M1.(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 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]

M2.(a) 1. To show the effect of the inhibitor / drug;

2. To show the effect of yoghurt (on its own does not affect blood glucose);

2

(b) 1. Food is a factor affecting blood glucose / different foods contain different amounts of starch / glucose / sugar / carbohydrate;

Accept converse

2. To keep starch / fibre intake the same / similar;
Accept something in food which affects the inhibitor

2

(c) 1. Fewer E-S complexes formed;

2. (With inhibitor) less / no starch digested to maltose ;
Require knowledge that maltose comes from starch

3. (So) less / no glucose from maltose;
Require knowledge that glucose comes from maltose
Accept no glucose

4. (So) less absorption of glucose (from gut);

2 max

(d) **Suitable reason; with explanation;**

Paired responses – do not mix and match
Ignore references to correlation does not prove causation, it could be due to other factors

Examples,

1. Need larger sample / only 30 mice / only 15 mice in each group;
Accept small sample size

2. Might not be representative / anomalies might have a bigger or smaller effect;
Accept mean not reliable

OR

3. Investigation only lasted 20 days;
Experiment was not long enough

4. Can't see what longer term effects are;

OR

5. Fall in blood glucose is small / numbers from graph;

6. Mice with inhibitor still have a large rise in blood glucose / so don't know if differences significant;
Accept differences are due to chance

OR

7. No stats / SDs / SEs;

8. So don't know if differences significant;

OR

9. Blood glucose could continue to fall;

10. which could be harmful;

OR

11. No group without yoghurt;

12. So cannot compare to other groups;

2 max

[8]

M3.(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]

M4.(a) 1. Glucose oxidase and peroxidase;
Both enzymes required

2. Dye (with colour A);
Reject 'dye with colour B'. Ignore named dyes

2

(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]

M5.1. Diabetics have (blood glucose) concentration greater than 140 mg cm^{-3} / than her estimate / estimate suggests she is pre-diabetic;

2. Colour change is subjective / blood on test strip masks colour change;

3. Concentration given as a range / estimation is not reliable;

4. May not have fasted;

5. May not have had a drink with 75 g glucose;

6. Only one test carried out;

No mark for valid or not valid

[3]

M6. (a) 1. Adenylate cyclase activated / cAMP produced / second messenger produced;

2. Activates enzyme(s) (in cell so) glycogenolysis / gluconeogenesis occurs / glycogenesis inhibited;

2. Neutral: 'glucose produced' as given in the question stem

Accept: correct descriptions of these terms

2

(b) (i) 1. Glucose / sugar in food would affect the results;

1. Accept references to starch / carbohydrate

Or

2. Food / eating would affect blood glucose (level);

Or

3. (Allows time for) blood glucose (level) to return to normal;

3. Neutral: allows time for insulin to act

1 max

(ii) Type 2 diabetes is a failure to respond to insulin / still produces insulin / is not insulin-dependent;

1

(iii) (For) – 3 max

A maximum of three marks can be awarded for each side of the argument

1. Avoids injections / pain of injections;

2. Long(er) lasting / permanent / (new) cells will contain / express gene;

Ignore references to methodology e.g. sample size not known

3. Less need to measure blood sugar / avoids the highs and lows in blood sugar;

4. Less restriction on diet;

(Against) – 3 max

5. Rats are different to humans;

6. May have side effects on humans;
6. Accept: virus may be harmful / disrupt genes / cause cancer

7. Long(er) term effects (of treatment) not known / may have caused effects after 8 months;

8. (Substitute) insulin may be rejected by the body;

4 max

[8]

M7. (a) (i) Eaten;

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]**