carotid bodies.

• Blood supply and O₂ uptake of the carotid body.

**Physiology Unit 18:**

Revision Week

**Physiology Unit 19:**

• Renal blood flow:
  * Know value.
  * Renal plasma flow and how measured.
  * Regulation of renal blood flow (including autoregulation).

• GFR:
  * Know value.
  * How measured.
  * Control of GFR.

• Tubular function.
• Na⁺ handling.
• Glucose handling:
  * Concept of renal threshold (NB 200 mg/dl ≈ mmol/l.)
• PAH handling.
• Tubuloglomerular feedback / Glomerulotubular balance.

**Physiology Unit 20:**

• Regulation of Na⁺ and Cl⁻ excretion.
• Water excretion and things affecting it.
• Regulation of K⁺ secretion.
• Emptying of the bladder.
• Renal H⁺ excretion
• pH balance

**Physiology Unit 21:**

• Defence of tonicity.
• Vasopressin
• Defence of volume.
• Renin-angiotensin System
• Erythropoietin

**Physiology Unit 22:**

• Gastrointestinal secretions:
  * Salivary secretion
  * Origin and regulation
  * Contents of gastric juice (Table 26-1 = MCQ)
• Exocrine pancreas:
  * Principal digestive enzymes
  * Regulation
• Composition of bile (Table 26-4 = MCQ)
• Regulation of gastric acid secretion.
  * Gastrin
  * Cholecystokinin
  * Secretin
  * Somatostatin

**Physiology Unit 23:**

• Carbohydrates:
  * Digestion
  * Absorption
• Protein:
  * Digestion
  * Absorption
• Lipids:
  * Digestion
  * Absorption

• Definition of metabolic rate.
• Respiratory quotient (MCQ):
  * Definition.
  * Factors affecting.
• Factors affecting metabolic rate.

**Physiology Unit 24:**

Revision Week

**Physiology Unit 25:**

• Overview of iodine metabolism.

• T3 / T4 synthesis / secretion.

• Protein binding (Table 20-1 = MCQ).

• Effects of T3 / T4. (Table 20-5 = MCQ)

• Regulation of T3 / T4 secretion.
• Overview of hypothyroidism / hyperthyroidism.

• Causes of hyperthyroidism (Table 20-4 = MCQ)

**Physiology Unit 26:**

• Cell types in Islets of Langerhans (and which cells secrete what).

• Insulin (Important):
  * Structure.
  * Synthesis / secretion.
  * Effects. (Table 21-4)
  * Mechanism of action

• Insulin deficiency and excess

• Regulation of insulin secretion (Table 21-6 = MCQ)

• Glucagon:
  * Actions.
  * Regulation of secretion.

• Somatostatin

• Pancreatic polypeptide.

• Carbohydrate metabolism

**Physiology Unit 27:**

• Adrenal morphology / architecture (Fig 22-2 = MCQ)

• Adrenal medulla:
  * Effects of catecholamines (Fig 22-5 = MCQ)
  * Regulation of medullary secretion.

• Adrenal cortex:
  * Substances secreted. (Table 22-2 = MCQ)

• Glucocorticoids:  
  * Physiological effects
  * Pathological effects
  * Regulation

• ACTH.

• Aldosterone:  
  * Effects
  * Regulation (Table 22-6)
Physiology Unit 28:

- Overview of $\text{Ca}^{2+}$ metabolism (Fig. 23-1).
- Table 23-1 (distribution of calcium in plasma).
- Vitamin D and OH-Cholecalciferols.
- PTH.
  * Actions.
  * Regulation of secretion.
- Figure 23-3
- Calcitonin.
  * Actions.
- Bone physiology

Physiology Unit 29:

- Hypothalamic function (Table 18-1)
- Thirst
- Posterior pituitary hormones
- Anterior pituitary hormones
- Temperature regulation
- Overview of growth hormone.
- Physiology of growth
- Atrial natriuretic polypeptide:
  * Actions. / Factors affecting secretion.

Physiology Unit 30:

Revision Week
Physiology Unit 31:

- Chapter 9 (Reflexes):
  * Bell-Magendie law (MCQ).
  * Monosynaptic reflexes (stretch receptor).
  * Inverse stretch reflex
  * Polysynaptic reflexes (withdrawal reflex).

- Chapter 10 (Pain & Temperature):
  * Nociceptors
  * Classification of pain

- Chapter 11 (Somatosensory Pathways)
  * Dorsal column pathways and an overview of their position in the spinal cord. (Fig 11-2)
  * Ventrolateral spinothalamic tract

Physiology Unit 32:

- Chapter 12 (Vision):
  * Neural pathways (Fig 12-4)
  * Accommodation
  * Pupillary reflexes
  * Effect of lesions in the optic pathways

- Chapter 13 (Hearing and Equilibrium)
  * Table 13-1 (tuning fork tests)
  * Vestibular system
  * Rotational acceleration
  * Nystagmus

- Chapter 16 (Control of Posture and Movement)
  * Corticospinal and corticobulbar tracts
  * Figure 16-2
  * Spinal shock