SECTION B: ANSWER TRUE OR FALSE IN FULL AGAINST EACH OPTION (DO NOT WRITE T FOR TRUE OR F FOR FALSE) – 40 marks

1. Plasmin
   a) Is a proteolytic enzyme
   b) Is formed from plasminogen
   c) Digests fibrin
   d) Digests fibrinogen into thrombin

2. With respect to iron metabolism
   a) The body contains about 40g of iron
   b) Most of the iron in the body is contained in ferritin
   c) Iron is transported in plasma as ferritin
   d) Haemosiderin is the main form in which iron is stored in tissues

3. Blood coagulation
   a) Through the intrinsic and extrinsic pathways results in activation of factor X
   b) Results from the conversion of thrombin to prothrombin
   c) Results from the conversion of fibrinogen to fibrin
   d) Can occur in the absence of calcium

4. With respect to iron metabolism
   a) Antacids reduce iron absorption
   b) Heme iron is better absorbed than non-heme iron
   c) Ferrous iron is better absorbed than ferric iron
   d) The majority of iron absorption occurs in the terminal ileum

5. With respect to Rhesus blood group
   a) Transfusion of Rhesus incompatible blood into a non-sensitized individual causes an immediate transfusion reaction
   b) The first pregnancy is never affected by Rhesus disease
   c) The child of a Rhesus positive father and a Rhesus negative mother must be Rhesus positive
   d) The child of a Rhesus negative father and a Rhesus negative mother cannot be Rhesus positive

6. The functional residual capacity:
   a) Is increased in the obese
   b) Is the residual volume plus the inspiratory reserve volume
   c) Falls with general anaesthesia
   d) Is not affected by posture
   e) Falls with increasing age

43. Purpura is caused by deficiency of:
A. Factor VIII
B. Prothrombin
C. Vitamin K
D. Platelets
E. Factor IX

44. The conversion of fibrinogen to fibrin is promoted by:
A. Factor X
B. Thrombin
C. Prothrombin
D. Platelets
E. Calcium

45. The coagulation time is prolonged in:
A. Haemophilia
B. Anaemia
C. Polycythemia
D. Purpura
E. Erythroblastosis fetalis

46. The A/G ratio is important clinically in detecting:
A. Liver disease
B. Cardiac disease
C. Blood disease
D. Lung disease
E. Plasma proteins

47. The plasma albumin is especially needed for:
A. Immunity
B. Production of osmotic pressure
C. Blood coagulation
D. All of the above
E. None of the above

7 Respiratory dead space
a) Saturates inspired air with water vapor before it reaches the alveoli
b) Removes all particles from inspired air before it reaches the alveoli
c) Decreases when blood catecholamine levels rise
d) Decreases during a deep inspiration
e) Decreases during a cough

8. Vital capacity is
a) The volume of air expired from full inspiration to full expiration.
b) Reduces as one grows older
c) Greater in men than in women of the same age and height
d) Related more to total body mass than to lean body mass
e) The sum of the inspiratory and expiratory reserve volumes

9. Loss of pulmonary elastic tissue in 'emphysema' reduces
a) Physiological dead space
b) Anatomical dead space
c) Residual volume
d) Vital capacity
e) The percentage of the vital capacity expired in one second.

10. Vital capacity
a) Is increased in the third trimester of pregnancy
b) Is dependent on the compliance of the lungs and chest wall
c) Is dependent on the strength of the respiratory muscle
d) Is higher in obese individuals compared to tall slim individuals.

48. Neutrophils are attracted to infection areas by the process of:
A. Phagocytosis
B. Diapedesis
C. Endocytosis
D. Opsonization
E. Chemotaxis.

49. Immunoglobulins are produced by the:
A. Granulocytes
B. Monocytes
C. Erythrocytes
D. Plasma cells
E. Liver cells

50. Violent antigen-antibody reactions occur due to release of:
A. Histamine
B. Serotonin
C. Acetylcholine
D. Heparin
E. Catecholamines

38. The absolute refractory period (ARP) of a nerve fibre.
A. Has a duration about 10 msec and is longer than that of cardiac muscle
B. Last throughout the action potential
C. Follows the relative refractory period
D. Occurs during the time of increased permeability of the membrane to Na+
E. Occurs mainly during repolarization

39. Excitation and contraction of skeletal muscle are coupled by:
A. ATP
B. Myosin
C. release of calcium into sarcoplasm
D. calmodulin
E. All of the above

40. Rigor mortis is due to:
A. Damage to actin and myosin
B. Rapid sequestration of Ca^{2+} in ER
C. Increased myosin-ATPase
D. ATP depletion
E. Hypoglycemia

41. The amount of plasma proteins is near to:
A. 10 gm %
B. 7 gm %
C. 7 mg %
D. 10 mg %
E. 30 gm %

42. The normal osmotic pressure of the plasma is similar:
A. 0.9 % glucose solution
B. 0.9 % NaHCO3 solution
C. 40 mmHg
D. 0.9 % NaCl solution
E. None of the above

33. The skeletal muscles:
   A. Contain pacemaker cells
   B. Contract when Ca^{2+} is taken up by the sarcoplasmic reticulum
   C. Contraction strength is related to the initial length
   D. Contract when actin and myosin filaments shorten

34. Unmyelinated nerves differ from myelinated nerves in that they:
   A. Are more excitable
   B. Conduct impulses by saltatory conduction
   C. Have no nodes of Ranvier
   D. Are not capable of regeneration
   E. Have no neurolemma (Schwann cells)

35. About the action potential, all of the following is true except:
   A. It is initiated by reduction of the membrane potential to a critical value
   B. It is the result of a transient increase in Na^+ permeability followed by a prolonged increase in K^+ permeability
   C. It is associated with reduction of the electrical resistance of the nerve membrane
   D. It has varying amplitudes when produced by stimuli of varying intensities

36. Which of the following statements is wrong?
   A. The Na^+/K^+ pump requires energy from ATP and is essential to keep the normal distribution of ions around the nerve fibre.
   B. The electrogenic pump couples Na^+ and K^+ pump with a ratio of 1:1
   C. The resting membrane potential is the potential difference between the inside and outside of the resting membrane
   D. During the nerve action potential, the firing level is reached when the membrane potential reaches -55 mV

37. About electrotonus, all the following are true except:
   A. It results from stimulation of the nerve by a subthreshold galvanic current
   B. Catelectrotonus is accompanied by increased excitability of the nerve
   C. A strong catelectrotonus can cause nerve block
   D. Catelectrotonus may be followed by the local response
   E. Both catelectrotonus and anelectrotonus are passive changes in the nerve membrane

28. The nerve impulse:
   A Can travel in one direction only
   B Is not delayed at the synapses before transmission
   C Requires energy
   D Is conducted by the same speed in different axons
   E Maximum conduction is approximately as the speed of light

29. In skeletal muscles, all the following is true except:
   A Tropomyosin is found in the thin filaments
   B. Mycsin is found in the thick filaments
   C The lateral sacs of the sarcoplasmic reticulum are rich in Ca^{2+}
   D Troponin C molecules bind Ca^{2+}
   E Energy from ATP is not required for muscle relaxation

30. In the nerve, the action potential:
   A Has a magnitude dependent on the stimulus strength
   B Is accompanied by hyperpolarization of the membrane
   C Travels in one direction only
   D Has a velocity that is reduced with demyelination
   E Has a velocity that increases with decreased fibre diameter

31. In the motor end plate, all the following is true except:
   A. The acetylcholine receptors are similar to those in smooth muscle
   B. The nerve ending contains many vesicles and mitochondria
   C. Lack of Ca^{2+} diminishes the release of acetylcholine
   D. There is a high concentration of the cholinesterase enzyme
   E. There is a delay of neuromuscular transmission of 0.5-0.7 millisecond

32. About nerve impulses, all the following is true except:
   A. They can travel in both directions when axon is stimulated at its middle
   B. They travel in one direction only across a synapse and in the M.E.P
   C. They have a duration which corresponds approximately to the ARP of the nerve
   D. They are conducted at a faster rate in type C nerve fibres than in type B fibres

22. The following characteristics are present in both skeletal and smooth muscles:
   A. The myofibrils in both have Z membranes
   B. Both initiate spontaneous rhythmic contractions
   C. Both contain actin and myosin and show tonic (partial) contractions at rest
   D. Both can be affected by hormones and chemicals equally

23. The local response in a single nerve fibre:
   A. Is produced by a cathodal current of the threshold intensity
   B. Is associated with increased K^+ permeability
   C. Is not dependent on the intensity of stimulus
   D. Can produce an action potential if the membrane potential reaches -55 mV

24. Concerning the sodium pump, it:
   A. Requires high energy phosphate bonds
   B. Is pumping of sodium ions from outside to inside the cell
   C. Is explained by facilitated diffusion
   D. Is independent of K^+ influx
   E. Is independent of the intracellular Na^+ concentration

25. A series of stimuli that cause summations of contractions leads to:
   A. Rigor
   B. Contracture
   C. Tonus
   D. Tetanus
   E. Spasm

26. The nerve cell membrane:
   A. Is highly permeable to K^+ ions
   B. Is moderately permeable to Na^+
   C. Maintains a potential difference across it
   D. Has excitability properties that vary in different conditions
   E. All of the above

27. During nerve cell excitation, the peak of K^+ efflux occurs:
   A. Before the spike
   B. Before the peak of Na^+ influx
   C. Coincide with the peak of Na^+ influx
   D. After both the spike and peak of Na^+ influx
   E. In the after-depolarization phase of action potential

11. During muscle contraction
    A. The A bands remain constant
    B. The I bands are elongated
    C. The Z lines move further apart
    D. The H zones become wider
    E. The tropomyosin molecules remain in place

12. Which of the following occurs in plain muscles but not in skeletal muscles:
    A. The sliding mechanism of contraction
    B. Cholinergic innervation
    C. Action potential
    D. Breakdown of ATP
    E. Myogenic rhythmicity

13. The absolute refractory period:
    A. Is due to hyperpolarization
    B. Refers to a normal or increased excitability state
    C. Follows the negative afterpotential
    D. Is prolonged when K^+ efflux is delayed
    E. Is equal in skeletal and cardiac muscles

14. In the action potential, all the following is true except:
    A. The firing level is the level at which the spike potential begins
    B. The rapid repolarization is due to increased K+ permeability
    C. The duration of the isoelectric interval (latent period) is inversely proportional to the speed of conduction
    D. Decreasing the external Na+ concentration reduces the size of the action potential
    E. The absolute refractory period is the period from the firing level until repolarization is completed.

15. About the types of nerve fibres, all the following is true except:
    A. The type A fibres have the largest diameter and most rapid conduction velocity
    B. The preganflionic autonomic nerves belong to type B
    C. The type C fibres have the smallest diameter and lowest conduction velocity
    D. The postganglionic autonomic nerves belong to type C
    E. The type A fibres have a spike duration longer than that of type B fibres

16 Concerning the oxygen debt mechanism
- A It is used for supply of the basal oxygen consumption
- B It involves the oxygen consumed during muscular exercise
- C Athletes develop a greater O_2 debt during a given exercise than sedentary people
- D It is used to remove excess lactic acid and to replenish the ATP and CP stores

17. In skeletal muscles, the tranverse tubules and adjacent cisterns constitute:
- A A triad
- B. The sarcolemma
- C A myofibril
- D. A muscle fibre
- E The sarcomere

18. All of the following are effects of denervation of skeletal muscles except:
- A Atrophy of muscles
- B Hypersensitivity to circulating acetylcholine
- C. Muscle fibrillations
- D. Muscle fasciculations

19. The fast type of muscles is characterized by all of the following except:
- A. High ATPase activity in the mitochondria
- B. Specialization for posture maintenance
- C. Innervation by large motor neurons
- D. Rapid fatigue
- E. Absence of myoglobin

20. In plain muscles(e.g. in the intestine)
- A. The contraction is dependent on the nerve supply
- B. The resting potential is high
- C. Ca^{2+} is involved in the initiation of contraction
- D. Epinephrine decreases the membrane potential and increases the frequency of spikes
- E. Catecholamines cause muscle contraction

21. Decreasing the Na^+ concentration around a nerve
- A. Decreases the resting potential
- B. Increases the overshoot
- C. Increases the chronaxie
- D. Decreases the action potential

6. The resting membrane potential in nerve fibres is:
   A. Normally about -10 mV
   B. Due to K^+ diffusion from outside to inside the nerve fibres
   C. Due to diffusion of intracellular protein to outside the nerve fibres
   D. A passive process
   E. None of the above

7. The all or none law states that a threshold stimulus produces an impulse which:
   A. Is weaker than that produced by a stronger stimulus
   B. Is propagated only partially along the cell membrane
   C. Does not need any energy
   D. Is not different from that produced by a stronger stimulus

8. During muscle contraction, all the following is true except:
   A. The binding sites at the actin filaments are activated by Ca^{2+}
   B. The walk along theory of the contraction assumes that sliding of actin continues as long as Ca^{2+} is attached to troponin C
   C. The detachment of myosin heads from actin needs binding of an ATP molecule
   D. The transverse tubules become filled with intracellular fluid

9. In skeletal muscles:
   A. The initiation of contraction occurs by binding of Ca^{2+} to tropomyosin
   B. The action potential follows the work done
   C. The one way conduction at the M.E.P is due to location of the chemical mediator (acetylcholine) in the nerve terminals
   D. Fatigue has no relation to the adequacy of the blood supply
   E. Fatigue sets in after fatigue occurs in the nerves

10. About blocking the conduction in nerve fibres:
   A. It can be induced by a strong catelectrotonic potential
   B. The B nerve fibres are most sensitive to pressure
   C. The A nerve fibres are most sensitive to local anaesthetics
   D. It is enhanced by increasing the Ca^{2+} concentration in the extra cellular fluid
   E. The C nerve fibres are most sensitive to hypoxia

m. Why would removal of the thymus gland be beneficial to this patient? [2 marks]

2. A male patient aged 70 years, suffered from fracture neck femur of the left side. He was operated for the fracture. After the operation, he was unable to move even in bed although he was encouraged to move. Three days after the operation, the doctor observed swelling in his left leg and was diagnosed as deep venous thrombosis.

a) Mention two causes of occurrence of deep venous thrombosis in this patient [2 marks]

b) The patient received heparin three times daily and dicumarol once daily. What is the mode of action of dicumarol? [2 marks]

c) How is heparin administered? [1 mark]

d) After two days, heparin treatment was stopped and dicumarol treatment continues. The efficacy of dicumarol treatment can be adjusted by testing which haemostatic function? [1 mark]

e) Ten days later, the patient suffers from severe bleeding from a slight cut in the face. The clotting of blood does not occur. This was diagnosed as a complication of dicumarol therapy. What substance can be given to the patient in this case? [1 mark]

f) Give one reason each for the prolonged bleeding time in the following conditions

1. Vitamin C deficiency [1 mark]
2. Deficiency of von Willibrand factor [1 mark]
3. Prolonged use of aspirin [1 mark]
4. Purpura [1 mark]

Aspirin blocks the cyclooxygenase enzyme so that production of ... and ... is reduced. ... thus platelet aggregation is reduced (defective platelet aggregation)

SECTION A: MULTIPLE CHOICE QUESTION (50 marks)

FOR EACH OF THE FOLLOWING QUESTIONS, CHOOSE THE ONE MOST APPROPRIATE ANSWER

1. The chronaxie:
   A. Is the threshold stimulus
   B. Is twice the rheobase
   C. Can be used as a measure of excitability
   D. Is the time needed to excite a nerve by a current strength equal to the rheobase

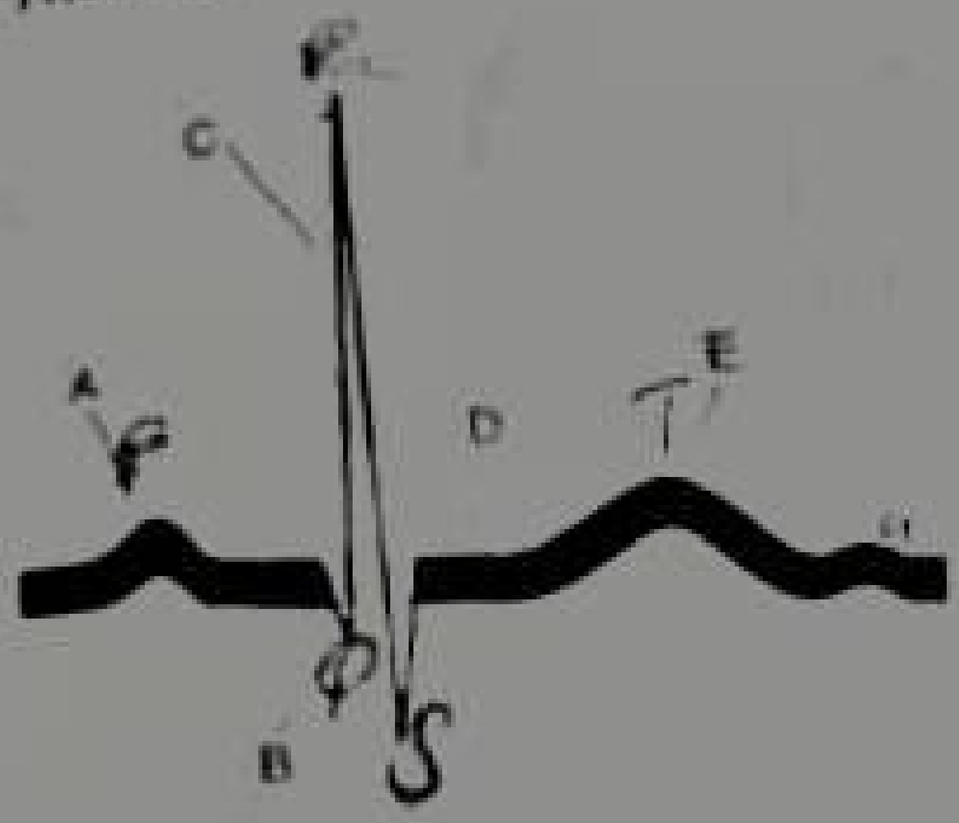
2. Among the steps of skeletal muscle relaxation:
   A. Inward spread of the depolarization wave along the transverse tubules
   B. Pumping of Ca^{2+} back into the sarcoplasmic reticulum
   C. Release of Ca^{2+} from the sarcoplasmic reticulum
   D. Binding of Ca^{2+} to troponin C

3. The Treppe (stair case) phenomenon is characterized by:
   A. It is produced by a series of maximal stimuli below the tetanizing frequency
   B. It does not occur in the cardiac muscle
   C. It has no relation to the availability of Ca^{2+}
   D. It is related to the muscle length

4. The resting heat production in skeletal muscles:
   A. Occurs during contraction
   B. Occurs during recovery following exercise
   C. Is called the initial heat
   D. Is the external manifestation of basal metabolic processes

5. The saltatory conduction in nerves:
   A. Is a slow process
   B. Depends on circular current flow
   C. Occurs in nonmyelinated nerve where depolarization takes place at intermodal areas
   D. Occurs in myelinated nerves where depolarization takes place at intermodal areas

4 The diagram below shows a normal electrocardiogram(ECG)



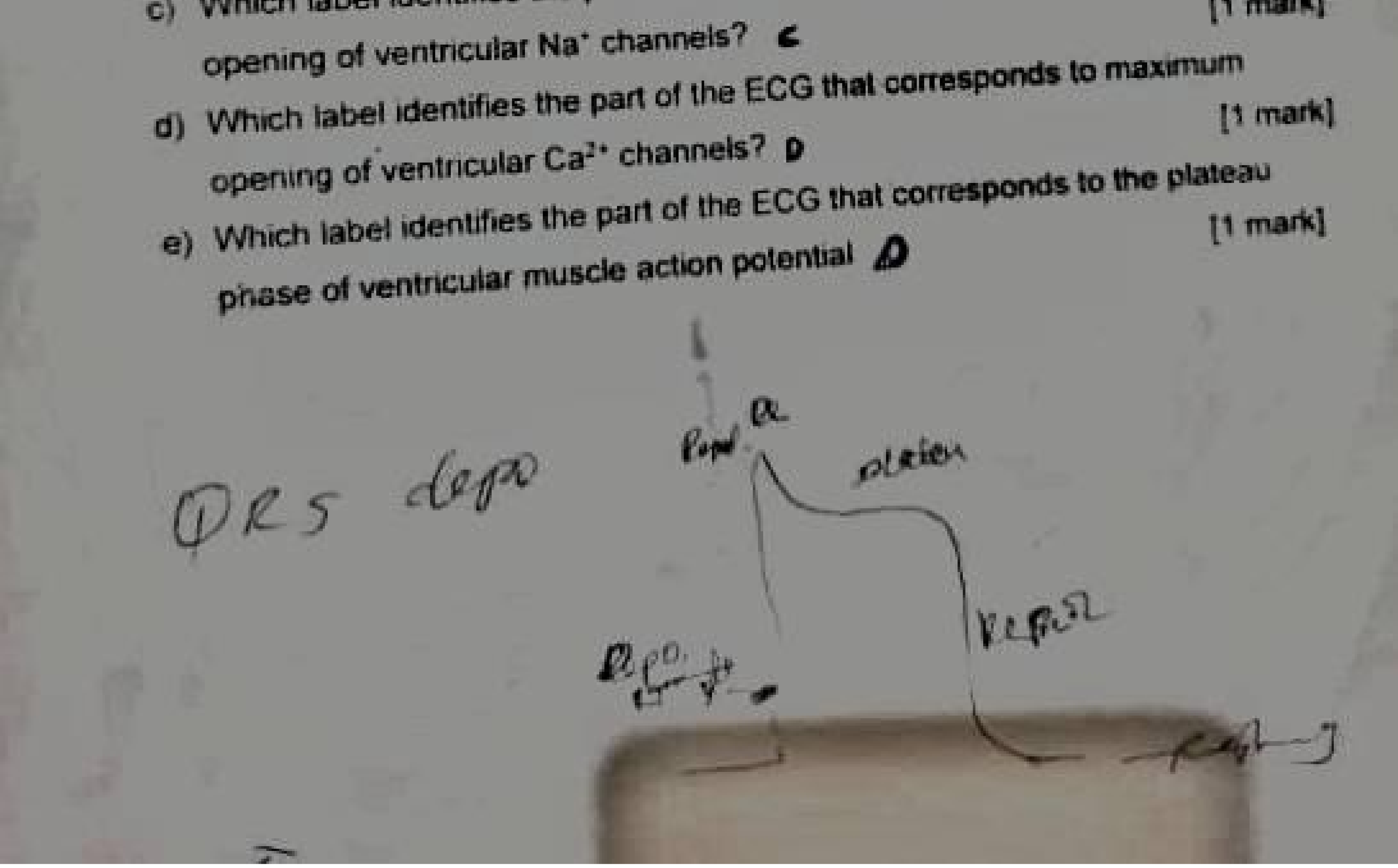
a) Which label identifies the part of the ECG that corresponds to ventricular repolarization? E [1 mark]

b) Which of the labels identifies the Q wave? B [1 mark]

c) Which label identifies the part of the ECG that corresponds to maximum opening of ventricular Na^+ channels? C [1 mark]

d) Which label identifies the part of the ECG that corresponds to maximum opening of ventricular Ca^{2+} channels? D [1 mark]

e) Which label identifies the part of the ECG that corresponds to the plateau phase of ventricular muscle action potential D [1 mark]



3. For each blood coagulation related disorder below, select the most suitable description of a case (Use each item once) [5 marks]

A	Consumption of many clotting factors	I	A 15-year-old child with diffuse purpura. Laboratory tests showed prolonged bleeding time
	Deficiency of factor VIII	II	A 50-year-old man who is receiving an anticoagulant therapy (warfarin). He is admitted to hospital complaining of hematuria (blood in urine)
	Increased fibrinogen level	III	A 10-year-old child with hemophilia A complains of persistent bleeding after tooth extraction and has prolonged coagulation time
	Deficiency of prothrombin	IV	A 30-year-old pregnant female who stopped feeling the movements of her baby for several weeks. She was admitted to the hospital with bleeding tendency and examination revealed widespread clotting
	Excessive heparin administration	V	A newly born infant with bleeding tendency, laboratory tests showed deficiency of factors II, VII, IX, X and prolonged coagulation time
	Vitamin K deficiency		
	Low platelets count below 50,000/mm³		
	Deficiency of factor XI		

5

SECTION C: SCENARIO AND STRUCTURED ESSAY QUESTIONS

1 Wendy, a 23-year old photographer visits his physician after experiencing "strange symptoms" for the last 8 months. She had severe eyestrain when she read for longer than 15 minutes. She became tired when she chewed her food, brushed her teeth, or dried her hair. She was evaluated by her physician. While awaiting the results, the physician initiated a trial of pyridostigmine, an acetylcholinesterase inhibitor. Wendy immediately felt better while taking the drug, her strength returned to almost normal.

a. What is the most likely neuromuscular condition that Wendy is suffering from? [2 marks] Myasthenia gravis

b. With respect to neuromuscular transmission, what is a quantum? [2 marks] It is a package of neurotransmitter

c. Why is the neuromuscular junction said to have a high safety margin? [2 marks]

d. State the range of the synaptic delay [1 mark] 0.3 to 0.4 ms

e. Mention two factors that account for the delay in (d) [2 marks]

f. What is responsible for the non-quantal release of acetylcholine at the nerve terminal? [1 mark]

g. Mention the cholinergic receptor type located on the postsynaptic membrane of the synaptic cleft [1 mark] Nicotinic Receptor

h. The interaction of acetylcholine with its receptor is blocked reversibly by _____ and almost irreversibly by _____ [2 marks]

i. What destroys the acetylcholine that diffuses away from the endplate into the blood stream and other tissues? [1 mark]

j. Apart from the inhibitor stated in the question state another class of chemicals that block the hydrolysis of acetylcholine. [1 mark]

k. What is the implication of the blockage in (j) above? [1 mark]

l. What is most likely to be seen in a biopsy sample of intercostal muscles of the patient in this question? [2 marks]

m. Why would removal of the thymus gland be beneficial to this patient? [2 marks]

2. A male patient aged 70 years, suffered from fracture neck femur of the left side. He was operated for the fracture. After the operation, he was unable to move even in bed although he was encouraged to move. Three days after the operation, the doctor observed swelling in his left leg and was diagnosed as deep venous thrombosis.

a) Mention two causes of occurrence of deep venous thrombosis in this patient [2 marks] (1) Blood flow become sluggish (1)
(2) Prolonged immobilization

b) The patient received heparin three times daily and dicumarol once daily. What is the mode of action of dicumarol? [2 marks] competitive inhibition of vitamin K in the liver.

c) How is heparin administered? [1 mark] Intravenously.

d) After two days, heparin treatment was stopped and dicumarol treatment continues. The efficacy of dicumarol treatment can be adjusted by testing which haemostatic function? [1 mark] prothrombin time is to be used

e) Ten days later, the patient suffers from severe bleeding from a slight cut in the face. The clotting of blood does not occur. This was diagnosed as a complication of dicumarol therapy. What substance can be given to the patient in this case? [1 mark] Vitamin K

f) Give one reason each for the prolonged bleeding time in the following conditions

1. Vitamin C deficiency [1 mark] → (blood vessels become fragile) weak vascular walls
2. Deficiency of von Willibrand factor [1 mark] → defective platelet adhesion
3. Prolonged use of aspirin [1 mark] → due to reduced platelets count below 50,000
4. Purpura [1 mark] →

10

Aspirin blocks the cyclooxygenase enzyme that produces TS Thromboxane A_2 and