



# **A-Level Biology**

## **Synaptic Transmission**

### **Mark Scheme**

**Time available: 60 minutes**

**Marks available: 43 marks**

**[www.accesstuition.com](http://www.accesstuition.com)**

## Mark schemes

1.

- (a) 1. (Dopamine) diffuses across (synapse);
2. Attaches to receptors on postsynaptic membrane;  
*Ignore name/nature of receptor e.g. cholinergic*
3. Stimulates entry of sodium ions **and** depolarisation/action potential;  
*Accept Na<sup>+</sup> for sodium ions*  
*Accept generator potential for action potential* 3
- (b) 1. Morphine attaches to opioid receptors;  
*Reject reference to active site*
2. (More) dopamine released (to provide pain relief);  
*Reject receptors release dopamine* 2
- (c) 1. (Inside of postsynaptic) neurone becomes more negative/hyperpolarisation/inhibitory postsynaptic potential;  
*Ignore K<sup>+</sup>*  
*Accept -75mV or any value below this as equivalent to more negative*  
*Accept 'decrease in charge'*
2. More sodium ions required (to reach threshold)  
**OR**  
Not enough sodium ions enter (to reach threshold);  
*Accept Na<sup>+</sup> for sodium ions*
3. For depolarisation/action potential;  
*Context must convey idea that depolarisation / action potential is less likely* 3

[8]

2.

1. Depolarisation of presynaptic membrane;  
*Accept action potential for depolarisation.*
2. Calcium channels open and calcium ions enter (synaptic knob);  
*Accept  $Ca^{2+}$ .*
3. (Calcium ions cause) synaptic vesicles move to/fuse with presynaptic membrane **and** release acetylcholine/neurotransmitter;  
*Accept abbreviations for acetylcholine as term is in the question.*
4. Acetylcholine/neurotransmitter diffuses across (synaptic cleft);  
*Accept abbreviations for acetylcholine as term is in the question.*
5. (Acetylcholine attaches) to receptors on the postsynaptic membrane;
6. Sodium ions enter (postsynaptic neurone) leading to depolarisation;  
*Accept  $Na^+$ .*  
*Accept 'action potential' or 'generator potential' for depolarisation.*

5 max

[5]

3.

- A Vesicle;
  - B Neurotransmitter;
  - C Synaptic cleft;
- B Accept named neurotransmitter*

[3]

4.

- (a)
1. Complementary to receptor for acetylcholine;
  2. Binds to receptor;
  3. On postsynaptic (membrane);
  4. Prevents acetylcholine from binding;
  5. No action potential in postsynaptic neurone;  
*2. Accept description of 'binds'*  
*3. Must be in context of membrane*  
*5. Accept 'depolarisation' but not 'impulse'*

3 max

- (b)
1. Takes longer to become unconscious than it does to stop blinking;
  2. No overlap of standard error;  
*1. Accept reference to 0.24/0.28 and 0.48/0.44 in place of longer*

2

- (c) Different body masses but need to have comparable effects;  
*Do not accept 'same' effects or unqualified references to 'bias / comparison / fair test'.*

1

[6]

5.

- (a)
1. Causes sodium ion channels to open;  
*1. Reject if wrong sequence of events*
  2. Sodium ions enter (cell and cause depolarisation);  
*Reject sodium on its own only once*
- (b)
1. (If not removed) keeps binding (to receptors);  
*Accept answers based on what happens if it is transported out – ie what should happen*
  2. Keeps causing action potentials / depolarisation (in post-synaptic membrane);  
*2. Accept keeps Na<sup>+</sup> channels open(ing)*

2

2

- (c) 1. Movement in all groups (about) same before MDMA;  
**Q**
2. MDMA increases movement in Group **L**;  
*2. Accept normal mice for L*
3. Group **K** shows MDMA causes movement;  
*3. Accept K is a control*
4. No / little increase in mice without receptor / Group **M**;

3 max

[7]

6.

- (a) action potential arrives / depolarisation occurs;  
 calcium ions enter synaptic knob;  
 vesicles fuse with membrane;  
 acetylcholine diffuses (across synaptic cleft);  
 binds to receptors;

4 max

- (b) inside becomes more negatively charged / hyperpolarised; stimulation does not reach threshold level / action potential not produced;  
 depolarisation does not occur / reduces effect of sodium ions entering;

3

- (c) (i) inhibits enzyme (which breaks down GABA);  
 more GABA available (to inhibit neurone);

OR

- binds to (GABA) receptors;  
 inhibits neuronal activity / chloride ions enter (neurone);

2 max

- (ii) receptors have different tertiary / 3D structure / shape not complementary;  
 GABA cannot bind; inhibition of neuronal activity does not occur / chloride ions do not enter;

3

- (d) motor area;  
 left cerebral hemisphere;

2

[14]