Humoral response invades antibodies (6marks)
*There will be one B cell that has the complementary antibody for an invading pathogen's antigen
*When the antibody on the surface of B cell meets a complimentary shaped antigen it binds to it
*This together with substances is released by helper T cells activates B cells process= clonal selection
*Activated B cells divide into plasma cells which secrete antibodies into the plasma
*The plasma cells are identical-clones of B cells. They secrete lots of antibodies specific to antigens called monoclonal antibodies

Explain what an antibody is and why is suited to carry out its functions (4marks)
*Antibody- a protein immunoglobulin specific to an antigen
*Produced by B cells or secreted by plasma cells. It's a protein with a quaternary structure so has more than 1-4 polypeptide chains made up
*Antibody as a variable region specific to amino acid sequence-primary structure
*The shape-tertiary structure of its binding site is complementary to fit, binds with antigens
*Forms complex between antigen and antibody

Describe how a vaccine leads to the production of antibodies against the disease-causing organism (5marks)
*Vaccine contains antigen from pathogen
*Macrophage presents antigen on its surface
*T cells with complementary receptor protein binds to antigen
*T cells stimulates B cells with complementary antibody on its surface
* B cell secretes large amounts of antibodies
* B cell divides to form clone all secreting same antibody

Mechanism of water movement (6marks)
*Energy from sun
*Water evaporates from spongy mesophyll cells and diffuse from tissues
*Decreases water potential in leaf cells
*Water moves out of xylem into tissues by osmosis, Decreases pressure in xylem
*Water sucked up xylem by cohesion tension, Decreases water potential in root system
*Water moves through root cells to xylem
*Decreases water potential in root epidermis cells
*Water moves into root hair cells from soil by osmosis

Describe the mass flow hypothesis for the mechanism of translocation in plants (6marks)
*In source / leaf sugars actively transported into phloem; By companion cells;
*Lowers water potential of sieve cell / tube and water enters by osmosis;
*Increase in pressure causes mass movement (towards sink / root);
*Sugars used / converted in root for respiration for storage;

TOPIC 6C – HOMEOSTASIS

Blood leaving the kidney eventually returns to the kidney. Describe the pattern of blood circulation in a mammal that causes blood to return to the kidney. (6 marks)
*(blood flows from kidney along) renal vein to vena cava;
*(along) vena cava to RIGHT atrium/side of heart;
*(along) pulmonary artery to lungs; (along) capillaries to pulmonary vein;
*(along) pulmonary vein to RIGHT atrium/side of heart;
*(along) aorta to renal artery (to kidney);
*Blood may pass through several complete circuits before returning to kidney;

Describe the mechanisms that are triggered in the mammalian body when water intake is reduced. (6 Marks)
*High osmotic potential detected by osmoreceptors in hypothalamus
*More ADH secreted from pituitary into blood
*To collecting duct, becomes more permeable,
*Water absorbed due to low water potential in medulla

Explain the function of the Loop of Henle in osmoregulation. (4 Marks)
*Water leaves decending limb osmotically, Na+ is retained in decending limb
*At apex Na+ very conc
*Na+ AT out of ascending limb, lowering water potential in the medulla
*Ascending limb is impermeable to water

Describe how hormonal control affects the final concentration and volume of urine produced when someone is dehydrated (4 Marks)
*High osmotic pressure, high solute conc of blood detected by osmoreceptors
*Secretion of ADH by pituitary
*Collecting duct more permeable to water so moves into medulla by osmosis
*Removed by low volumes of conc urine produced

Give four possible effects of kidney failure (4 Marks)
*Increase levels of urea in blood
*Blood in urine
*Reduced volume of urine
*Nauseus

The urea concentration of urine is much higher than that of glomerular filtrate. Describe the role of the nephron and collecting duct in achieving this increase in concentration. (5 Marks)
*Water reabsorbed from filterate less urea reabsorbed
*Reabsorbed in PCT therefore water reabsorbed by osmosis in PCT
*AT of Na+ ions in ascending limb of loop of henle
*Water reabsorbed from filterate in descending limb of loop of henle, permeable to water
*Hypertonic conditions in medulla, lowering water potential therefore water reabsorbed in collecting duct

Describe how ultrafilteration produces glomerulus filterate (5 Marks)
*Blood pressure, hydrostatic pressure increases afferent arteriole
*Small molecules e.g: glucose
*Pass through basement membrane acts as filter;
*Protein too large to go through so stays behind;
*Presence of pores in capillaries

TOPIC 7C – POPULATION IN ECOSYSTEMS

Describe & explain the changes which occur in the learning & stoat population (6marks)
*4 year cycles
*Predator/ stoat peaks after prey/ lemming
*Lemmings increase due to low number of stoats/ available food
*More food for stoats so numbers increases
*Increased predation reduces number of lemmings
*Number of stoats decreases due to lack of food/ starvation

Anolis sagrei is a species of lizard that is found on some of the smallest Caribbean islands. Describe how you could use the mark-release-recapture method to estimate the number of /Anolis sagrei/ on one of these islands. (4 marks)
*Capture/collect sample, mark AND release;
*Method of marking does not harm lizard/make it more visible to predators;
*Leave sufficient time for lizards to distribute before collecting a second sample;
*Population = number in first sample x number in second sample divided by number of marked lizards in second sample

Describe the advantages and disadvantages of using chemical pesticides to control pests of crops. (5 marks)
(Advantages)
*Acts quickly;
*Can apply to a particular area;
*Kills all/most/wide variety of pests;
(Disadvantages)
*Needs to be re-applied;
*Not specific;
*Pests can develop resistance;
*(Bio)accumulation;

Describe the advantages and disadvantages of using biological agents to control pests. (5 marks)
ADVANTAGES *Specific to 1 pest *Only needs 1 application *Maintains low population
*Pests don't develop resistance *Doesn't leave chemical in environment (no bioaccumulation)
*Can be used in organic farming
DISADVANTAGES *Doesn't get rid of pests completely *May become a pest itself
*Slow acting, time lags to reduce post population

Succession occurs in natural ecosystems. Describe and explain how succession occurs. (6 marks)
*Colonisation by pioneer (species);
*Change in environment enables other species to colonise/survive;
*Change in diversity/biodiversity;
*Stability increases / less hostile environment;
*Climax community is reached.

What are some factors limiting the size of the climax community?
*Competition for habitat/food/light *Nutrient availability
*Number of producers providing energy
*Light intensity affecting rate of photosynthesis
*Disease killing members of species
*Space for niches *Predation

Describe the process of therapeutic cloning (6marks)
*A body cell is removed from a patient and an egg cell is taken from a donor
*The nucleus is removed from the (donor) egg cell and discarded
*The nucleus is taken from the patient's cell
*The nucleus is transferred to the donor cell
*The resulting embryo is stimulated to divide
*The embryo is cultured for 4-5days
*Stem cells can then be removed & cultured

Dolly the sheep was the first mammal to be successfully cloned. Describe the process of cloning used to produce Dolly the sheep. (6marks)
*Dolly was cloned using the process of nuclear transfer.
*The nucleus of a sheep's egg was removed. This left the egg cell without any genetic material.
*Another nucleus was inserted in the egg cell. This was a diploid nucleus from the body cell of another sheep and had all its genetic information.
*The cell was given an electric shock to make it divide by mitosis.
*The dividing cell/embryo was implanted into the uterus of a surrogate mother, where it developed until it was ready to be born. The embryo was Dolly the sheep – a clone.

This siRNA would only affect gene expression in cells infected with HIV. Suggest two reasons why (4 marks)
*Only infected cells have HIV protein on surface- so siRNA can only enter these cells
*siRNA (base sequence) complementary one mRNA- so only infected cells contain mRNA of HIV stops translation of this gene

TOPIC 8B – GENOME PROJECTS & GENE TECHNOLGY

The DNA probe the geneticist used was for an exon in the DNA, not an intron. Explain why (3 marks)
*Introns not translated, do not code for amino acids
*Mutations of these exons affect amino acid sequences that produce faulty protein
*So important to know if parents' exons affected, rather than any other part of DNA

Describe how genetic fingerprinting is carried out and how it can be used to identify individuals (6 marks)
*DNA is cut using restriction enzymes
*Electrophoresis, separates according to length
*DNA made single stranded
*Transfer to membrane, apply probe
*Add a radioactive/ florescent marker
*Variable number tandem repeats (VNTR) pattern which is unique to every individual

The polymerase chain reaction can be used to produce large quantities of DNA. Describe how the PCR is carried out (6 marks)
*DNA heated to 95°C strands separate
*Cooled to 50°C, primers bind
*Nucleotides attatch by complementary base pairing
*Temp 72°C DNA polymerase joins nucleotides together
*Cycle repeated

Describe how gene probes are used to identify alleles (6 marks)
*DNA probes are short strands of DNA complementary base sequence to target allele
*DNA probe will hybridise the target allele
*DNA probe is either labelled radioactively or fluorescently marked
*Restriction enzymes digest the DNA sample, separate using gel electrophoresis
*DNA fragments are transferred to nylon membrane and incubated with fluorescently labelled probe
*If allele present then DNA probe will hybridise with it
*Expose membrane to UV light, if gene is present there will be a florescent band

Evaluate re-combinant DNA technology (6 marks)
* Medicine & drugs
*Agriculture (nutrition & resistance)
*Increase crop yield
*Monoculture leads to less resistance to diseases besides the odd one
*Unknown risks, don't know genetic effects- could cause chronic diseases
*Research could harm other animals- ethics
*Risks to ecosystems & biodiversity

PRACTICAL SKILLS

Describe how you would use a $\frac{1}{2}$-metre × $\frac{1}{2}$-metre quadrat frame and a 30-metre tape measure to obtain data similar to the data shown in the diagram. You should include details of how you would make sure that you would obtain valid results. (6marks)

*Use of tape measure to produce transect
*Placing of quadrats
*Transect placed across stream
*Score presence of each plant species
*Use quadrat at regular intervals along tape
*Repeat transect several times (≥ 3), along stream, at random **or** regular intervals

Describe how you would decide the number of quadrats to use in order to collect representative data (2marks)

Calculate remaining mean when enough quadrats this shows little change if plotted like a graph. A large enough number to carry out a statistical test.

Describe aseptic techniques and justify the chosen method (6marks)

*Keep lid on Petri dish, open lid as little as possible; To prevent unwanted bacteria contaminating the dish or avoid bacteria getting out;
*Wear gloves, mask and wash hands; prevent spread of bacteria outside the lab;
*Use sterile pipette or Flame the loop or the neck of the container of the culture; maintain a pure culture of bacteria;
*Use Bunsen Burner to maintain upward movement of air; Helps to prevent contamination of culture when lid is removed;