**Question 39 (20 marks)**

Explain how a nerve impulse is transmitted across a synaptic gap. (8 marks)

|  |  |  |
| --- | --- | --- |
|  | **Description** | **Marks** |
| (a) | Action potential opens calcium channels in membrane | **1-8** |
| Calcium ions flow into pre-synaptic knob |
| Vesicles stimulated to release transmitter |
| Vesicle releases neurotransmitter by exocytosis into the gap/synaptic cleft/synapse |
| Neurotransmitter diffuses across the gap |
| Neurotransmitter attaches/binds to receptors/post synaptic receptors on dendrite |
| Nerve impulse can then travel down the neuron/receptor triggers a postsynaptic response specific for that receptor |
| Excitatory response produced causing the depolarisation of the postsynaptic membrane. |
| Neurotransmitter destroyed after impulse gone |
|  | **Total** | **8** |

1. Discuss how a nerve gas would affect the transmission the nerve impulses and the side effects a person would experience from nerve gas poisoning. (4 marks)

|  |  |  |
| --- | --- | --- |
|  | **Description** | **Mark** |
| (b) | Nerve gas prevents the neurotransmitter being broken down | **1-4** |
| Neurotransmitter remains in the synaptic cleft/synapse |
| Neurotransmitter builds up in the cleft/gap |
| Nerve impulses can flow/transmission of nerve impulse more likely |
| Can result in all muscles in the body trying to contract |
| Muscle control can be lost |
| Can prevent breathing/cause suffocation/respiratory failure |
| Muscles can go into spasm/tremors/convulsions/twitching/paralysis |
| Cramping and vomiting |
| Loss of consciousness/coma |
| Sweating/drooling/nausea/diarrhoea |
| **Total** | **4** |

1. The sympathetic and parasympathetic nervous systems are vital part of the peripheral nervous system. Compare and contrast the structure and function of the two systems. (8 marks)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| (c |  | | | **Marks** |
|  | **Similarities** | Both part of autonomic nervous system  Both efferent branch of nervous system  Both are under involuntary control  Both have two sets of nerve fibres | | **2 marks** |
|  | **Differences** | **Sympathetic** | **Parasympathetic** | **Between 1-6 marks** |
| (c | Neurotransmitter | Noradrenaline/adrenaline | Acetylcholine |
| Purpose | Fight or flight | Moderates all functions/homeostasis |
| Heart | Increase rate/strength of contractions | Decrease rate/strength of contractions |
| Lungs | Dilate bronchi | Constrict bronchi |
| Stomach/intestines | Decrease movement | Increase movement |
| Liver | Increase breakdown of glycogen to glucose | Increase uptake of glucose and synthesis of glycogen |
| Iris of eye | Dilates pupil | Constricts pupil |
| Salivary glands | Decrease production of saliva | Increase production of saliva |
| Urinary bladder | Relax muscle wall | Constrict muscle wall |
| Sweat glands | Increase sweat production | No effect |
| Blood vessels  Skin  Skeletal  Internal organs | Constricts  Vasodilates  Constricts (except heart and lungs) | Little effect  No effect  Little effect |
| Adrenal medulla | Stimulates hormone secretion | No effect |
|  | **Total** | | | **8** |

**Question 40 (20 Marks)**

1. . Using your understanding of the functioning of the thyroid gland, explain how these symptoms are brought about. (8 marks)

|  |  |  |
| --- | --- | --- |
|  | **Description** | **Mark** |
|  | Thyroxine increases metabolic rate/body metabolism (can have a mark for stating this) |  |
|  |
| Weight loss – increased metabolic rate means food is used up very quickly to produce energy(1), fat converted to energy as supply needed causing weight loss(1) |
| Increased appetite – all food being converted into energy, little stored/or removed from cells (1) so trigger brain to produce behavioural response giving person sense of hunger(1) |
| Fatigue – all food being used to produce energy (1), cells no replenishing supplies so when energy needed no reserves to call upon so feels tired(1). |
| Sweating – increased metabolic rate increases heat production (1), raises body temp so homeostasis mechanism of sweating used to loss excess heat instigated to bring (1) |
| restlessness – body full of energy all the time (1), causes heightened brain activity leading to increased movement/twitchy (1) |
| **Total** | **8** |

1. Describe how the body would normally bring the heart rate and blood pressure back to normal and explain how hyperthyroidism affects these systems. (12 marks)

|  |  |  |
| --- | --- | --- |
| Step | | Mark |
| Stimuli  High blood pressure | | 1 |
| Baroreceptors  In carotid artery and aorta detect change | | 1 |
| 1 |
| Message sent to the  Cardiac centre in medulla oblongata | | 1 |
| Parasympathetic autonomic system responds | | 1 |
| Vagus nerve stimulated  Cause release of acetylcholine  Slows heart rate | | 1  1  1 |
| Vasodilation of blood vessels | | 1 |
|  | Blood pressure falls | 1 |
| Total | | 10 |

The reason for the increase is that the hormone Thyroxin increase the heart rate(1 mark) and stroke volume(1 mark). Can also say cardiac output(1 mark). And this increases the blood pressure (1 mark)

Max 2 marks

**Question 41 (20 marks)**

a) Describe three types of vaccine. (6 marks)

Max 6. Any 3 examples

|  |  |  |  |
| --- | --- | --- | --- |
| Living Attenuated | 1 | Contains weakened microorganisms  Or microorganisms of lowered virulence. | 1 |
| Dead microorganism | 1 | As the name suggests | 1 |
| Toxoid | 1 | Filtrates of bacterial culture containing the toxins made by the bacteria | 1 |
| Sub unit | 1 | Contains a fragment of a microorgansim | 1 |
| Recombinant DNA | 1 | DNA of microorganism made less virulent by modifying the DNA of the microorganisms | 1 |

b)

(maximum 8 marks)

|  |  |
| --- | --- |
| Step | Mark |
| Macrophage identifies antigen as foreign | 1 |
| Macrophages bring the foreign antigen to the lymph glands | 1 |
| Macrophage engulfs antigen | 1 |
| Antigen displays parts of antigen on its surface | 1 |
| Helper T cells sensitised | 1 |
| Sensitised T-cell enlarges | 1 |
| T white blood cells replicate and from killer T cells | 1 |
| Killer T cells move to area of infection | 1 |
| Killer T cells kill infected body cells | 1 |
| Memory T cells made in case of late exposure to antigen | 1 |
| Helper-cells secrete substances that intensify the response of lymphocytes at infection site | 1 |
| Attract macrophages to site so they can destroy antigen  Intensify macrophage activity | 1 |
| Helper T cells can also stimulate B white blood cells | 1 |

c)

I) What type of drug would Relenza be classified as? Give a reason for your answer.

Relenza is an antiviral 1 mark

As influenza is caused by a virus 1 mark

(2 marks)

II) What happens when a flu particle enters the body?

|  |  |
| --- | --- |
| Virus particle invades living cell | 1 |
| Virus DNA or RNA induces the living cell to replicate the virus particles | 1 |
| Cell ruptures | 1 |
| Viral particles spread through the body infecting other living body cells | 1 |

(4 marks)