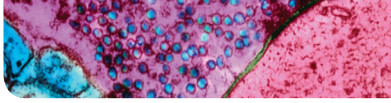

Topic 6 - data-based questions

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1. blood is pumped from atria to ventricles 0 seconds to 0.1 seconds (N.B the slight rise in atrial pressure at 0.15 seconds is probably due to the AV valve bulging back into the atria as ventricular systole starts;)

2. ventricles start to contract at 0.10 seconds;

3. AV valve closes at 0.1 seconds (atrial pressure falls below ventricular pressure);

4. SL valve opens at 0.15 seconds (ventricular pressure rises above arterial pressure);

5. SL valve closes at 0.4 seconds (ventricular pressure falls below arterial pressure);

6. blood is pumped from the ventricle to the artery from 0.15 to 0.4 seconds;

7. **a)** blood in the ventricle is at a maximum at 0.1 seconds (just before the SL valve opens);

b) blood in the ventricle is at a minimum at 0.4 seconds (at the end of ventricular systole);

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1. **a)** increasing to peak in 1993; decreasing to 1996; increasing to a peak in 1998; declines to lowest level in 2002;

b) pattern appears to be cyclical;

2. $\frac{(5.2 - 16.0)}{16.0} \times 100\% = -67.5\%$;

3. lowest levels of resistance occurred after programme implementation; therefore same success; peak in 1998 suggests programme not fully effective;

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1. inhaled air mixes with air in alveolus which has a lower oxygen concentration / is stale air; some oxygen has diffused into capillaries that surround the alveoli due to low partial pressure of oxygen in those capillaries;

2. **a)** $\frac{105 - 40}{40} \times 100\% = 163\%$; the partial pressure of oxygen is 163% higher in the alveolus;

b) diffusion;

c) **(i)** $\frac{3 - 27}{3} \times 100\% = 800\%$; 800% increase in CO_2 concentration between inhaled and exhaled air;

(ii) CO_2 produced by cell respiration; CO_2 enters blood as it flows through tissues of the body; CO_2 has diffused out of the blood into the alveolus raising the CO_2 concentration in the alveolus;

d) nitrogen concentration in blood is already as high as in the atmosphere; nitrogen not used by tissues of the body; no concentration difference between blood and air in alveolus; as many carbon dioxide molecules move from blood to air as from air to blood / no net movement;

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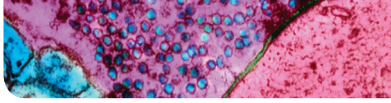
1. **a)** *typical results:* healthy lung 8 times; lung with emphysema 4 times; units are number of gas exchange surfaces per 60 mm of micrograph; (if the magnification of the micrograph is known, the units could be converted to per micrometre of lung);

b) as a result to emphysema, the mean number of gas exchange surfaces decreases; by about half; the volume of the alveolus increase; decreasing surface area to volume ratio; decreasing total gas exchange per unit time;

2. total gas exchange per unit time decreases; lower levels of oxygen in blood; lower availability of ATP for energy requiring activities;

3. greater resistance to blood flow in the lungs because of decreased numbers of capillaries; leads to increase in blood pressure;



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1. −72 mV;

2. −30mV; because the membrane potential starts to rise very steeply on the trace when this potential is reached;

3. depolarisation takes approximately 2 ms according to the graph; repolarisation takes approximately 2 to 3 ms; depolarisation and repolarisation together take 4 to 5 ms;

4. more than 65 ms because the graphs shows that the resting potential has not been reached after than time; estimates between 80 and 500 ms are reasonable;

5. assuming a refractory period of 60 ms after the action potential during which impulses cannot be initiated, there could be one action potential per 80 ms; 1000 / 80 impulses per second = 12 action potentials per second;

6. pulse of current that was given to stimulate impulses has not yet finished and causes the membrane potential to rise briefly after the repolarisation;

Page 325–326

1. a) precursor to L-Dopa so increases dopamine production in existing neurons;

b) prevents dopamine breakdown, prolonging dopamine effects;

c) favours dopamine production pathway by blocking alternative pathway;

d) an agonist either mimics or promotes the activity of a chemical such as dopamine;

e) causes dopamine concentration to increase / remain high in the synapse;

2. a) stem cells cultured and develop into neurons; dopamine-secreting neurons / cells produced; transplanted into brain to replace dopamine-secreting neurons;

b) insert functional copy of gene to replace mutant gene; insert into vector such as a virus; inject large numbers of transgenic viruses into patient;

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In person with diabetes:

a) higher concentration of glucose at time zero;

b) longer time to return to baseline (hasn't occurred after 5 hours);

c) much higher maximum glucose;

d) delay in time before glucose begins to fall;

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1. a) the more menstrual cycles, the higher the bone mineral density; significant increase in bone density once the number of cycles surpasses 10; effect on bone density is not uniform across the bone;

b) as few as 1–3 has clear effect on entire bone but 4–10 has a different effect depending on the part of the bone; neck of femur has lower density when number is between 4–10; trochanter has higher density when number is between 11–13; lowest density reached in neck/highest density reached in trochanter; both show the relationship that the more menstrual cycles, the higher the bone mineral density;

2. a) may have better diets; may have more moderate running regimes;

b) lower bone density might be caused by caused by insufficient nutrient intake; lower bone density might be caused by low estrogen levels; older runners might be over-represented in this category; high energy consumption might forestall bone maintenance;

3. a) preserving resources for demanding exercise regime; reduced estrogen impacts uterine and ovarian hormone cycles;

b) reduced appetite/exercise regime is part of weight loss strategy.