A-Level Biology

Control of Blood Glucose

Mark Scheme

Time available: 64 minutes
Marks available: 45 marks

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1.

(a) 1. Changes tertiary structure;

Reject change in tertiary structure of receptor.

2. No longer complementary (to receptor);

Reject 'active site' or reference to enzyme or substrate.

2

(b) 1. Less/no AKT activated;

2. Fewer/no vesicles move to membrane

OR

Fewer/no (channel) proteins in membrane;

Accept 'fuse with membrane'.

3. Less/no glucose diffuses into cell (so high blood glucose);

3

(c) 1. High concentration of glucose in blood/filtrate;

Accept tubule for filtrate.

2. Not all the glucose is (re)absorbed at the proximal convoluted tubule;

Reject no glucose is (re)absorbed.

3. Carrier/co-transport proteins are working at maximum rate

OR

Carrier/co-transport proteins/ are saturated;

Accept all carrier/co-transport proteins are 'in use' but reject all carriers are 'used up'.

Accept symport for carrier protein.

Accept not enough carrier proteins to absorb all the glucose.

3

[8]

2.

(a) 1. (Attaches to receptors on target cells and) activates/stimulates enzymes;

Reject 'produces enzymes'.

2. Glycerol/amino acids/fatty acids into glucose;

Reject 'glucagon converts' as context suggests enzyme action.

Ignore lipids/fats/proteins but reject glycogen.

Reject occurs in pancreas.

2

(b) 1. Correct answer of 3.24 = **2 marks**;;

2. Incorrect but multiplies by 34 (with decimal point in any position) = **1 mark**
OR
Incorrect but shows sequence 324 = **1 mark**
OR
3.2 = **1 mark**;

2

(c) 1. (More) insulin binds to receptors;

2. (Stimulates) uptake of glucose by channel/transport <u>proteins</u>
OR
Activates enzymes which convert glucose to glycogen;

Accept activates enzymes for glycogenesis.

Reject active transport.

Accept carrier proteins or GLUT 4 for channel proteins.

Accept insulin stimulates addition of channel proteins in membranes.

2

(d) 1. Less/no ATP is converted to cyclic AMP/cAMP;

2. Less/no kinase is activated;

3. Less/no glycogen is converted to glucose
OR
Less/no glycogenolysis;

*If no indication of less/no for any of the mark points award **max 2 marks**.*

Accept all marks in context of adrenaline.

Ignore gluconeogenesis.

3

[9]

3. (a) 1. (Usually)Type II produce insulin;
2. Cells / receptors less sensitive / responsive (to insulin)
OR
Faulty (insulin) receptors;
3. (Treated / controlled by) diet / exercise;

2. Accept: cells / receptors do not respond.

2. Accept: 'fewer receptors'

3. Accept: (Treated / controlled by) weight loss / medication / drugs.

3. Ignore: diabetes is caused by diet / exercise.

2 max

(b) Tick in box 4

1

(c) 1. Attach to gene / DNA / promoter region;
2. Stimulate / inhibit transcription / RNA polymerase;

Note: Genes being expressed / inhibited or switched on / off is not enough on its own.

2

(d) 1. (Effective as) group A / with iPS / treated lower than group B / with diabetes;
2. (Effective as) group A similar to group C / without diabetes;
3. (Investigation) done on mice not humans;
4. Only shows results for 12 weeks / short-time period / long-term effects not known;

Ignore: Only one study / not repeated / sample size.

2. Accept: 'healthy' or 'normal' or control for group C.

4

[9]

4. (a) 1. Release of glucagon;
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 <u>less than</u> 0.01 / 1% / 1 in 100 / probability of difference not being due to chance <u>more than</u> 0.99 / 99% / 99 in 100.

Ignore: references to 0.05 / 5% / 5 in 100

2

[8]

5. (a) (Formation of glycogen)

1. Glucose concentration in cell / liver falls below that in blood (plasma) which creates / maintains glucose concentration / diffusion gradient;

2. Glucose enters cell / leaves blood by facilitated diffusion / via carrier(protein) / channel (protein);

Not just diffusion

2

(b) 1. Insulin sensitivity similar to / not (significantly) different from those with diabetes;

No values for non-obese, so comparisons with 'normal' not possible

2. Overlap of SDs;

Accept SE

3. Their sensitivity (to insulin also) improved by GBS;

2 max

(c) 1. Sensitivity (to insulin) does increase;

This part of the question concerns spread of data, not overlap of SDs

2. But large SD / large variation (after GBS);

Accept use of figures / use of SD values to make this point.

Ignore ref to SE

3. (So) some showing no / little change / get worse;

4. Do not know what sensitivity to insulin is of non-diabetics (who are not obese);

Accept 'normal' as non-diabetic

3 max

[7]

6. (a) 1. Glucose oxidase and peroxidase;

Both enzymes required

2. Dye (with colour A);

Reject 'dye with colour B'. Ignore named dyes

2

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(b) 1. Concentration is given as a range (for each colour) / measurement is not precise;

2. Only measures glucose concentration above normal / above 170 (mg 100 cm^{-3}) (in blood);

3. 170 (mg 100 cm^{-3}) is an average figure / concentration for loss to urine varies (between people);

4. Difficult to match colour against chart / colour match is subjective;

2 max

[4]

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