

Appendix Two - Study Guide for the Primary Exam

Learning outcomes mapped to the primary examination

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| 1. Applied Procedural Anatomy | | | |
|-------------------------------|--|------|------------|
| A. Airway/ respiratory | | | |
| Code | Learning outcome | Role | Assessment |
| BT_AM 1.1 | Describe the anatomy of the upper airway, larynx and trachea, including its innervation and endoscopic appearance. see also SS_PA 1.1 and SS_OB 1.6 | ME | PEX |
| BT_RT 1.22 | Outline the anatomy relevant to drainage of the pleural space | ME | PEX |
| B. Vascular access | | | |
| BT_RT 1.20 | Describe the anatomy (including ultrasound anatomy) relevant to vascular access in resuscitation: specifically for safe cannulation of antecubital, saphenous, jugular and subclavian veins and placement of intraosseous infusion devices | ME | PEX |
| BT_GS 1.70 | Describe the anatomy (including ultrasound anatomy) of the peripheral venous system relevant to performing intravenous cannulation and PICC line insertion | ME | PEX |
| BT_GS 1.72 | Describe the anatomy and anatomical relations of the great veins relevant to performing central venous cannulation, including the ultrasound anatomy | ME | PEX |
| BT_GS 1.74 | Outline the anatomy of the radial, brachial, femoral and dorsalis pedis arteries and their anatomical relations relevant to arterial cannulation, including the ultrasound anatomy | ME | PEX |
| C. Neuraxial | | | |
| BT_RA 1.4 | Describe the anatomy of the vertebral column, spinal cord and meninges relevant to the performance of central neuraxial block with appropriate surface markings. See also SS_OB 1.7 | ME | PEX |
| BT_RA 1.17 | Describe the midline and paramedian approaches to the sub-arachnoid space and epidural space | ME | PEX |
| 2. Fundamental Pharmacology | | | |
| A. Pharmacodynamics | | | |
| BT_GS 1.1 | Explain the concept of drug action with respect to: <ul style="list-style-type: none"> • Receptor theory • Enzyme interactions • Physico-chemical interactions | ME | PEX |
| BT_GS 1.2 | Explain receptor activity with regard to: <ul style="list-style-type: none"> • Ionic fluxes • Second messengers and G proteins | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|----------------------------|---|------|------------|
| | <ul style="list-style-type: none"> Nucleic acid synthesis Evidence for the presence of receptors Regulation of receptor number and activity | | |
| BT_GS 1.3 | Define and explain dose-effect relationships of drugs with reference to: <ul style="list-style-type: none"> Graded and quantal response Therapeutic index Potency and efficacy Competitive and non-competitive antagonists Partial agonists, mixed agonist-antagonists and inverse agonists Additive and synergistic effects of drug combinations | ME | PEX |
| BT_GS 1.4 | Describe efficacy and potency with reference to dose-response curves | ME | PEX |
| BT_GS 1.5 | Explain the law of mass action and dynamic equilibrium. Describe receptor affinity and dissociation constants | ME | PEX |
| BT_GS 1.6 | Describe the mechanisms of adverse drug effects | ME | PEX |
| B. Pharmacokinetics | | | |
| BT_GS 1.7 | Explain the concept of pharmacokinetic modelling of single and multiple compartment models and define: <ul style="list-style-type: none"> Half life Clearance Zero and first order kinetics Volume of distribution Bio-availability Area under the plasma concentration time curve Extraction ratio | ME | PEX |
| BT_GS 1.8 | Describe drug absorption with reference to clinically utilised routes of administration | ME | PEX |
| BT_GS 1.9 | Describe factors influencing the distribution of drugs (for example, protein binding, lipid solubility, pH, pKa) and their alteration in physiological and pathological disturbance | ME | PEX |
| BT_GS 1.10 | Describe the mechanisms of drug clearance and how physiological and pathological disturbance may affect these | ME | PEX |
| BT_GS 1.11 | Describe the mechanisms of non-hepatic and hepatic metabolism of drugs including: <ul style="list-style-type: none"> Phase 1 and phase 2 reactions Hepatic extraction ratio and its significance First pass effect Enzyme induction and inhibition | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|--|--|------|------------|
| BT_GS 1.12 | <p>Explain and describe the clinical application of concepts related to intravenous and infusion kinetics including:</p> <ul style="list-style-type: none"> • Effect-site and effect-site equilibration time • Concept of context sensitive half time • Calculation of loading and maintenance dosage regimens <p>See also BT_GS 1.59</p> | ME | PEX |
| BT_GS 1.13 | Outline clinical drug monitoring with regard to peak and trough concentrations, minimum therapeutic concentration and toxicity | ME | PEX |
| C. Variability in drug response | | | |
| BT_GS 1.14 | Discuss the variations in individual drug responses, and apply this concept to clinical situations | ME | PEX |
| BT_GS 1.15 | Define tachyphylaxis, tolerance, addiction, dependence and idiosyncrasy. Describe mechanisms of tolerance | ME | PEX |
| BT_GS 1.16 | Describe alterations to pharmacokinetics and pharmacodynamics due to physiological changes with particular reference to the elderly and obesity. See also SS OB 1.1 , SS PA 1.52 and SS PA 1.53 | ME | PEX |
| BT_GS 1.17 | Describe alterations to pharmacokinetics and pharmacodynamics due to pathological disturbance with particular reference to cardiac, respiratory, renal and hepatic disease | ME | PEX |
| BT_GS 1.19 | Describe the mechanisms of drug interactions | ME | PEX |
| BT_GS 1.20 | Outline and give examples of the clinical importance of pharmacogenetic variation, for example, atypical plasma cholinesterase and CYP450 variations | ME | PEX |
| BT_GS 1.21 | Outline and give examples of the clinical importance of isomerism | ME | PEX |
| D. Pharmaceutics | | | |
| BT_GS 1.22 | Outline the mechanisms of action and potential adverse effects of buffers, anti-oxidants, anti-microbial and solubilising agents added to drug | ME | PEX |
| 3. Cellular Physiology | | | |
| BT_PO 1.82a | <p>Outline basic cellular physiology in particular:</p> <ul style="list-style-type: none"> • The structure of the cell membrane and trans-membrane transport mechanisms • The composition and regulation of intracellular fluid • The generation of the trans-membrane potential • Protein synthesis | ME | PEX |

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|--|---|------|------------|
| 4. General Anaesthetic Agents and Sedatives | | | |
| A. Inhalational | | | |
| BT_GS 1.23 | Describe the physical properties of inhalational agents, including the: <ul style="list-style-type: none"> Principles of vaporisation of inhalational agents Properties of an ideal inhalational anaesthetic agent Structure-activity relationships of inhalational agents | ME | PEX |
| BT_GS 1.24 | Describe the uptake, distribution and elimination of inhalational anaesthetic agents and the factors which influence induction and recovery from inhalational anaesthesia including the: <ul style="list-style-type: none"> Concepts of partition coefficients, concentration effect and second gas effect Relationships between inhaled and alveolar concentration Significance of the distribution of cardiac output and tissue partition coefficients on uptake and distribution of volatile agents | ME | PEX |
| BT_GS1.25 | Describe the effects of inhalational agents on the cardiovascular, respiratory and central nervous systems | ME | PEX |
| BT_GS 1.26 | Describe the toxicity of inhalational agents | ME | PEX |
| BT_GS 1.27 | Describe the pharmacology of nitrous oxide | ME | PEX |
| BT_GS 1.28 | Describe the comparative pharmacology of - nitrous oxide, sevoflurane, desflurane Outline the comparative pharmacology of - isoflurane, methoxyflurane, ether, halothane, xenon | ME | PEX |
| BT_GS 1.50 | Describe the concept and clinical application of MAC in relation to inhaled anaesthetic agents | ME | PEX |
| B. Intravenous | | | |
| BT_GS 1.29 | Outline the physical properties of sedative/hypnotic agents, including: <ul style="list-style-type: none"> Formulation Properties of an ideal agent Structure-activity relationships | ME | PEX |
| BT_GS 1.30 | Discuss the pharmacokinetics of IV anaesthetic and sedative agents, including: <ul style="list-style-type: none"> Onset and offset Clinical implications of differences between drugs <p>See also BT_GS 1.59 and 1.59a</p> | ME | PEX |
| BT_GS 1.31 | Discuss the comparative pharmacology of IV anaesthetic and sedative agents, in particular the | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|----------------------|--|------|------------|
| | effects on the central nervous, respiratory, and cardiovascular systems | | |
| BT_GS 1.32 | Describe the adverse effects of individual induction, sedative and premedicant agents | ME | PEX |
| BT_GS 1.34 | Outline the pharmacology and clinical use of flumazenil | ME | PEX |
| BT_GS 1.59 | Discuss the pharmacokinetics and pharmacodynamics of target controlled infusions, including the concepts of: <ul style="list-style-type: none"> • Multi-compartment model and rate constants • Effect site (biophase) and k_{e0} • The relationship between plasma and effect site concentration • Altered response due to factors including age, obesity, and cardiac output • Sources of error | ME | PEX |
| BT_GS 1.59a | Outline the similarities and differences between commonly used Target Controlled Infusion (TCI) models | ME | PEX |
| C. Integrated | | | |
| BT_GS 1.49 | Outline the proposed mechanisms of anaesthesia, and the sites of action of anaesthetic agents | ME | PEX |
| BT_GS 1.51 | Describe the concept of depth of anaesthesia and how this may be assessed | ME | PEX |
| BT_GS 1.51a | Outline the aetiology of and measures to prevent intra-operative awareness under general anaesthesia | ME | PEX |
| BT_GS 1.53 | Describe the synergism between anaesthetic agents, opioids and regional blockade and how this is used clinically | ME | PEX |
| BT_GS 1.48 | Describe the effects of anaesthetic agents on regional circulations | ME | PEX |
| BT_GS 1.60 | Describe the physiological effects of anaesthesia on the respiratory system and its clinical management | ME | PEX |
| BT_GS 1.61 | Outline the effects of anaesthesia on the immune, haematological and endocrine systems | ME | PEX |
| BT_GS 1.33 | Describe alterations to the pharmacokinetics and pharmacodynamics of inhalational and intravenous anaesthetic agents for example: <ul style="list-style-type: none"> • the elderly • obesity • cardiac, respiratory, renal, and hepatic disease <p>See also SS_OB 1.1, SS_PA 1.52 and SS_PA 1.53</p> | ME | PEX |

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|-----------------------------------|--|------|------------|
| 5. Respiratory system | | | |
| A. Anatomy | | | |
| BT_PO 1.7 | Outline the anatomy of the lungs, tracheobronchial tree, and alveoli. See also BT_AM 1.1 | ME | PEX |
| B. Physiology | | | |
| i. Control of breathing | | | |
| BT_PO 1.9 | Describe the neural and chemical control of ventilation via central and peripheral chemoreceptors and indicate how this is altered by anaesthesia and abnormal clinical states | ME | PEX |
| ii. Mechanics of breathing | | | |
| BT_PO 1.6 | Outline the structure of the chest wall and diaphragm and the implications for respiratory mechanics | ME | PEX |
| BT_PO 1.11 | Define compliance (static, dynamic and specific) and relate this to the elastic properties of the lung | ME | PEX |
| BT_PO 1.12 | Describe 'fast' and 'slow' alveoli, including the concept of 'time constants' | ME | PEX |
| BT_PO 1.13 | Describe the elastic properties of the chest wall and plot pressure-volume relationships of the lung, chest wall and the total respiratory system | ME | PEX |
| BT_PO 1.14 | Explain the vertical gradient of pleural pressure and its significance | ME | PEX |
| BT_PO 1.10 | Describe the properties of surfactant and relate these to its role in influencing respiratory mechanics | ME | PEX |
| BT_PO 1.15 | Explain the physics of gas flow and the significance of the relationship between resistance and flow in the respiratory tract | ME | PEX |
| BT_PO 1.16 | Describe the factors affecting airway resistance and how airway resistance may be measured | ME | PEX |
| BT_PO 1.17 | Describe closing capacity and its relationship to airway closure and explain its clinical significance and measurement | ME | PEX |
| BT_PO 1.18 | Describe the work of breathing | ME | PEX |
| BT_PO 1.19 | Describe altered lung mechanics in common disease states | ME | PEX |
| iii. Pulmonary gas volumes | | | |
| BT_PO 1.20 | Describe lung volumes and capacities, their measurement and normal values | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|---|---|------|------------|
| BT_PO 1.21 | Describe dead space, its measurement and apply the Bohr equation and alveolar gas equation | ME | PEX |
| BT_PO 1.22 | Describe the composition of ideal alveolar and mixed expired gases | ME | PEX |
| iv. Pulmonary circulation | | | |
| BT_PO 1.8 | Outline the anatomy of the pulmonary and bronchial circulations | ME | PEX |
| BT_PO 1.33 | Describe the difference between the pulmonary and systemic circulations | ME | PEX |
| BT_PO 1.34 | Describe pulmonary vascular resistance and the control of pulmonary vascular tone | ME | PEX |
| v. Ventilation/perfusion (V/Q) relationships | | | |
| BT_PO 1.26 | Describe normal ventilation-perfusion matching | ME | PEX |
| BT_PO 1.27 | Describe West's zones of the lung | ME | PEX |
| BT_PO 1.28 | Describe the shunt equation | ME | PEX |
| BT_PO 1.29 | Discuss regional ventilation-perfusion inequalities and abnormalities, venous admixture, and the effect on oxygenation and carbon dioxide elimination | ME | PEX |
| vi. Diffusive transfer of gases | | | |
| BT_PO 1.23 | Describe the oxygen cascade | ME | PEX |
| BT_PO 1.24 | Describe the alveolar exchange of oxygen and carbon dioxide | ME | PEX |
| BT_PO 1.25 | Describe diffusion capacity and its measurement | ME | PEX |
| vii. Gas transport in blood | | | |
| BT_PO 1.31 | Discuss the carriage of oxygen in blood, the oxyhaemoglobin dissociation curve, oxygen stores in the blood and their clinical significance and implications | ME | PEX |
| BT_PO 1.32 | Discuss the carriage of carbon dioxide in blood, the carbon dioxide dissociation curve and their clinical significance and implications | ME | PEX |
| viii. Applied respiratory physiology | | | |
| BT_AM 1.2 | Outline the physiology of the airway including airway reflexes | ME | PEX |
| BT_PO 1.35 | Discuss the physiological consequences of intermittent positive pressure ventilation and positive end-expiratory pressure | ME | PEX |
| BT_PO1.35a | Describe preoxygenation, including its physiological basis | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|------------------------------------|---|------|------------|
| BT_PO 1.36 | Discuss the physiological effects of hypoxaemia, hyper and hypocapnia, and carbon monoxide poisoning | ME | PEX |
| BT_PO 1.37 | Discuss the effect of the following on ventilation: <ul style="list-style-type: none"> • Changes in posture • Exercise • Altitude • Anaesthesia • Ageing • Morbid obesity | ME | PEX |
| BT_PO 1.38 | Define humidity and outline the importance of humidification | | |
| BT_PO 1.39 | Outline the non-ventilatory functions of the lungs | | |
| BT_RT 1.10 | Classify and describe the causes of hypoxia and hypoxaemia | ME | PEX |
| BT_RT 1.11 | Describe the physiological consequences of hypoxia and hypoxaemia | ME | PEX |
| BT_RT 1.38 | Define respiratory failure and differentiate between type 1 and type 2 respiratory failure | ME | PEX |
| BT_RT 1.39 | Interpret blood gas analysis in respiratory failure | ME | PEX |
| BT_AM 1.4 | Describe the physiological consequences of anaesthesia and patient positioning on the respiratory system | ME | PEX |
| BT_AM 1.19 | Describe different modes of mechanical ventilation and their physiological consequences | ME | PEX |
| C. Pharmacology | | | |
| BT_PO 1.40 | Outline the pharmacology of anti-asthma drugs | ME | PEX |
| BT_PO 1.41 | Outline the pharmacology of drugs used to treat pulmonary hypertension including nitric oxide | ME | PEX |
| BT_PO 1.41a | Discuss oxygen therapy including methods of delivery, indications and contraindications, physiological and pathophysiological effects | ME | PEX |
| BT_AM 1.3 | Describe the effect of anaesthetic agents and other drugs on airway reflexes | ME | PEX |
| 6. Autonomic Nervous System | | | |
| A. Anatomy and physiology | | | |
| BT_PM 1.2 | Describe the anatomy of the autonomic nervous system | ME | PEX |
| BT_PO 1.51 | Describe the autonomic nervous system and its physiological roles including: <ul style="list-style-type: none"> • Autonomic receptors and cellular effects of receptor activation | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|---|---|------|------------|
| | <ul style="list-style-type: none"> Autonomic transmitters, their synthesis, release and fate | | |
| B. Pharmacology | | | |
| See Cardiovascular Pharmacology BT_PO 1.52 BT_PO 1.53 BT_PO 1.54 BT_RT 1.17 BT_RT 1.18 | | ME | PEX |
| 7. Cardiovascular system | | | |
| A. Anatomy | | | |
| BT_PO 1.42 | Describe the anatomy of the heart including the coronary circulation and territories supplied | ME | PEX |
| B. Physiology | | | |
| i. Electrical properties of the heart | | | |
| BT_PO 1.43 | Describe the physiological basis of electrical activity and its relationship to mechanical events including the: <ul style="list-style-type: none"> Ionic basis of automaticity The normal and abnormal processes of cardiac excitation Physiological basis of the electrocardiograph in normal and common pathological states Factors that may influence cardiac electrical activity Correlation of the mechanical events of the cardiac cycle with the electrical and ionic events | ME | PEX |
| ii. Cardiac output, blood pressure, and regional circulations | | | |
| BT_PO 1.44 | Describe the physiology of cardiac muscle and the mechanism of excitation contraction coupling | ME | PEX |
| BT_PO 1.44a | Describe the events of the cardiac cycle using a Wiggers diagram and pressure-volume loop | ME | PEX |
| BT_PO 1.45 | Discuss the factors that determine and control cardiac output and the implications for clinical practice including: <ul style="list-style-type: none"> Preload, afterload and contractility The Frank-Starling mechanism Cardiac output and vascular function curves Pressure volume relationships in the heart | ME | PEX |
| BT_PO 1.46 | Describe the factors determining myocardial oxygen supply and demand and their clinical implications | ME | PEX |
| BT_PO 1.47 | Discuss the control of blood pressure and the distribution of blood volume and flow throughout the cardiovascular system including: | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|---|---|------|------------|
| | <ul style="list-style-type: none"> The factors determining systemic blood pressure and its regulation and control Total peripheral resistance and factors affecting it The relationship between organ blood flow and demand and the role of autoregulation Clinically significant features of the coronary, cerebral, skin, muscle, renal, hepatic and splanchnic circulations The essential features of the microcirculation including fluid exchange and its control | | |
| iii. Applied cardiovascular physiology | | | |
| BT_PO 1.48 | Discuss the cardiovascular responses to: <ul style="list-style-type: none"> Changes in posture Exercise Valsalva manoeuvre Positive pressure ventilation and PEEP Pneumoperitoneum Haemorrhage and hypovolaemia Surgery and trauma | ME | PEX |
| BT_PO 1.49 | Describe the cardiovascular changes that occur with ageing | ME | PEX |
| BT_PO 1.50 | Outline the cardiovascular changes that occur with morbid obesity | ME | PEX |
| iv. Shock | | | |
| BT_RT 1.1 | Define shock. Classify and describe causes of shock based on the underlying pathophysiological mechanisms | ME | PEX |
| BT_RT 1.2 | Discuss different types of shock with reference to the determinants of cardiac output | ME | PEX |
| BT_RT 1.3 | Describe the physiological consequences of shock | ME | PEX |
| BT_RT 1.4 | Describe oxygen delivery and outline the use of indicators of tissue oxygenation (base deficit, lactate, mixed venous oxygen saturation) in resuscitation | ME | PEX |
| BT_RT 1.30 | Outline how the clinical signs of shock may be altered by age | ME | PEX |
| C. Pharmacology | | | |
| BT_PO 1.52 | Describe the mechanism of action and effects of sympathomimetic and anticholinergic drugs | ME | PEX |
| BT_PO 1.53 | Describe the pharmacology and clinical application of adrenergic agonists | ME | PEX |
| BT_PO 1.54 | Outline the pharmacology of commonly used alpha and beta receptor blocking agents | ME | PEX |
| BT_PO 1.55 | Outline clinically important drug interactions with the autonomic nervous system (e.g. tricyclic antidepressants, monoamine oxidase inhibitors) | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|------------------------|--|------|------------|
| BT_PO 1.56 | Outline the physiological and pharmacological basis of classifying antiarrhythmic agents | ME | PEX |
| BT_PO 1.57 | Describe the pharmacology of amiodarone. Outline the pharmacology of other antiarrhythmic agents | ME | PEX |
| BT_PO 1.58 | Describe the pharmacology of <ul style="list-style-type: none"> • Glyceryl trinitrate • Sodium nitroprusside Outline the pharmacology of other antihypertensive agents | ME | PEX |
| BT_PO 1.59 | Outline the pharmacology of drugs used to manage myocardial ischaemia/infarction | ME | PEX |
| BT_PO 1.60 | Outline the pharmacology of drugs used to manage acute or chronic cardiac failure | ME | PEX |
| BT_RT 1.17 | With reference to the management of shock, describe the pharmacology of vasopressors and inotropes | ME | PEX |
| BT_RT 1.18 | With reference to cardiopulmonary resuscitation, describe the pharmacology of drugs listed in the current ACLS guidelines | ME | PEX |
| 8. Renal System | | | |
| A. Physiology | | | |
| BT_PO 1.61 | Outline the functional anatomy of the nephron | ME | PEX |
| BT_PO 1.62 | Explain the physiology of renal blood flow | ME | PEX |
| BT_PO 1.63 | Describe glomerular filtration and tubular function | ME | PEX |
| BT_PO 1.64 | Explain the counter-current mechanisms in the kidney | ME | PEX |
| BT_PO 1.65 | Explain the mechanisms involved in the regulation of renal function | ME | PEX |
| BT_PO 1.66 | Outline the endocrine functions of the kidney | ME | PEX |
| BT_PO 1.67 | Describe the role of the kidney in the handling of glucose, nitrogenous products and drugs | ME | PEX |
| BT_PO 1.68 | Describe the principles of measurement of glomerular filtration rate and renal blood flow | ME | PEX |
| BT_PO 1.69 | Describe the physiological effects and clinical assessment of renal dysfunction | ME | PEX |
| BT_PO 1.70 | Explain the renal responses to hypovolaemia | ME | PEX |
| BT_PO 1.71 | Outline the effects of anaesthesia on renal function | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|-----------------------------------|--|------|------------|
| B. Pharmacology | | | |
| BT_PO 1.80 | Describe alterations to drug response due to renal disease | ME | PEX |
| BT_PO 1.81 | Classify diuretics based on their site of action | ME | PEX |
| BT_PO 1.82 | Outline the pharmacology of diuretics | ME | PEX |
| 9. Fluids and Electrolytes | | | |
| BT_PO 1.72 | Describe the function, distribution and physiological importance of sodium, chloride, potassium, magnesium, calcium and phosphate ions | ME | PEX |
| BT_PO 1.73 | Describe the mechanisms involved in the maintenance of fluid and electrolyte balance | ME | PEX |
| BT_PO 1.74 | Outline the constituents and functions of plasma | ME | PEX |
| BT_PO 1.75 | Define osmotic pressure and outline the factors that determine it | ME | PEX |
| BT_PO 1.76 | Describe the regulation of osmolality | ME | PEX |
| BT_PO 1.77 | Outline the significance of oncotic pressure, colloid osmotic pressure and reflection coefficients | ME | PEX |
| BT_PO 1.77a | Describe the body fluid 'compartments' and the movement of fluid between compartments | ME | PEX |
| BT_PO 1.77b | Describe the chemical composition of crystalloids and colloids, and their use as volume replacement and maintenance fluid, including potential adverse effects | ME | PEX |
| 10. Acid Base | | | |
| BT_PO 1.78 | Describe the regulation of acid/base balance | ME | PEX |
| BT_PO 1.79 | Describe acid-base chemistry using the Henderson-Hasselbach equation and strong ion difference | ME | PEX |
| BT_PO 1.79a | Interpret blood gases in clinical situations. | ME | PEX |
| 11. Nervous System | | | |
| A. Anatomy | | | |
| BT_RT 1.23 | Outline the anatomy of the cerebral and spinal cord circulation | ME | PEX |
| B. Physiology | | | |
| BT_RA 1.1 and BT_PO 1.92 | Describe the physiology of nerve conduction | ME | PEX |
| BT_PO 1.93 | Outline the difference between normal sleep and anaesthesia, including the EEG | ME | PEX |
| BT_PO 1.95 | Discuss the determinants and control of: <ul style="list-style-type: none"> Intracranial and intraspinal pressure | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|-------------------------|--|------|------------|
| | <ul style="list-style-type: none"> Cerebral blood flow and autoregulation Cerebral perfusion pressure Spinal cord perfusion | | |
| BT_PO 1.96 | Outline the structure and function of the blood brain barrier | ME | PEX |
| BT_PO 1.97 | Outline the production, reabsorption, and role of cerebrospinal fluid | ME | PEX |
| BT_PO 1.98 | Outline cerebral and spinal cord metabolism including energy production, effects of temperature and factors leading to cell damage and cell death | ME | PEX |
| BT_RT 1.12 | Discuss the factors determining intracranial pressure and its regulation | ME | PEX |
| BT_RT 1.13 | Describe the regulation of cerebral blood flow, and factors leading to loss of autoregulation | ME | PEX |
| BT_RT 1.14 | Describe cerebral perfusion pressure | ME | PEX |
| BT_RT 1.15 | Outline the blood supply to the spinal cord and the regulation of spinal cord blood flow | ME | PEX |
| BT_RT 1.16 | Describe spinal cord perfusion pressure | ME | PEX |
| BT_RA 1.2 | Describe the physiological consequences of a central neuraxial block | ME | PEX |
| C. Pharmacology | | | |
| BT_PO 1.98d | Outline the pharmacology of hyperosmolar solutions used to decrease brain volume | ME | PEX |
| BT_PO 1.99 | Outline the pharmacology of anti-depressant, anti-psychotic, anti-convulsant, anti-parkinsonian and anti-migraine medication | ME | PEX |
| BT_PO 1.101 | Outline the pharmacology of drugs acting via effects on serotonin or serotonin receptors | ME | PEX |
| BT_PO 1.102 | Outline the clinical features and management of serotonin syndrome | ME | PEX |
| 12. Pain | | | |
| A. Anatomy | | | |
| BT_RA 1.7 and BT_PM 1.1 | Describe the anatomy of the sensory pathways with particular reference to pain sensation | ME | PEX |
| BT_RA 1.5 | Outline the dermatomal innervations | ME | PEX |
| BT_RA 1.6 | Outline the myotomal innervations | ME | PEX |
| B. Physiology | | | |
| BT_PM 1.3 | Describe the basic physiological mechanisms of pain including: <ul style="list-style-type: none"> Peripheral nociception | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|------------------------|--|------|------------|
| | <ul style="list-style-type: none"> • Conduction • Spinal cord modulation • Central processing of pain • Mediators, pathways and reflexes • Peripheral and central sensitisation • Pre-emptive and preventive analgesia | | |
| BT_PM 1.4 | Outline the mechanisms of progression from acute to chronic pain | ME | PEX |
| BT_PM 1.6 | Outline the pathophysiology of neuropathic pain | ME | PEX |
| BT_PM 1.8 | Describe the alterations to physiology and perception of pain in the older patient | ME | PE |
| C. Pharmacology | | | |
| i. General | | | |
| BT_PM 1.9 | <p>Describe the pharmacology of the following agents applicable to pain management:</p> <ul style="list-style-type: none"> • Opioids • Tramadol • Tapentadol • Local anaesthetic agents • NSAIDs • Paracetamol • NMDA antagonists • Inhalational analgesics – nitrous oxide, methoxyflurane <p>Outline the pharmacology of the following agents applicable to pain management:</p> <ul style="list-style-type: none"> • Anticonvulsants • Antidepressants • Corticosteroids | ME | PEX |
| BT_PM 1.10 | Describe the effect of physiological change and pathological disturbance on the pharmacology of the agents listed in learning outcome BT_PM 1.9, with special reference to the elderly | ME | PEX |
| ii. Opioids | | | |
| BT_PM 1.12 | Describe opioid receptors | ME | PEX |
| BT_PM 1.13 | Describe the mechanisms of action of opioids, including tramadol and tapentadol | ME | PEX |
| BT_PM 1.14 | Describe the actions of agonists, partial agonists, mixed agonist-antagonists and antagonists | ME | PEX |
| BT_PM 1.15 | Discuss the pharmacokinetic and clinical implications of different routes of administration for commonly used opioids, including the oral, transdermal, subcutaneous, intramuscular and intravenous routes (including Patient Controlled Analgesia – PCA) | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|-----------------------------------|--|------|------------|
| BT_PM 1.16 | Calculate dose conversions between commonly used opioids | ME | PEX |
| BT_PM 1.17 | Describe the pharmacokinetics and pharmacodynamics of intravenous opioids and evaluate their clinical applications | ME | PEX |
| BT_GS 1.41 | Describe the clinical application of opioids to anaesthesia and sedation | ME | PEX |
| BT_GS 1.42 | Describe the pharmacokinetics of intravenous opioids | ME | PEX |
| BT_PM 1.18 | Describe the pharmacology of epidural or intrathecal opioids | ME | PEX |
| BT_PM 1.19 | Describe the adverse effects of opioids administered by systemic and neuraxial routes and their prevention and management | ME | PEX |
| BT_PM 1.20 | Describe the potential adverse drug interactions between opioids and other agents | ME | PEX |
| BT_PM 1.21 | Outline the pharmacology of opioid antagonists | ME | PEX |
| iii. Local anaesthetics | | | |
| BT_RA 1.3 | Discuss the pharmacology of local anaesthetic agents including: <ul style="list-style-type: none"> • Mechanisms of action • Comparative pharmacology of different agents • Speed of onset • Duration of action • Toxicity including management • Pharmacokinetics of drugs administered in the epidural and subarachnoid space | ME | PEX |
| BT_RA 1.14 | Describe factors influencing dose and choice of anaesthetic agents for spinal anaesthesia and epidural anaesthesia/analgesia | ME | PEX |
| BT_RA 1.15 | Outline how the baricity of the agents used and positioning of patients may affect the extent of block in spinal anaesthesia | ME | PEX |
| BT_RA 1.16 | Outline the adjuvant agents that may be used with neuraxial and peripheral nerve blocks, including risks and benefits | ME | PEX |
| iv. NSAIDs and paracetamol | | | |
| BT_PM 1.23 | Outline the prostaglandin pathways and their physiological role in the production of pain | ME | PEX |
| BT_PM 1.24 | Classify non-steroidal anti-inflammatory drugs and describe their pharmacology | ME | PEX |
| BT_PM 1.25 | Describe the pharmacology of paracetamol, including toxicity | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|----------------------------|--|------|------------|
| v. Other | | | |
| BT_PM 1.26 | Describe the location, structure, and function of N-methyl-D-aspartate (NMDA) receptors | ME | PEX |
| BT_PM 1.27 | Describe the pharmacology of ketamine | ME | PEX |
| BT_PM 1.28 | Outline the pharmacology of gabapentinoids and other anticonvulsants relevant to pain medicine | ME | PEX |
| 13. Muscular System | | | |
| A. Physiology | | | |
| BT_GS 1.35 | Describe the physiology of the neuromuscular junction | ME | PEX |
| BT_PO 1.98a | Outline the physiology of skeletal muscle including mechanism of excitation contraction coupling | ME | PEX |
| BT_PO 1.98b | Outline the physiology of smooth muscle | ME | PEX |
| BT_PO 1.98c | Outline the similarities and differences between skeletal, cardiac, and smooth muscle | ME | PEX |
| B. Pharmacology | | | |
| BT_GS 1.36 | Describe the mechanism of action and pharmacokinetics of neuromuscular blocking agents | ME | PEX |
| BT_GS 1.37 | Describe the pharmacological differences between neuromuscular blocking agents and the clinical importance of these differences. | ME | PEX |
| BT_GS 1.37a | Describe the onset and offset of neuromuscular blockade at different muscle groups | ME | PEX |
| BT_GS 1.38 | Describe the adverse effects of neuromuscular blocking agents and factors that may modify responses to muscle relaxants | ME | PEX |
| BT_GS 1.39 | Describe the pharmacology of drugs used to reverse neuromuscular blockade | ME | PEX |
| BT_GS 1.40 | Describe the adverse effects of anticholinesterase agents | ME | PEX |
| BT_GS 1.47 | Discuss the indications for muscle relaxation in anaesthesia | ME | PEX |
| BT_GS 1.56 | Describe the clinical features and management of inadequate reversal of neuromuscular blockade | ME | PEX |
| BT_RT 1.19 | Outline the pharmacology of dantrolene in the treatment of malignant hyperthermia | ME | PEX |
| 14. Liver | | | |
| A. Physiology | | | |
| BT_PO 1.103 | Outline the functions of the liver | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|--|--|------|------------|
| BT_PO 1.104 | Outline the determinants of liver blood flow | ME | PEX |
| BT_PO 1.105 | Outline the portal circulation and its significance | ME | PEX |
| BT_PO 1.106 | Outline the laboratory assessment of liver function and hepatic failure | ME | PEX |
| B. Pharmacology | | | |
| BT_PO 1.108 | Describe alterations to drug response due to hepatic disease | ME | PEX |
| 15. Gastrointestinal | | | |
| A. Physiology | | | |
| BT_GS 1.43 | Describe the physiological basis of vomiting | ME | PEX |
| BT_PO 1.107 | Describe the: <ul style="list-style-type: none"> • Physiology of nausea and vomiting Outline the: <ul style="list-style-type: none"> • Physiology of swallowing • Factors preventing reflux of gastric contents into the oesophagus • Control of gastric motility and emptying • Composition of gastric fluid | ME | PEX |
| B. Pharmacology | | | |
| BT_GS 1.44 | Describe the pharmacology of anti-emetic and pro-kinetic agents | ME | PEX |
| BT_GS 1.62 | Discuss the prevention and management of postoperative nausea and vomiting | ME | PEX |
| BT_PO 1.109 | Outline the pharmacological treatment of peptic ulcer disease and reflux | ME | PEX |
| 16. Endocrine, Metabolism and Nutrition | | | |
| A. Physiology | | | |
| BT_PO 1.82b | Describe energy production by metabolic processes in cells | ME | PEX |
| BT_PO 1.83 | Describe the physiological consequences of fasting and starvation | ME | PEX |
| BT_PO 1.84 | Outline the factors that influence metabolic rate | ME | PEX |
| BT_PO 1.85 | Explain the control of blood glucose | ME | PEX |
| BT_PO 1.86 | Outline the role of the hypothalamus in the integration of neuro-humoral responses | ME | PEX |
| BT_PO 1.87 | Outline control of secretion and the functions of: <ul style="list-style-type: none"> • Pituitary hormones • Thyroid hormones • Adrenocortical hormones • Adrenomedullary hormones | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|--|---|------|------------|
| | <ul style="list-style-type: none"> • Renin and angiotensin • Atrial natriuretic peptide | | |
| BT_PO 1.88 | Outline the regulation of plasma calcium including the actions and control of vitamin D, parathyroid hormone and calcitonin | ME | PEX |
| BT_PO 1.89 | Outline the role of prostaglandins and other autocooids | ME | PEX |
| B. Pharmacology | | | |
| BT_PO 1.90 | Outline the pharmacology of: <ul style="list-style-type: none"> • Insulin preparations • Oral hypoglycaemics | ME | PEX |
| BT_PO 1.91 | Outline the pharmacology of: <ul style="list-style-type: none"> • Thyroid hormone replacement and anti-thyroid drugs • Corticosteroids • Glucagon • Vasopressin and analogues | ME | PEX |
| 17. Haematology and Transfusion | | | |
| A. Physiology | | | |
| BT_PO 1.110 | Describe the physiological consequences of acute and chronic anaemia, including iron deficiency. | ME | PEX |
| BT_PO 1.112 | Describe the physiology of haemostasis, including: <ul style="list-style-type: none"> • Coagulation • The role of platelets • Fibrinolysis | ME | PEX |
| BT_PO 1.113 | Describe the physiological mechanisms of limiting and preventing thrombosis | ME | PEX |
| BT_PO 1.114 | Describe the methods for assessing coagulation, platelet function and fibrinolysis | ME | PEX |
| BT_PO 1.115 | Describe blood groups and methods of cross matching blood | ME | PEX |
| BT_RT 1.7 | Describe blood groups and the physiological basis of transfusion reactions | ME | PEX |
| BT_PO 1.116 | Describe the composition, indications and risks of use of the following blood components and products: <ul style="list-style-type: none"> • Packed red cells • Fresh frozen plasma • Cryoprecipitate • Platelets • Factor VIIa | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|-------------------------------------|--|------|------------|
| BT_PO 1.117 | Outline the changes that occur during blood storage and their clinical implications | ME | PEX |
| BT_RT 1.8 | Outline the changes that occur in stored blood | ME | PEX |
| BT_RT 1.9 | Describe physiological consequences of massive transfusion | ME | PEX |
| B. Pharmacology | | | |
| BT_PO 1.118 | Describe the pharmacology of heparin and low molecular weight heparins including their side-effects | ME | PEX |
| BT_PO 1.119 | Outline the pharmacology of protamine | ME | PEX |
| BT_PO 1.120 | Describe the pharmacology of warfarin and other anticoagulant drugs | ME | PEX |
| BT_PO 1.121 | Describe methods to reverse the effect of warfarin and other anticoagulant drugs | ME | PEX |
| BT_PO 1.122 | Classify and describe the pharmacology of anti-platelet drugs | ME | PEX |
| BT_PO 1.123 | Outline the pharmacology of thrombolytic agents | ME | PEX |
| BT_PO 1.124 | Outline the pharmacology of tranexamic acid | ME | PEX |
| BT_PO 1.124a | Outline the pharmacology of iron replacement | ME | PEX |
| 18. Immunology and Infection | | | |
| A. Physiology | | | |
| BT_PO 1.126 | Outline how the body defends against infection | ME | PEX |
| BT_PO 1.127 | Outline the effects of anaesthesia and surgery on immune function | ME | PEX |
| BT_PO 1.128 | Describe the immunology and pathophysiology of hypersensitivity reactions | ME | PEX |
| BT_RT 1.5 | Describe the systemic inflammatory response and its physiological effects | ME | PEX |
| BT_RT 1.6 | Describe the immunology and pathophysiology of anaphylaxis. | ME | PEX |
| B. Pharmacology | | | |
| BT_PO 1.130 | Describe the pharmacology of antimicrobial drugs used perioperatively, including their spectrum of activity. | ME | PEX |
| BT_PO 1.131 | Explain the principles of antibiotic prophylaxis | ME | PEX |
| BT_PO 1.3 | Describe the adverse effects of antimicrobial agents | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|-----------------------------|--|------|------------|
| BT_PO 1.132 | Outline the pharmacology of antiseptics and disinfectants, their clinical use and associated risks | ME | PEX |
| 19. Thermoregulation | | | |
| BT_GS 1.65 | Describe the mechanisms by which heat is produced by the body and transferred between the body and its environment | ME | PEX |
| BT_GS 1.66 | Describe the physiological effects of hypo- and hyperthermia | ME | PEX |
| BT_GS 1.68 | Describe the physiological responses to lowered and raised environmental temperature, and the effects of anaesthesia on these responses | ME | PEX |
| BT_GS 1.69 | Discuss methods of maintaining body temperature during anaesthesia and sedation, including active warming of patients | ME | PEX |
| BT_SQ 1.17 | Discuss the safety of methods for maintaining body temperature during anaesthesia and sedation, including active warming of patients | ME | PEX |
| 20. Obstetrics | | | |
| A. Anatomy | | | |
| SS_OB 1.6 | Describe the changes in the anatomy of the maternal airway and their impact on airway management during anaesthesia | ME | PEX |
| SS_OB 1.7 | Describe the changes in the anatomy of the maternal vertebral column, the spinal cord and meninges relevant to performing a central neuraxial block (including epidural, spinal and combined spinal-epidural), with appropriate surface markings | ME | PEX |
| SS_OB 1.8 | Describe the anatomy of pain in labour and childbirth | ME | PEX |
| B. Physiology | | | |
| SS_OB 1.5 | Describe the mechanism and consequences of aorto-caval compression in pregnancy | ME | PEX |
| SS_OB 1.1 | Describe the physiological changes that occur during pregnancy, labour and delivery, in particular the respiratory, cardiovascular, haematological and gastrointestinal changes, and their implications for anaesthesia | ME | PEX |
| SS_OB 1.2 | Outline the reference ranges for physiological and biochemical variables in pregnancy | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|--|--|------|------------|
| SS_OB 1.4 | Describe the utero-placental circulation and the principles of placental physiology as related to placental gas exchange and regulation of placental blood flow | ME | PEX |
| C. Pharmacology | | | |
| SS_OB 1.9 | Describe the influence of pregnancy on the pharmacokinetics and pharmacodynamics of drugs commonly used in anaesthesia and analgesia | ME | PEX |
| SS_OB 1.10 | Describe the pharmacology of drugs which increase uterine tone | ME | PEX |
| SS_OB 1.11 | Outline the pharmacology of tocolytic agents | ME | PEX |
| SS_OB 1.12 | Outline the pharmacology of agents used for the treatment of pre-eclampsia | ME | PEX |
| 21. Foetal/ Neonatal and Paediatric | | | |
| A. Anatomy | | | |
| SS_PA 1.1 | Describe the anatomy of the neonatal airway, how this changes with growth and development, and the implications for airway management | ME | PEX |
| B. Physiology | | | |
| SS_PA 1.21 | Describe the foetal circulation | ME | PEX |
| SS_OB 1.3 | Describe the transition from foetal to neonatal circulation and the establishment of ventilation | ME | PEX |
| SS_PA 1.22 | Describe the circulatory and respiratory changes that occur at birth | ME | PEX |
| SS_PA 1.23 | Define the thermoneutral zone. Outline temperature regulation in the neonate and the physiological responses to lowered and raised environmental temperature, the effects of anaesthesia on these responses and how this changes with growth and development | ME | PEX |
| SS_PA 1.24 | Outline the physiology of the cardiovascular, respiratory, renal and neurological systems in the neonate, the changes that occur with growth and development, and the implications of this for anaesthetic care | ME | PEX |
| SS_PA 1.25 | Outline the composition of body fluids in the neonate and explain the changes that occur with growth and development | ME | PEX |
| SS_PA 1.26 | Outline glucose homeostasis in the neonate and explain the changes that occur with growth and development | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|---|---|------|------------|
| C. Pharmacology | | | |
| SS_OB 1.13 | Explain the factors which influence the transfer of drugs across the placenta to the foetus | ME | PEX |
| SS_OB 1.14 | Outline the potential effects on the foetus and neonate of drugs administered during pregnancy | ME | PEX |
| SS_OB 1.15 | Outline the potential effects on the neonate of drug administration in association with lactation | ME | PEX |
| SS_PA 1.52 | Describe how the pharmacokinetics of drugs commonly used in anaesthesia in neonates and children differ from adults | ME | PEX |
| SS_PA 1.53 | Describe how the pharmacodynamics of drugs commonly used in anaesthesia in neonates and children differ from adults | ME | PEX |
| SS_PA 1.54 | Describe the pharmacology of agents used for premedication in children | ME | PEX |
| SS_PA 1.80 | Calculate the maximum safe doses of local anaesthetic agents in different age groups | ME | PEX |
| 22. Physics and Clinical Measurement | | | |
| BT_SQ 1.5 | Outline basic physics applicable to anaesthesia in particular: <ul style="list-style-type: none"> • Behaviour of fluids (gases and liquids) • Electrical concepts, current, potential difference, resistance, impedance, inductance and capacitance • Principles of humidification and use of humidifiers Describe: <ul style="list-style-type: none"> • the physics of ultrasound imaging, including Doppler | ME | PEX |
| BT_SQ 1.6 | Describe the methods of measurement applicable to anaesthesia, including clinical utility, complications and sources of error in particular: <ul style="list-style-type: none"> • SI units • Measurement of volumes, flows, and pressures, including transducers. • Measurement of blood pressure • Measurement of cardiac output • Measurement of temperature • ECG • Oximetry • Infrared gas analysis, including capnography • paramagnetic and fuel cell analysis of oxygen • Basic pulmonary function tests | ME | PEX |
| BT_PO 1.94 | Outline the basis of the electroencephalogram | ME | PEX |

| Code | Learning outcome | Role | Assessment |
|---------------------------------------|--|------|------------|
| BT_GS 1.52 | Explain the principles involved in the electronic monitoring of depth of sedation and anaesthesia, including the use of EEG analysis | ME | PEx |
| BT_GS 1.55 | Describe the concept of depth of neuromuscular blockade and explain the use of neuromuscular monitoring | ME | PEx |
| 23. Equipment and Safety | | | |
| BT_SQ 1.3 | Outline the mandatory safety requirements for anaesthetic machines. (Refer to College professional document PS54 Statement on the Minimum Safety Requirements for Anaesthetic Machines and Workstations for Clinical Practice) | ME | PEx |
| BT_SQ 1.7 | Outline microshock and macroshock and the mechanisms for preventing these, with particular reference to ensuring the compatibility of medical procedure, treatment area, and medical equipment used | ME | PEx |
| BT_SQ 1.9 | Outline the hazards of anaesthetic gas pollution and the methods of scavenging anaesthetic gases | ME | PEx |
| BT_SQ 1.10 | Describe the supply of medical gases (bulk supply and cylinder) and features to ensure supply safety including pressure valves and regulators and connection systems | ME | PEx |
| BT_SQ 1.11 | Outline how medical suction is generated and how to set up and test suction systems, both fixed and portable | ME | PEx |
| BT_SQ 1.12 | Describe the principles and safe operation of vaporisers | ME | PEx |
| BT_SQ 1.13 | Describe and classify breathing systems used in anaesthesia and resuscitation. Evaluate their clinical utility and hazards associated with their use | ME | PEx |
| BT_SQ 1.14 | Describe different systems to deliver supplemental oxygen and the advantages and disadvantages of these systems | ME | PEx |
| BT_SQ 1.15 | Outline how CO ₂ is absorbed in a circle system and the hazards associated with the use of CO ₂ absorption | ME | PEx |
| BT_SQ 1.18 | Outline the principles of surgical diathermy, its safe use and the potential hazards | ME | PEx |
| BT_RA 1.8 | Describe the principles of ultrasound imaging | ME | PEx |
| 24. Miscellaneous Pharmacology | | | |
| BT_PO 1.100 | Outline the pharmacology of histamine antagonists | ME | PEx |
| BT_PO 1.4a | Outline potential perioperative adverse effects and drug interactions of herbal medicines | ME | PEx |

| Code | Learning outcome | Role | Assessment |
|--|--|------|----------------|
| BT_PO 1.3a | Outline the pharmacology of commonly encountered illicit drugs and their interactions with drugs used in anaesthetic care | ME | PEX |
| BT_PO 1.125 | Outline the major perioperative implications of cancer chemotherapy agents and immunotherapy | ME | PEX |
| BT_SQ 1.20 | Outline the potential perioperative effects of radiological contrast agents. | ME | PEX |
| 25. General/ Overarching principles | | | |
| AR_ME 1.3 | Apply knowledge of the clinical and biomedical sciences relevant to anaesthesia | ME | PEX, FEx |
| AR_ME 3.2 | Demonstrate knowledge and understanding of the procedure including indications, contraindications, anatomy, technique side-effects and complications | ME | DOPS, Fex, PEX |