1. Administration of 40ml/kg of 0.9% sodium chloride (normal saline) will produce
   A. metabolic alkalosis
   B. metabolic acidosis
   C. respiratory alkalosis
   D. respiratory acidosis
   E. no acid-base change

2. Glycosuria is most likely to occur if
   A. both glomerular filtration rate and plasma glucose level increase
   B. glomerular filtration rate is unchanged and plasma glucose level increases
   C. glomerular filtration rate decreases and plasma glucose level increases
   D. both glomerular filtration rate and plasma glucose levels decrease
   E. glomerular filtration rate increases and plasma glucose level is unchanged

3. In the fetal circulation
   A. superior vena caval blood enters the left atrium via the patent foramen ovale
   B. haemoglobin in the umbilical vein blood is 40% saturated with oxygen
   C. inferior vena caval blood is directed via the ductus arteriosus to the head vessels
   D. the inferior vena cava receives blood directly from the ductus venosus
   E. all the haemoglobin is haemoglobin F

4. Endothelins
   A. are produced in vascular smooth muscle cells
   B. are not found in the brain
   C. are vasodilator polypeptides
   D. are released in response to vascular stretch
   E. act by inducing Na⁺ influx

5. In a healthy 70kg man, the coronary blood flow:
   A. has an O₂ extraction of 50%
   B. is about 500 ml/min at rest
   C. can increase to a maximum of 10 times the normal flow
   D. ceases in mid-systole
   E. is directly altered by vagal activity

6. The final reaction catalysed by the electron transport chain is:
   A. ADP + Pi → ATP
   B. ½ O₂ + 2 H⁺ → H₂O
   C. FAD + 2 H⁺ → FADH₂
   D. H₂CO₃ → H₂O + CO₂
   E. HPO₄²⁻ + H⁺ → H₂PO₄
7. Regarding the Electrocardiogram;
A. by convention Lead I records the potential difference between the Left arm and the Left leg
B. by convention the precordial leads record the potential difference between the Left arm and six points on the anterior and lateral chest wall
C. the normal QT interval is 0.4 sec and increases with increasing heart rate
D. the PR interval is a measure of the time from atrial depolarisation to the onset of ventricular depolarisation
E. the ST interval is isoelectric because the right ventricle is repolarised while the left ventricle is depolarised

8. A patient has serum Na\(^+\) of 120mmol/l, K\(^+\) of 6.7mmol/l and a Cl\(^-\) of 85mmol/l. This is consistent with
A. severe dehydration
B. adrenal insufficiency
C. primary hyperaldosteronism
D. diabetes insipidus
E. water intoxication

9. The most important factor triggering the closure of the ductus arteriosus after birth is
A. decrease in pulmonary vascular resistance as the lungs expand after delivery
B. increase in aortic pressure when the umbilical cord is ligated
C. increase in PO\(_2\) in aortic blood after delivery
D. reduction in intracardiac right-to-left shunt after delivery
E. surge of stress hormones due to passage through the birth canal

10. Which of the following carbohydrates is absorbed in the small bowel?
A. Maltose
B. Glucose
C. Sucrose
D. Trehalose
E. Lactose

11. With regard to haemoglobin
A. it is always bound to 2,3-DPG
B. it is a large metalloprotein with a molecular weight of 165,000 Da
C. contains 65-70% of total body iron
D. the iron is excreted unchanged in the urine during breakdown
E. it contains 4 haem complexes made up of a porphyrin and 1 atom of ferric iron

12. Actions of the components of complement include:
A. neutrophil deactivation
B. vasoconstriction
C. eosinophil degranulation
D. phagocytosis
E. chemorepulsion

13. Oxygen supply to the liver is by:
A. the hepatic artery
B. the portal vein
C. the hepatic vein
D. the hepatic artery and the portal vein
E. the hepatic artery and the portal artery
14. During LABOUR, a DECREASE is likely to be seen in maternal:
   A. cerebrospinal pressure fluid
   B. endorphin concentrations
   C. epidural pressure
   D. gastric emptying
   E. plasma urea

15. The actin filament is made up of a complex of protein components. Which of the following statements is TRUE?
   A. the complex is made up of tropomyosin, actinomyosin, and troponin
   B. in smooth muscle troponin is missing and calcium binds to calmodulin to initiate contraction
   C. the Fenn effect describes the binding of calcium to the troponin component of the complex facilitating contraction
   D. the tropomyosin is itself complex, having 3 subunits
   E. tropomyosin binds loosely to myosin preventing troponin from binding and initiating contraction

16. The sharp initial pain associated with injury is transmitted by
   A. unmyelinated C fibres
   B. unmyelinated Aδ fibres
   C. nerve fibres with a conduction velocity of approximately 15 m/sec
   D. nerve fibres which project to the anterior horn and the spinothalamic tract
   E. nerve fibres with a diameter of less than 2 μm

17. Following ingestion of a meal
   A. digestion of carbohydrates and fats begins in the mouth and protein in the stomach
   B. increased intestinal blood supply occurs only because of the increases in systemic blood pressure
   C. absorption of fluid and electrolytes occurs mainly in the large intestine
   D. the composition of the food has no effect on the time of passage through the bowel
   E. drugs are unable to influence gastric emptying

18. Which of the following is NOT used in the calculation of Reynolds number?
   A. tube length
   B. tube diameter
   C. velocity of gas
   D. gas density
   E. gas viscosity

19. Which one of the following applies to collecting tubule principal cells?
   A. reabsorbs potassium ions
   B. secretes hydrogen ions
   C. reabsorbs sodium ions
   D. reabsorbs bicarbonate ions
   E. secretes chloride ions

20. Which of the following statements is CORRECT regarding renal oxygen consumption?
   A. it is higher in the medulla than the cortex
   B. it is greater than brain oxygen consumption on a weight for weight basis
   C. it correlates with the rate of active transport of sodium
   D. it is about 25 ml.100 gm-1 tissue.min-1
   E. it is uniform throughout the kidney
21. What would be the calculated alveolar PO₂ breathing air, assuming a PaCO₂ of 20mm Hg at an altitude of 8848 m (Barometric pressure = 248 mmHg)?
   A. 0 mm Hg  
   B. 17 mm Hg  
   C. 27 mm Hg  
   D. 30 mm Hg  
   E. 42 mm Hg

22. What is the rate of rise of PaCO₂ during breath holding?
   A. 1 mmHg/min  
   B. 2 mmHg/min  
   C. 4 mmHg/min  
   D. 8 mmHg/min  
   E. 16 mmHg/min

23. Biologically active substances partially removed by the lung include
   A. surfactant  
   B. histamine  
   C. angiotensin  
   D. noradrenaline  
   E. all of the above

24. The initial fall in patient temperature following induction of general anaesthetic results from:
   A. alteration in the thermoneutral zone  
   B. cooling effect of intravenous fluids  
   C. loss of tonic vasoconstriction in cutaneous arterioles venous shunts  
   D. evaporative heat loss from operative site  
   E. radiation to cooler objects nearby

25. The following arterial blood gas analysis would most likely be found in PH 6.96 [HCO₃⁻] 5.0 PCO₂ 23
   A. mountain climber after several weeks at altitude  
   B. long standing pulmonary disease  
   C. diabetic coma  
   D. after five minutes hyperventilation  
   E. after prolonged vomiting

26. Significant hypovolaemia in the presence of reduced plasma osmolality will result in
   A. increased urine output  
   B. increased permeability of the collecting ducts to water  
   C. decreased aldosterone secretion  
   D. decreased renin secretion  
   E. none of the above

27. Concerning damping of an intra-arterial blood pressure measuring system which of the following statements is TRUE?
   A. a measuring system with a resonance frequency of 5 Hz results in a false apparent decrease in mean arterial pressure  
   B. an over-damped arterial pressure trace results in a false apparent decrease in mean arterial pressure  
   C. an under-damped arterial pressure trace results in a false apparent decrease in mean arterial pressure  
   D. an over-damped arterial pressure trace results in a false apparent decrease in diastolic arterial pressure  
   E. an under-damped arterial pressure trace results in a false apparent increase in systolic arterial pressure
28. With increasing levels of exercise
   A. tissue oxygen delivery decreases
   B. tissue oxygen extraction decreases
   C. systemic arterial pressure decreases
   D. systemic vascular resistance decreases
   E. left coronary artery blood flow decreases

29. The pulmonary capillary wedge pressure trace
   A. reflects RV preload
   B. is used to calculate SVR
   C. is 2-3mmHg lower than LAP
   D. peak V wave amplitude occurs in late systole
   E. is normally 2-3mmHg lower than the RAP

30. Products of the citric acid cycle include all of the following EXCEPT
   A. CO₂
   B. H⁺
   C. FADH₂
   D. NADH
   E. NAD

31. A pneumotachograph
   A. is a variable orifice flowmeter
   B. measures the velocity of gas flow
   C. is accurate under laminar and turbulent flow conditions
   D. can be used to measure peak flow
   E. is not influenced by temperature

32. A unit of fresh frozen plasma
   A. contains an anticoagulant
   B. has all the clotting factors except V and VIII
   C. requires cross matching with the patient's blood
   D. does not contain albumin
   E. does not contribute to the oncotic pressure of the blood when it is infused

33. The majority of muscle fibres in the soleus muscle of the lower limb
   A. depend mainly on glycolysis for ATP production
   B. contain few mitochondria
   C. store large amounts of glycogen
   D. have a long duration of contraction
   E. have a large diameter

34. As a person moves from a hyperalert state to sleep, the electroencephalogram (EEG) waves change as follows
   A. alpha → delta → beta → theta
   B. alpha → beta → delta → theta
   C. beta → theta → delta → alpha
   D. beta → alpha → theta → delta
   E. theta → delta → beta → alpha
35. Following a meal the basal metabolic rate is determined after
   A. 1 hour
   B. 2 hours
   C. 6 hours
   D. 12 hours
   E. 18 hours

36. On a standard 12 lead ECG
   A. the voltage calibration is 0.5 mV/cm and the paper speed is 25 mm/s
   B. the voltage calibration is 1 mV/cm and the paper speed is 25 mm/s
   C. the voltage calibration is 0.5 mV/cm and the paper speed is 50 mm/s
   D. the voltage calibration is 1 mV/cm and the paper speed is 50 mm/s
   E. the voltage calibration is 10 mV/cm and the paper speed is 25 mm/s

37. The ascending limb of the loop of Henle
   A. is permeable to water
   B. actively transports potassium ions into the lumen
   C. actively transports water into the lumen
   D. actively transports chloride ions out of the lumen
   E. actively transports sodium ions into the lumen

38. Which of the following would be found in a patient with obstructive airways disease?
   A. an FEV1.0/FVC ratio of 70% or greater
   B. an increased carbon monoxide diffusion capacity
   C. an increased functional residual capacity
   D. an increased peak expiratory flow rate
   E. none of the above

39. A pressure-volume curve can be used for measuring:
   A. anatomical dead space
   B. closing capacity
   C. compliance
   D. functional residual capacity
   E. respiratory quotient

40. Static lung compliance
   A. is the change in pressure per unit volume
   B. is affected by airway resistance
   C. is equal to pulmonary elastance
   D. depends upon surface tension forces
   E. is the sum of lung and chest wall compliance

41. Pure water at pH 7 has a hydrogen ion concentration of
   A. zero nanomol/litre
   B. 40 nanomol/litre
   C. 70 nanomol/litre
   D. 100 nanomol/litre
   E. 1000 nanomol/litre
42. Total osmotic pressure in normal human extracellular fluid is approximately
A. 25 mmHg
B. 286 milliosmoles per litre
C. 5900 mmHg
D. 300 kPa
E. none of the above

43. Which of the following is a usual physiological response to the sudden loss of 1000 mL of blood in an adult patient?
A. increased secretion of atrial natriuretic factor
B. increased vagal activity
C. significant cerebral vasoconstriction caused by sympathetic activation
D. decreased venous compliance caused by splanchnic vasoconstriction
E. depressed myocardial contractility caused by vasopressin

44. The cardiac tissue with the highest conduction rate is the
A. sino-atrial node
B. atrio-ventricular node
C. ventricular muscle
D. right and left bundle branches
E. atrial muscle

45. Concerning the coronary blood flow; which of the following statements is TRUE?
A. flow in the left coronary artery may be reversed early in systole
B. left coronary artery flow is maximal at the end of diastole
C. right coronary artery flow is maximal at the start of diastole
D. cardiac sympathetic nerve stimulation results in coronary vasodilation
E. myocardial metabolic rate is inversely correlated with coronary blood flow

46. Sodium-potassium-ATPase
A. involves moving 2 sodium ions out of cells for 3 potassium ions moving into cells
B. is stimulated by a fall in cell volume
C. is a complex monomer
D. is phosphorylated extracellularly
E. is inhibited by digoxin binding to the potassium binding site

47. All of the following affect the attenuation of ultrasound in body tissue EXCEPT
A. the frequency of the ultrasound
B. the velocity of the ultrasound
C. the number of tissue interfaces
D. the type of tissue
E. the wavelength of the ultrasound

48. In the awake adult human at rest with mind wandering and eyes closed the most prominent EEG pattern
A. alpha rhythm
B. beta rhythm
C. theta rhythm
D. delta waves
E. a combination of alpha and beta rhythms
49. For a wash out exponential function \( y = y_0 e^{-kt} \)
   A. after 1 time constant \( y \) will equal one half of the initial value
   B. after 2 time constants \( y \) will equal about 13.5% of the initial value
   C. after 6 time constants \( y \) will approximate to \( e \)
   D. after 1 half life \( y \) will equal about 37% of the initial value
   E. after 2 half lives \( y \) will equal about 10% of the initial value

50. The minimum urine pH attainable by the kidney is
   A. 3.0
   B. 3.5
   C. 4.0
   D. 4.5
   E. 5.0

51. Regarding carbon dioxide,
   A. \( \text{CO}_2 \) carriage is decreased by haemoglobin deoxygenation
   B. dissolved carbon dioxide is a significant proportion of the arteriovenous difference
   C. chloride shift balances \( \text{HCO}_3^- \) inward movement from the red blood cell
   D. 60% of AV difference in \( \text{CO}_2 \) carriage is as a result of carbamino compounds
   E. \( \text{CO}_2 \) uptake in the periphery is associated with increased haematocrit

52. In the erect position, the lung apex has
   A. greater transmural pressure than the base
   B. less negative intrapleural pressure
   C. small alveoli relative to the base
   D. low ventilation/perfusion ratios
   E. more blood flow than the base

53. The partial pressure of oxygen in mixed venous blood in a healthy adult breathing 100% \( \text{O}_2 \) is approximately
   A. 50 mmHg (6.7 kPa)
   B. 75 mmHg (10 kPa)
   C. 100 mmHg (13.3 kPa)
   D. 500 mmHg (67 kPa)
   E. 650 mmHg (87 kPa)

54. A patient has a pancreatic fistula losing 1000 mL/day. The patient has a normal intravascular volume. The acid base picture you would expect as a result of this fistula is
   A. hypochloraemic metabolic alkalosis
   B. hypochloraemic metabolic acidosis
   C. metabolic acidosis with a normal chloride
   D. hyperchloremic metabolic acidosis
   E. hyperchloremic metabolic alkalosis

55. All the following are likely to cause an increase in pulse pressure EXCEPT
   A. increasing stroke volume
   B. decreasing diastolic pressure
   C. increasing aortic compliance
   D. increasing the rate of ventricular ejection
   E. decreasing total peripheral resistance
56. Resistance in the left coronary artery is increased most by
   A. metabolic activity of the heart
   B. cholinergic stimulation
   C. systolic contraction
   D. sympathetic stimulation
   E. positive pressure ventilation

57. During isotonic exercise there is decreased
   A. arteriovenous oxygen difference
   B. diastolic blood pressure
   C. total peripheral resistance
   D. cardiac output
   E. oxygen consumption

59. During reduced potassium intake, where does the majority of potassium reabsorption occur?
   A. proximal tubule
   B. thick ascending loop of Henle
   C. distal convoluted tubule
   D. principal cells of collecting duct
   E. medullary collecting duct

60. The most likely physiological cause of an increased pulmonary A-a gradient following intra-abdominal surgery is
   A. inadequate surfactant production
   B. alveolar hypoventilation
   C. increased dead space
   D. increased shunt
   E. inadequate hypoxic pulmonary vasoconstriction

61. Hypoxic pulmonary vasoconstriction is
   A. enhanced by hypervolaemia
   B. a linear response
   C. induced by hypoxia of bronchial blood
   D. neurally mediated
   E. inhibited by respiratory alkalosis, but not metabolic alkalosis

62. Functional residual capacity:
   A. can be measured by spirometry
   B. increases in pregnancy
   C. exceeds closing capacity in the supine elderly subject
   D. decreases with obesity
   E. decreases with advancing age

63. Which of the following statements about aortic and radial pressures is TRUE?
   A. the systolic pressure is greater in the aorta
   B. the diastolic pressure is lower in the aorta
   C. the mean arterial pressure is greater in the aorta
   D. the dicrotic notch is more prominent in the radial artery
   E. the systolic peak occurs earlier in the radial artery
64. Steady laminar flow of a Newtonian fluid through a cylindrical tube varies **INVERSELY** with

A. \( r^4 \)
B. \( \Delta P \)
C. \( \rho \) (density)
D. \( l \) (length)
E. \( v \) (velocity)

65. Which of the following is an example of normal cardiovascular change in the elderly?

A. an increase in arterial elasticity
B. an elevated arterial diastolic pressure
C. a widened arterial pulse pressure
D. increased ventricular compliance
E. faster diastolic ventricular filling

66. Cerebro Spinal Fluid:

A. is produced at a rate of about 4 ml/hour
B. is actively secreted
C. recirculates approximately 6 times per day
D. is reabsorbed through the choroid plexus
E. reabsorption is inversely proportional to CSF pressure

67. The liver makes all the following **EXCEPT**

A. Von Willebrand factor
B. antithrombin III
C. fibrinogen
D. albumin
E. prothrombin

68. The change in compliance with increasing respiration rates is due to

A. increased velocity of gas flow recruiting small alveoli
B. change in ventilation of alveoli with long time constants
C. gas-trapping causing distension of apical alveoli
D. hypocapnoea causing increased airways resistance
E. disruption of the surfactant layer

69. The calculation for body mass index (BMI) is:

A. body surface area/height
B. body surface area/weight
C. weight/height\(^2\)
D. height/weight\(^2\)
E. weight \( \times \) height

70. Stimulation of parasympathetic nerves to bronchial smooth muscle results in

A. an increase in dynamic lung compliance
B. a decrease in V/Q ratios
C. an increase in elastic work of breathing
D. a decrease in anatomical dead space
E. an increase in minute ventilation
71. Hyperkalemia produces which of the following ECG changes?
   A. prolonged QT interval  
   B. T wave inversion  
   C. absence of the P wave  
   D. sinus tachycardia  
   E. ST segment depression  

72. Venous return decreases with:
   A. exercise  
   B. a femoral arterio-venous fistula  
   C. the rapid infusion of blood  
   D. a Valsalva manoeuvre  
   E. venoconstriction  

73. In an osmotic diuresis
   A. sodium loss occurs  
   B. the amount of water reabsorbed in the proximal tubule is unchanged  
   C. the urine osmolality is greater than plasma osmolality  
   D. the fluid in the loop of Henle is isotonic  
   E. none of the above are correct  

74. In a normal patient the PCO₂ is highest in the
   A. alveolar dead space  
   B. ideal alveolar gas  
   C. end expiratory gas  
   D. anatomical dead space  
   E. mixed expired gas  

75. Peripheral chemoreceptors
   A. respond to a decrease in oxygen saturation  
   B. respond to an increase in arterial pH  
   C. respond to a decrease in arterial carbon dioxide tension  
   D. show a non-linear response to changes in arterial oxygen tension  
   E. respond slowly to mean changes in arterial carbon dioxide tension