Multiple choice questions

1. Which of the following could be used in a vaccination?
   I  Attenuated microbes
   II Antigen molecules from a pathogen
   III A harmless pathogen that challenges the immune system

A I only
B I and II only
C I and III only
D All of the above

1. Which of the following shorten on the contraction of a muscle fibre?
   I  Myosin filaments
   II The sarcomere
   III The light band
   IV The distance between Z lines

A I and II only
B II, III and IV only
C II and III only
D All of them

1. Which of the following best describes the way ADH controls water reabsorption in the kidney?
   1. Altering sodium concentrations in the medulla
   2. Increasing active transport of water molecules
   3. Decreasing the rate of osmosis
   4. Making the collecting duct more permeable to water
1. Which of the following statements about gametogenesis in humans is correct?

<table>
<thead>
<tr>
<th></th>
<th>Spermatogenesis</th>
<th>Oogenesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Involves oxytocin</td>
<td>Unequal cytoplasmic division produces one gamete per division</td>
</tr>
<tr>
<td>B</td>
<td>Involves FSH</td>
<td>Four equally sized gametes produced from one meiotic division</td>
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<tr>
<td>C</td>
<td>Involves estrogen</td>
<td>Four equally sized gametes produced from one meiotic division</td>
</tr>
<tr>
<td>D</td>
<td>Involves FSH</td>
<td>Unequal cytoplasmic division produces one gamete per division</td>
</tr>
</tbody>
</table>

1. Which of the following are involved in the control of muscular contraction?

   I  Tropomyosin
   II ATP
   III Calcium ions
   IV The neuromuscular junction

A I only
B I, III and IV only
1. Which of the following applies to excretion in mammals that conserve water because they live in an arid environment?

I. Lengthened Loop of Henle
II. Low sodium concentration in the medulla of the kidney
III. Producing urine hypertonic to blood

A. III only
B. I and II only
C. I and III only
D. All of them

1. Which of the following statements most accurately describes the function of hCG hormone during pregnancy?

1. Stimulates maternal production of both oestrogen and progesterone
2. Stimulates maternal production of oestrogen
3. Stimulates maternal production of progesterone
4. Stimulates maternal production of FSH

1. Which human disease was the first to be eradicated by a programme of vaccination?

1. Bubonic plague
2. Smallpox
3. Cholera
4. Influenza

1. Which row correctly compares the levels of each chemical in the renal artery and renal vein?

<table>
<thead>
<tr>
<th></th>
<th>Oxygen</th>
<th>Protein</th>
<th>Urea</th>
<th>Carbon dioxide</th>
<th>Glucose</th>
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<tbody>
<tr>
<td>A</td>
<td>Higher in renal vein</td>
<td>Lower in renal vein</td>
<td>Higher in renal vein</td>
<td>Equal concentration in both artery and vein</td>
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<td>Equal concentration in both artery and vein</td>
<td>Higher in renal vein</td>
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<td>Higher in renal vein</td>
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<td>B</td>
<td>Equal concentration in both artery and vein</td>
<td>Higher in renal vein</td>
<td>Equal concentration in both artery and vein</td>
<td>Higher in renal vein</td>
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<td>C</td>
<td>Lower in renal vein</td>
<td>Equal concentration in both artery and vein</td>
<td>Lower in renal vein</td>
<td>Higher in renal artery</td>
<td>Higher in renal vein</td>
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<td>D</td>
<td>Lower in renal vein</td>
<td>Equal concentration in both artery and vein</td>
<td>Lower in renal vein</td>
<td>Higher in renal vein</td>
<td>Lower in renal vein</td>
</tr>
</tbody>
</table>

1. The placental barrier between mother and foetus allows for exchange of

   I Respiratory gases
   II Erythrocytes
   III Ions
   IV Antibodies

   A I only
   **B I, III and IV only**
   C I and III only
   D All of them

**Structured answer questions**

1. Outline two ways in which Edward Jenner’s testing of a smallpox vaccine would now be considered unethical. (2 marks)

   Use of a child as test subject/purposely infecting a child with cowpox
   Testing by inoculation of live pathogen/testing using smallpox pathogen
   Absence of informed consent
1. Outline how the acrosome and cortical reactions at fertilisation prevent polyspermy (the fertilisation of an ovum by more than one sperm). (3 marks)

   - Acrosome (enzymes) digest zona pellicuda
   - Cortical granules release/exocytose cortical granules
   - (which) digest binding proteins
   - No further sperm can bind to membrane

1. Outline, using a specific example, how the excretion of nitrogenous waste is related to the environment of an animal. (3 marks)

   - (Nitrogenous waste/environment must match for 2 or more marks)
   - Terrestrial/marine organisms
   - Excreted as urine
   - Aquatic organism/freshwater
   - Released by diffusion/over body surface
   - (shelled) Eggs/birds
   - Uric acid
   - Insoluble/saves water/mass/non-toxic

1. Describe the control of the secretion of oxytocin during pregnancy and birth. (5 marks)

   - Oxytocin causes uterine contractions (for parturition)
   - Progesterone inhibits oxytocin secretion during pregnancy
   - Negative feedback
   - At birth, progesterone levels drop
   - Inhibition removed/Pituitary gland secretes oxytocin
   - Oxytocin release/uterine contractions increase oxytocin release
   - Positive feedback

1. Outline, using a specific example, the role of the synovial joint in determining the range of movement of a limb. (4 marks)

   - Synovial joints allow movement (between bones)
Movement allowed in certain planes/directions
Due to structure of joint/position of ligaments

2 marks maximum
Hinge joint/elbow (other)
Flexion and extension
Hip/Pivot/Ball and socket joint
Flexion and extension and rotation (adduction, abduction)

2 marks maximum

1. Draw a labelled diagram of a human kidney. (5 marks)

One mark for each part correctly drawn and labelled
Capsule
Cortex
Medulla
Pyramids
Pelvis
Renal artery
Renal vein
Ureter

1. Urine is commonly tested for a number of substances. Suggests why the presence of protein in the urine is indicative of kidney damage. (4 marks)

Protein is not normally in urine
Proteins are macromolecules/large molecules
Cannot enter the filtrate/does not pass through membranes
Damage to Bowman’s capsules/membranes could allow protein to enter filtrate
Would then appear in urine/not able to be reabsorbed

1. Outline how active transport and osmosis are involved in reabsorption in the proximal tubule of the kidney. (4 marks)

Active transport uses energy (to transport molecules)
Glucose absorbed by active transport
Amino acids absorbed by active transport
Water follows by osmosis
As filtrate becomes hypotonic/solute concentration drops

1. Outline how movement of an insect limb is brought about by antagonistic muscles. (4 marks)

Muscles attached to (interior of) two successive limb segments
Antagonistic pair (of muscles)
Flexor and extensor
Flexor contracts
Bending the limb/pulling tibia towards femur
Extensor relaxes
Extensor contracts forcing straightening of limb/providing power for movement

1. The percentage of children vaccinated against measles worldwide and the incidence of the disease itself are outlined in the following table (source WHO):

<table>
<thead>
<tr>
<th></th>
<th>Percentage of population vaccinated (nearest 1%)</th>
<th>Number of cases in millions ± 0.1</th>
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</table>
1. Describe the relationship between the incidence of measles infections and the percentage of the population immunised. (2 marks)

   Negative correlation
   Greater the percentage of the population inoculated, less of population infected
   Possibly attaining a plateau

1. Suggest one reason for the decline in the percentage of the population immunised between 1990 and 1995. (1 mark).

   Fear/knowledge of possible side effects of vaccine
   Lower chance of infection
   Ethical/religious objections

1. Does the data tend to support the use of vaccination to completely eradicate a disease? (2 marks).

   Supports- negative correlation
   Does not support – infection number is significant even with high inoculation levels

1. One vaccination is 93% effective in producing immunisation and two vaccinations are 97% effective (source – Center for Disease Control, Atlanta, USA, 2014 figures). Explain why a second vaccination can increase the effectiveness of immunisation. (3 marks)

   First vaccination gives a primary response
   Booster vaccination gives a secondary response
   Presence of memory cells (from initial inoculation)
   Faster reaction/greater production of antibodies
   Increased number of memory cells

1. Outline why epidemiological studies are important in targeting populations for immunisation. (3 marks).

   Study of distribution/patterns of disease in populations
   Statistics of outbreaks are studied
   Use of databanks
   Target populations/at risk identified
Programmes initiated