

## Mark schemes

1

- (a) 1. Binding (of interferon gamma) changes shape/tertiary structure of receptor (protein);  
2. This activates/switches on the enzyme;  
3. Use of ATP (to phosphorylate STAT1);  
1. *Accept reference to second messenger mechanism/process*  
*Context is important*

2 max

- (b) 1. Phosphorylated STAT1;  
2. IRF (protein);  
*Accept in either order*  
1. *Must be phosphorylated but accept STAT1P*  
2. *Ignore references to phosphorylated*

2

- (c) 1. Causes more helper T cells to form;  
2. (So) more interferon (gamma) production (by helper T cells);  
1. *and 2. require idea of more*

2

- (d) 1. (Tumour suppressor gene) slows cell division/causes death of damaged/tumour/cancer cells;  
2. *IRF* gene leads to formation of IRF (protein) that binds to gene B;  
3. (Gene B protein) causes death of damaged/mutated cells OR slows division;  
2. *'It' means IRF gene*  
3. *Context is important*  
3. *If clearly stated **and** includes the protein, scores 2 marks because it subsumes point 1*

3

[9] (a) 1. Release of glucagon;

2

2. Leads to formation of glucose in liver (cells);  
*Reject: glucagon breaks down glycogen, or any other biological molecule*
3. From non-carbohydrates / amino acids / fatty acids.  
*Accept: gluconeogenesis / references to glycogen as source of glucose*

3

- (b) 1. Mutant mice (mRNA suggests) make a lot of (the) enzyme; *Accept: PCK1 made (for enzyme made)*

2. Mutant mice use kidney / intestine (cells) to make glucose; *Accept: use other organ (than liver)*
3. Normal mice do this much less / normal mice use liver cells.

3

- (c) 1. Differences significant;  
*Reject: references to results being significant once*
2. Probability of difference being due to chance less than 0.01 / 1% / 1 in 100 / probability of difference not being due to chance more than 0.99 / 99% / 99 in 100.  
*Ignore: references to 0.05 / 5% / 5 in 100*

2

- [8] (a) 1. Positive correlation between sucrose and dopamine concentrations / higher

3

concentration of sucrose, more dopamine;

**Q NB question is 'How do these ...', not 'Do these ....**

1. *Ignore simple statements of numbers from graph without description of trend*
2. So (dopamine) makes them want to drink / eat more (sucrose);
3. Positive feedback because drinking / eating leads to wanting to drink / eat (even) more;  
*3. It must be a clear statement of why this example is positive feedback, not inferred from points 1 and 2*

3

- (b) 1. (Refractory period) leads to discrete / separate nerve impulses / time when another nerve impulse can't happen;

**OR**

(Refractory period) limits number of impulses per second / frequency of nerve impulses;

2. When maximum frequency reached / exceeded, no further increase in information / all (higher) concentrations of sucrose seem the same;

2

- (c) 1. (Negative feedback) stops desire / wish to eat / appetite;
1. *Accept stops dopamine release (in this context)*
  1. *Accept makes them feel full*
  2. (This) limits amount eaten / stops eating;
  2. *Accept prevents constant eating*
  3. Prevents / reduces risk of obesity / too much energy intake;
  3. *Accept prevents vomiting*

Accept descriptions based on what would happen in absence of the feedback mechanism - or if stomach empty for points 1 and 2

3

[8]

4

- (a) 1. (Acetylcholine) released from / in presynaptic side;
2. Receptors in postsynaptic (side) / binds on postsynaptic (side);  
2. Mark for diffusion only awarded in context of unidirectional movement.

2

- (b) (i) 1. Rapid response;
2. Short duration;  
Specific wording is not important. It is the principles that matter here.  
Points may be made by referring to figures.

2

(ii)

	1	2	3
Percentage	80	0	0

Ignore % sign.

1

[5] (a) (i) Eaten;

5

Containing carbohydrate / sugar;

Glucose absorbed from intestine / into blood;

Long time after insulin injection / needs more insulin / has not taken insulin;

Does not convert glucose to glycogen / glucose not taken up from blood;

2 max

(ii) Shows positive correlation / directly proportional;

A range of results for a particular value / values (for different colours) overlap;

Urine test only an arbitrary scale / not directly related to concentration / colour is subjective / few colour values;

Accept description

3

- (b) Glycogen to glucose / glycogenolysis by activating enzymes;  
If name incorrect this disqualifies.

Gluconeogenesis;

*Allow explanation in terms of glucose from a non-carbohydrate / named non-carbohydrate source.*

2

[7]

(a) (i) where a change triggers a response which reduces the effect of a change;

6

1

(ii) e.g. sweating, breathing, defaecating, other valid example;

*(reject respiration evaporation not acceptable as a 2<sup>nd</sup> mark if sweating or breathing given)*

2 max

(iii) hypothalamus;

1

(b) (i) pituitary;

*(ignore anterior pituitary)*

1

(ii) 1. ADH causes vesicles containing aquaporins / aquaporins to be inserted into membrane / collecting duct wall / plasma;

2. water enters cell through aquaporins;

3. by osmosis / diffusion / down a water potential gradient;

4. (from cell) to capillary;

5. via interstitial fluid;

4 max

(c) (i) excessive urination / drinking / diluted urine / thirst;

1

(ii) because males only have one X chromosome / do not have Y chromosome; a single copy of the recessive allele will be expressed;

2

(iii) recessive alleles can be carried by individuals without showing effects / dominant allele always expressed; organism that are carriers more likely to reproduce / affected organism less likely to reproduce; therefore recessive alleles are more likely to be passed on / dominant alleles less likely to be passed on;

3

[15]

### Quality of Communication

7

The answers to all sections of this question require the use of continuous prose.

Quality of language should be considered in crediting points in the scheme. In order to gain credit, answers should be expressed logically and unambiguously, using scientific terminology where appropriate.

- (a)
1. Deviation of a value from norm initiates corrective mechanisms;
  2. fluctuations in plasma glucose concentration detected by hypothalamus / isletcells in pancreas;
  3. initial decrease, no food given (in plasma glucose) stimulates (increased) secretion of glucagon;
  4. increases (in plasma glucose) stimulate (increased) secretion of insulin from  $\beta$ cells as secretors;
  5. correct ref. to interconversion of glycogen / glucose / increased / decreased uptake of glucose by cells (as appropriate) / correct ref to change in membrane permeability;

5

- (b)
1. Body temp. / 37 °C is optimum temp for enzymes;
  2. excess heat denatures enzymes / alters tertiary structure / alters shape of active site / enzyme so substrate cannot bind / eq;
  3. reactions cease / slowed;
  4. too little reduces kinetic energy of molecules / molecules move more slowly;
  5. fewer collisions / fewer ES complexes formed'

5

[10] (a) Maintaining a constant internal environment;

8

1

- (b)
- Binds to (specific) receptor;
  - On muscle / liver cell;
  - Activation of enzymes (in liver);
  - Hydrolysis of glycogen;
  - (Facilitated) diffusion of glucose out of (liver cells) cells;
  - Increases blood glucose levels;

4

- (c) (i) 0 / zero;

1

- (ii)
1. Filtration, out of blood (plasma) / into renal capsule;
  2. (Hydrostatic) pressure ;
  3. PCT;
  4. All reabsorbed;
  5. Active transport;

3 max

[9]

- (a) (i) maintaining a constant internal environment;

9

1

- (ii) *one mark for example of factor kept constant; one mark for explaining its importance;*

e.g.

temperature / pH; optimum for enzymes / effect of pH / temperature on enzyme activity;

OR

water potential / blood glucose;  
effect of osmotic / blood glucose imbalance on cells;

2 max

- (b) cannot interact with / move tropomyosin from binding sites on actin;  
(*reject active sites*) myosin(heads) do not bind /  
actinomyosin not formed; does not activate ATPase /  
energy not released from ATP;

3

[6]

10

- (a) bacteria have ligands / antigens / proteins / glycoproteins / polysaccharides (on membrane  
/ wall);

1

complementary to receptors / fits / binds / attaches to specific receptor

1

- (b) enzymes denatured / tertiary / secondary structure altered / altered active sites / breaks  
hydrogen bonds;

1

prevents named chemical reactions / metabolic pathways;

1

- (c) inhibits / kills other bacteria / fungi / decomposers / reduces competition;

1

- (d) 1 prepare a bacterial lawn / culture / sample;  
(*accept mix bacteria with agar / medium*)  
2 with oil and one with control / water / range of  
concentrations; 3 appropriate method of standardising how  
sample applied, e.g. discs / wells;  
4 appropriate measure of effectiveness / size / diameter of clear zone;  
5 the larger the zone the greater the effectiveness;  
6 use of aseptic technique;

(*ignore haemocytometer*)

4 max

[9]

11

- (a) moves to 40 °C side, then later to 20 °C;

gets lighter in hot side and darker in cool side;  
lighter as it absorbs heat / darker as it loses heat;  
by conduction / convection / radiation;

3 max

- (b) lizard finds favourable environment;

(helps it to) maintain constant body temperature;  
advantage of this, e.g. for enzyme activity;

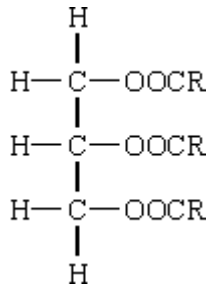
2 max

[5] (a) 3 fatty acids attached;

12

ester bond correct;

(H on glycerol component, O attached to carbon, R at other end)



2

(b) not made of monomers / many repeating units;

1

(c) (many) mitochondria present in brown fat cells; mitochondria release heat / energy; (*ignore ATP*)  
white fat cells for fat storage / reduced fat storage in brown fat cells;

3

[6]