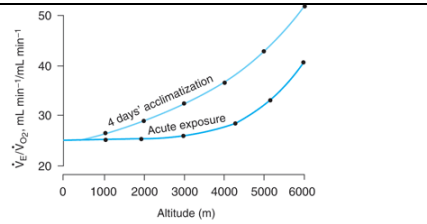
TOPIC	QUESTIONS	KNOWLEDGE **(essential in bold)**	NOTES
Question 1 LOA: 1	1.What factors influence myocardial oxygen consumption? 2.How does decreasing a patient's heart rate improve symptoms of angina?	1. intramyocardial **tension** which is dependant Pressure –after load, systolic pressure, contractility Radius – preload Wall thickness 2. **contractile state of the heart** ionotropy 3. **HR** ALSO -(cardiac work α SV x MAP) Pressure load increases O_2 consumption more than volume load 1. **decreasing HR** decreases O2 demands 2. at a slower heart rate there is more time for coronary **circulation which occurs in diastole**	Need bold to pass Prompt: What happens if a patient has tachycardia?
Question 2 LOA: 1	(a) Describe the ventilatory response that occurs as you acclimatise to high altitudes. (b) Outline other compensatory responses to high altitudes.	(a) **Hyperventilation: Inc altitude – hypoxic stimulation of peripheral chemoreceptors - inc ventilation.** Resulting low CO2 / alkalosis inhibits response; but bicarb shift from CSF and renal excretion bicarb – corrects pH to near normal, allowing further incr ventilation. (b) • Moderate altitude – right shift in O2 dissoc curve (due to incr 2,3 DPG) – dec O2 affinity to Hb (unload O2 at tissues); Higher altitude – left shift O_2 dissoc curve (due to decr CO2) – incr O2 affinity to Hb (load O2 in lungs) • Inc erythropoietin – polycythaemia • Inc mitochondria to facilitate O_2 transport into tissues • Inc cellular oxidative enzymes (cytochrome oxidase) • Inc capillaries in periph tissues • •	 Source: Barrett KE, Barman SM, Boitano S, Brooks H: *Ganong's Review of Medical Physiology, 23rd Edition*: http://www.accessmedicine.com **(a) Bold to pass** **(b) 2 to pass**

Question 3 LOA: 1	1) How does vasopressin act on the kidney? 2) What hormonal changes occur after drinking a large amount of water?	1) In the **collecting duct**, ADH binds to G-receptor V2 activates adenylate cyclase ↑ IC c-AMP → migration of IC endosomes H_2O channels (**aquaporin-2**) inserted into luminal membrane **↑H_2O permeability**, with ↑H_2O reabsorption 2) Begins about 15 min after ingestion. Maximum in about 45 min. The act of drinking produces a small decrease in **ADH** (vasopressin) secretion **resulting in dieresis**. Most of the inhibition is produced by the **decrease in plasma osmolality** after the water is absorbed.	Need bold to pass
Question 4 LOA: 2	1) What factors determine the plasma glucose level? 2) Explain how the blood glucose is maintained during fasting.	Dietary intake Rate of entry into cells (Muscle, adipose tissue, other organs) Glucostatic activity in liver **fasting** Liver glycogen broken down-glucose released into bloodstream. **Prolonged fasting** Glycogen depleted – increase gluconeogenesis from glycerol and amino acids in liver	2/3 to pass 2/2 to pass
Question 5 LOA: 1	1) What happens to acetylcholine when released into a synapse? 2) Describe the differences between the two types of acetylcholine receptors.	• Binds to post-synaptic cholinergic receptors • Catabolism by acetylcholinesterase at the postsynaptic membrane • Reuptake of choline • No acetylcholine reuptake • Catabolism by pseudocholinesterase in the circulation • Divided on basis of pharmacological properties into muscarinic and nicotinic • Muscarinic–actions mimicked by muscarine and blocked by atropine. Found in smooth muscle, glands and brain. G-protein coupled to adenylyl cyclase and/or phospholipase. • Nicotinic–actions mimicked by nicotine. Found in neuromuscular junction, autonomic ganglia and the central nervous system. Ligand-gated sodium ion channels.	3/5 to pass Necessary to pass Two sites to pass Two sites to pass

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Question 1 LOA: 1	Describe the factors that control blood flow to the myocardium	**a. Local factors control radius of blood vessels (overall flow and regional flow)** Hypoxia – vasodilatation (? mediated via adenosine) Hypoxia is the main factor controlling flow (NB , extraction ratio of about 70%) NO2 – vasodilatation Local metabolites e.g. -K+, adenosine,CO2, lactate, PG **b. Neurogenic factors controlling radius of blood vessels (overall flow and regional flow)** Parasympathetic nerves Sympathetic nerves α – vasoconstriction, β vasodilatation Circulating catecholamine's **c. Pressure differences** Flow is dependant gradient between arteries and veins OR external compression from muscles. During systole ventricular muscle pressure limits flow especially to subendocardium of the left ventricle d.Viscosity of the blood	Need bold and 1 example of each to pass
Question 2 LOA: 1	Outline the metabolic functions of the lung.	1. **Synthetic function:** synthesis of phospholipids such as dipalmitoyl phosphatidyl choline (**surfactant**), protein synthesis (collagen & elastin), carbohydrates - mucopolysaccarides of mucous 2. **Activation of Angiotensin I to II.** 3**. Inactivates bradykinin**, serotonin, PGE_1, PGE_2 and PGF_{2a},noradrenaline (30%) 4. Remove leukotrienes (e.g. SRS-A) 5. Secrete IgA	Prompt: 1.What substances can the lung produce? 2.What substances can the lung activate or inactivate? Bold to pass
Question 3 LOA: 1	1) Describe the differences between the ascending and descending loops of Henle.	1)Descending – **thin** cells; **permeable** to water, due to the presence of aquaporin-1 in both the apical and basolateral membrane. Ascending- proximal (thin): as above	*Prompt:* differences in structure and function

	2) Describe the changes in the tonicity of tubular fluid as it moves along the loop of Henle.	Ascending - distal (thick): **thick** cells containing many mitochondria; **impermeable** to water; co-transport of **Na^+, K^+, Cl^-** out of lumen into interstitium. 2) Fluid in the descending limb of the loop of Henle becomes **hypertonic** as water moves out of the tubule into the hypertonic interstitium. In the ascending limb it becomes more dilute because of the movement of Na^+ and Cl^- out of the tubular lumen. When fluid reaches the top of the ascending limb (the diluting segment) it is now **hypotonic** to plasma.	a)Bold to pass b)Need to describe the changes in tonicity.
Question 4 LOA: 1	1) Outline the biosynthesis of adrenaline. 2) How is the action of noradrenaline terminated?	**Tyrosine**-tyrosine *hydroxylase* – **DOPA** (dihydroxy-phenylalanine)-amino acid *decarboxylase*- **Dopamine**-dopamine *hydroxylase*- **Noradrenaline**- phenylethalonamine *methyltransferase* **Adrenaline** **a) reuptake** presynaptic neuron than metabolised by MAO to inactive deaminated derivates or recycled **b) catabolised synaptic cleft** by COMT (catechol methyltransferase) to Normetanephrine	Bold to pass Prompt: How is adrenaline synthesised from tyrosine? Bold to pass
Question 5 LOA: 2	1)Describe the role of parathyroid hormone in calcium metabolism. 2)How is parathyroid hormone secretion regulated?	• Directly increases bone resorption and mobilises Ca^{2+} causing increased serum calcium. • Directly increases Ca^{2+} reabsorption by the distal renal tubules although increased filtered Ca^{2+} may cause increased excretion. • Indirectly increases gut absorption of Ca^{2+} by increasing formation of 1,25-dihydrocholecalciferol. • Serum Ca^{2+} exerts negative feedback on PTH secretion via a membrane Ca^{2+} receptor. • Serum PO_4^{2-} exerts negative feedback on PTH secretion by decreasing Ca^{2+} and via a membrane Ca^{2+} receptor. • 1,25-dihydrocholecalciferol acts to decrease preproPTH mRNA. • Increased phosphate increases PTH by decreasing Ca2+ and 1,25-dihydrocholecalciferol. • Mg^{2+} is required for PTH secretion.	2/3 bullet points to pass Three of five bulleted points to pass

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Question 1: LOA: 1	1)What factors determine cerebral blood flow? 2)What is the Monro-Kellie Doctrine?	**1) Intracranial Pressure** 2) Local Constriction and dilation of cerebral arterioles **3) Mean Arterial pressure** 4) Viscosity of Blood 5) Mean Venous pressure at brain level Volume of blood (75ml), CSF (75ml) and brain (1400g) in the cranium at any time remains relatively constant within a rigid structure.	Bold + 1 other to pass To pass: stating the above without the volumes / weights for a normal person
Question 2 LOA: 1	(a) Describe the function of the central chemoreceptors in the regulation of ventilation. (b) Describe the function of the peripheral chemoreceptors in the regulation of ventilation.	Chemoreceptors – respond to changes in chemical composition in blood or fluid around them (a) **Central chemoreceptors** - situated in the ventral surface of the medulla, **regulates ventilation in response to CSF pH (**CO_2 in blood changes pH in CSF **– incr CO2 -> incr H+ in CSF -> incr ventilation).** (a) **Peripheral chemoreceptors** – located in the **carotid & aortic bodies**. They contain glomus cells with high conc dopamine, high blood flow. **Respond to a dec in PaO_2 and pH, inc in $PaCO_2$.** . **Responsible for all the inc ventilation in hypoxia** - max response occurs PaO_2<50 mm Hg. Also rapid response to sudden changes in $PaCO_2$, while carotid body responds to a fall in pH.	Adequate description of function for (a) and (b) - bold
Question 3 LOA: 1	How does the kidney handle potassium?	**Potassium is filtered, reabsorbed and secreted** Per 24 hours ■ 600 mmol **filtered** ■ 560 mmol **actively reabsorbed** mainly in **PCT (65%)** but also 25% in **TALLOH (NaK2Cl co-transporter) and in CD** ■ 50 mmol **secreted by late DCT and cortical CT** cells proportional to flow via Principal Cells ■ With high/low potassium intakes the required extra secretion of K+ achieved by increased/decreased secretion in DCT/cortical CT; with extremely low K+ intake, there can be net reabsorbtion of K+ in DCT/cortical CT ■ 90 mmol excreted	Need bold to pass

Question 4 LOA: 2	Q1. What factors are involved in regulating thyroid hormone secretion? Q2. What else affects TSH secretion?	Predominant factor controlling thyroid secretion is the **circulating level of TSH** released from the anterior pituitary. TRH from hypothalamus serves to increase TSH secretion. Important point – **negative feedback loop – whereby circulating T4 and T3 block the increase in TSH secretion produced by TRH.** Thyroid hormones inhibit TSH secretion before they inhibit synthesis. T3 – principal feedback regulator of TSH secretion. Other inhibitors of TSH secretion Stress Warmth (in exp animals) Dopamine, somatostatin and glucocorticoids (but physiological role in regulation of TSH secretion is not known) Cold – stimulates TSH secretion (exp animals and human infants)	Pass criteria – LOA 2 Bold to pass 2 to pass
Question 5 LOA: 1	1.Describe the resting membrane potential of a cell. 2.What conditions are required to create a resting membrane potential? 3. In a neuron what ions are involved and how is the concentration gradient produced?	There is difference in electronic charge across a cell membrane. The inside is negative compared to the outside. Resting MP results from separation of positive and negative charges across a cell membrane. Neuron average RMP -70 mV. Lipid bilayer, unequal distribution of ions, membrane must be permeable to ions, concentration gradient. Na and K. Na is primarily extracellular and K intracellular. Passive movement of ions occur via selective ion channels. Na-K ATPase actively move ions against their electrochemical gradient.	Bold to pass 2 out 4 Bold to pass.