

# FRCA Syllabus – Physics and Clinical Measurement

FRCA candidates must demonstrate knowledge of the following areas.

<i>Competence</i>	<i>Description</i>	<i>Chapter</i>
PC_BK_01	Mathematical concepts: relationships and graphs	27.3
PC_BK_02	Exponential functions including wash-in, wash-out, tear-away	16.2, 27.6 & 27.7
PC_BK_03	Logarithms	27.2
PC_BK_04	Area under the curve [integration] and rate of change [differentiation]	27.5
PC_BK_05	Basic measurement concepts relevant to understanding of monitoring in anaesthesia: <ul style="list-style-type: none"> <li>• linearity</li> <li>• drift</li> <li>• hysteresis</li> <li>• signal to noise ratio</li> <li>• static and dynamic response</li> </ul>	3.3, 22.3, 27.3
PC_BK_06	Electrolyte solutions [also drug doses]: conversion between units e.g. molar, mg/ml, %	9.2, 28.2
PC_BK_07	SI units: fundamental units and derived units	28.1 & 28.2
PC_BK_08	Other non SI units relevant to anaesthesia: including mmHg, bar, atmospheres, cm H <sub>2</sub> O, psi	6.1, 28.4
PC_BK_09	Simple mechanics: mass, force, work, energy, power	2.1, 2.2
PC_BK_10	Heat: including temperature, absolute zero	4.1, 4.2
PC_BK_11	Heat transfer and loss: conduction, convection, radiation, evaporation	4.3, 4.4
PC_BK_12	Temperature measurement: including Hg, alcohol, infrared, thermistor, thermocouple, Bourdon gauge, liquid crystal. Anatomical sites used for measurement	4.6
PC_BK_13	Latent heats, triple point of water	1.2, 1.3
PC_BK_14	Patient warming systems: principles	4.3
PC_BK_15	Warming equipment for intravenous fluids: principles	4.3
PC_BK_16	Laws of thermodynamics; mechanical equivalent of heat	4.7
PC_BK_17	Humidity, absolute and relative; including measurement	7.1, 7.2
PC_BK_18	Colligative properties: osmolarity, osmolality, osmometry, diffusion	Ch. 10
PC_BK_19	Physics of gases. Gas laws: kinetic theory of gases, Boyle, Henry, Dalton, Charles, Gay-Lussac	Ch. 9
PC_BK_20	Critical temperature, critical pressure	1.3
PC_BK_21	Physics of vapours	1.3

PC_BK_22	Pressure: absolute and relative pressure; gauge pressure	6.1
PC_BK_23	Manufacture and storage of gases and vapours, safety	Ch. 13
PC_BK_24	Cylinders and pipelines, Bourdon gauge	6.2, 13.3
PC_BK_25	Suction devices	13.4
PC_BK_26	Scavenging devices	14.6
PC_BK_27	Measurement of lung volumes and diffusion	8.7, 10.3
PC_BK_28	Density and viscosity of gases	2.3, 8.3
PC_BK_29	Laminar and turbulent flow: Hagen–Poiseuille equation, Reynold's number, examples including helium	8.1 – 8.3
PC_BK_30	Measurement of volume and flow in gases and liquids, including pneumotachograph and other respirometers	8.7
PC_BK_31	Bernoulli principle	8.4 1
PC_BK_32	Venturi effect and entrainment devices	8.5
PC_BK_33	Vapour pressure: saturated vapour pressure	7.1
PC_BK_34	Vaporization: process of vaporisation	1.2
PC_BK_35	Vaporizers: principles, including plenum and draw-over, temperature compensation, concentration	Ch. 12
PC_BK_36	Principles of surface tension	2.4
PC_BK_37	Basic concepts of electricity and magnetism	18.1 & 19.1
PC_BK_38	Electrical voltage, AC and DC current, resistance, impedance	18.2, 18.3 & 19.3
PC_BK_39	Electrical circuits: series and parallel	18.6
PC_BK_40	Symbols of basic components of electrical circuits	Ch. 18
PC_BK_41	Capacitance, inductance	19.4, 21.1
PC_BK_42	Wheatstone bridge: principles, uses	18.7
PC_BK_43	Electrical hazards: causes and prevention	Ch. 20
PC_BK_44	Electrocution: including microshock, earth faults, leakage	Ch. 20
PC_BK_45	Electrical equipment safety: domestic and medical, classification/types of equipment, symbols	20.5
PC_BK_46	Circuit breakers, fuses	20.3
PC_BK_47	Transformers, inductance	19.4
PC_BK_48	Transistors, diodes	18.3
PC_BK_49	Amplifiers: band width, low pass, high pass, band pass filters	Ch. 22

PC_BK_50	ECG: principles including electrodes and electrode placement	21.3 & 21.4
PC_BK_51	Fourier analysis	5.6
PC_BK_52	Amplification of biological signals: including ECG, EMG, EEG, BIS, CFM, CFAM	21.5, 21.6 & 22.1
PC_BK_53	Piezo-electric devices	23.1
PC_BK_54	Electrical interference: sources, methods of reduction	22.3
PC_BK_55	Processing, storage, display of physiological measurements	Ch. 22
PC_BK_56	Transducers and strain gauges	22.2
PC_BK_57	Lasers: basic principles and safety	Ch. 24
PC_BK_58	Ultrasound: basic principles of ultrasound	Ch. 23
PC_BK_59	Demonstrates knowledge of the physics relevant to optical fibres	Ch. 15
PC_BK_60	Doppler effect, principle and clinical application	5.7
PC_BK_61	Cardiac pacemakers: principles and classification	21.7
PC_BK_62	Defibrillators and defibrillation: principles, including thoracic impedance, monophasic, multiphasic, implantable devices	21.2
PC_BK_63	Diathermy: monopolar, bipolar; safety and uses	20.7
PC_BK_64	Pressure transducers	6.8
PC_BK_65	Resonance, damping, frequency response	5.5 & 5.6
PC_BK_66	Plenum systems: warming blankets, theatre and anaesthetic room ventilation	4.3 & 14.6
PC_BK_67	Breathing systems: Mapleson's classification, coaxial systems, circle systems, T-piece; resuscitation breathing devices	14.1 - 14.5
PC_BK_68	Ventilators: principles, including pressure and flow generators, cycling, minute volume dividers, jet and oscillator ventilators	14.7 - 14.11
PC_BK_69	Disconnection: monitoring of patient ventilatory disconnection	Ch. 14
PC_BK_70	CO <sub>2</sub> absorption: chemistry, complications	14.2
PC_BK_71	Capnography	11.3
PC_BK_72	Pulse oximetry	15.6
PC_BK_73	Fires and explosions: risks and prevention	13.5
PC_BK_74	Measurement of gas pressures	6.2
PC_BK_75	Blood pressure: direct and indirect measurement	6.6 & 6.7
PC_BK_76	Pulmonary artery pressure measurement	16.3
PC_BK_77	Cardiac output: principles of measurement	Ch. 16

PC_BK_78	Measurement of gas and vapour concentrations: e.g. infra-red, paramagnetic, fuel cell, oxygen electrode, mass spectrometry	Ch. 11
PC_BK_79	Measurement of pH, PCO <sub>2</sub> , PO <sub>2</sub> , electrolytes	11.6
PC_BK_80	Derived blood gas variables, e.g. HCO <sub>3a</sub> , HCO <sub>3s</sub> , BE. Siggaard-Andersen nomogram	See <a href="http://www.acid-base.com">www.acid-base.com</a>
PC_BK_81	Measurement of CO <sub>2</sub> production, oxygen consumption, respiratory quotient	14.2
PC_BK_82	Simple tests of pulmonary function: peak flow rate, spirometry	8.7
PC_BK_83	Measurement of perfusion: coronary, cerebral, splanchnic, renal	Ch. 16
PC_BK_84	Assessment of neuromuscular blockade	See <a href="http://www.aagbi.org">www.aagbi.org</a>
PC_BK_85	Infusion pumps and syringe drivers; including PCA drivers and epidural infusion devices: principles, use, safety, and relevant drug infusion calculations	6.5
PC_BK_86	Environmental monitoring: contamination by anaesthetic gases and vapours	14.6
PC_BK_87	Minimum monitoring standards	See <a href="http://www.aagbi.org">www.aagbi.org</a>
PC_BK_88	Understanding the limits of monitoring equipment	17.3
PC_BK_89	Principles of calibration of monitoring equipment	17.3
PC_BK_90	Principles of hygiene, including cleaning and sterilization of equipment	17.4 & 17.5