Questions are for both separate science and combined science students unless indicated in the question

Q1.

The hormone insulin helps to control the concentration of glucose in the blood.

(a) Which organ produces insulin?

Tick (✓) **one** box.

Adrenal gland	☐
Pancreas	☐
Thyroid	☐

(1)

People with Type 2 diabetes:

- produce insulin
- have body cells that do **not** respond to insulin
- often have a high concentration of glucose in their blood.

(b) Why do people with Type 2 diabetes often have a high concentration of glucose in their blood?

Tick (✓) **one** box.

The body cells change glucose into glycogen for storage.	☐
The body cells have a high rate of respiration to release energy.	☐
The body cells take in a low amount of glucose from the blood.	☐

(1)

Drug **X** is used for treating people who have Type 2 diabetes.

Scientists investigated the effect of drug **X** on the concentration of glucose in the blood of mice.

This is the method used.

1. Give two groups of mice the same diet for 8 weeks.
2. Give each mouse in group **A** 2 cm^3 of water to drink.
3. Give each mouse in group **B** 2 cm^3 of drug **X** to drink.
4. After 30 minutes, give each mouse 1 cm^3 of glucose solution to drink.
5. Measure the concentration of glucose in the blood of each mouse at intervals for 3 hours.

(c) Give **two** control variables used in the investigation.

1 _____

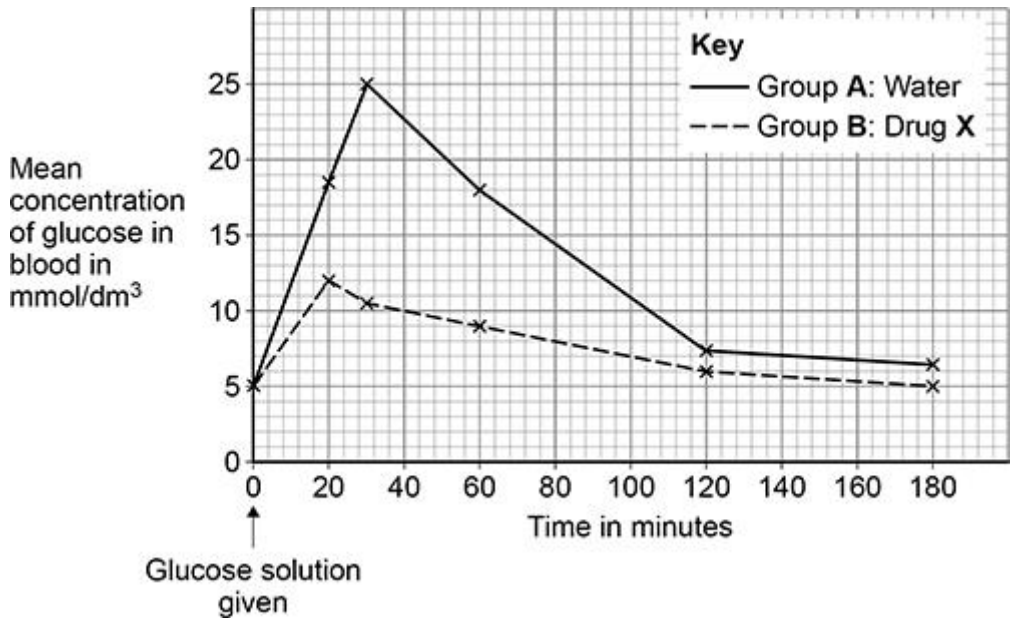
_____

2 _____

_____

(2)

The figure below shows the results.



In each group of mice, the concentration of glucose increases to a maximum value and then decreases.

(d) Group **B** reached a maximum value earlier than group **A**.

Determine how many minutes earlier.

_____

_____

Number of minutes earlier = _____

(2)

(e) Give **two** conclusions about the effect of drug **X** on the concentration of glucose in the blood.

Do **not** refer to reaching the maximum value earlier.

1 _____

_____

2 _____

_____

(2)

(f) How could scientists find the best **dose** of drug **X** for controlling blood glucose concentration?

Tick (✓) **one** box.

Repeat the investigation twice more. ☐

Use different concentrations of drug **X**. ☐

Use more mice in the investigation. ☐

(1)

(Total 9 marks)

Q2.

Hormones are important for controlling many processes in the human body.

Hormones are produced by glands.

(a) Which organ system has glands that produce hormones?

Tick (✓) **one** box.

The circulatory system ☐

The endocrine system ☐

The nervous system ☐

(1)

(b) How are hormones transported around the body?

Tick (✓) **one** box.

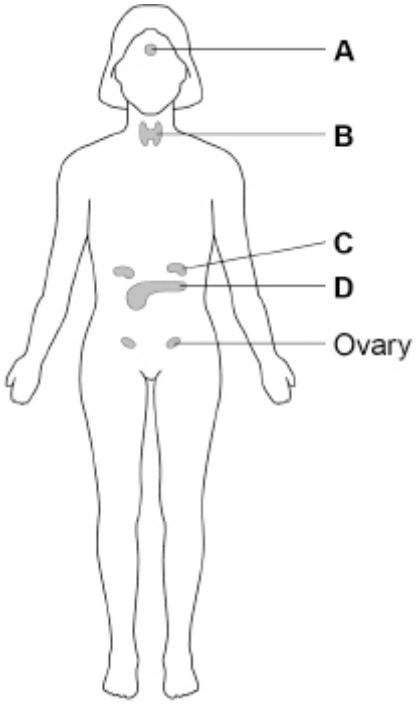
By the blood ☐

By the muscles ☐

By the nerves ☐

(1)

The figure below shows glands in a woman's body.



(c) Draw **one** line from each gland to the name of that gland.

Gland	Name
A	Adrenal
B	Pituitary
C	Testes
	Thyroid

(3)

(d) Which gland in the figure above produces insulin?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(e) Which organ does insulin mainly affect?

Tick (✓) **one** box.

The brain ☐

The liver ☐

The ovary ☐

(1)

(f) Give **one** effect of insulin.

_____

_____

(1)

Some hormones control a woman's menstrual cycle.

(g) Which hormone causes an egg to mature in the ovary?

Tick (✓) **one** box.

Adrenaline ☐

Follicle stimulating hormone (FSH) ☐

Testosterone ☐

(1)

(h) Which **two** are hormones that help to maintain the lining of the uterus during pregnancy?

Tick ✓ **two** boxes.

- Amylase ☐
- Oestrogen ☐
- Progesterone ☐
- Protease ☐
- Thyroxine ☐

(2)

(i) Contraception prevents pregnancy.

Give **two** methods of contraception that use hormones.

1 _____

_____

2 _____

_____

(2)

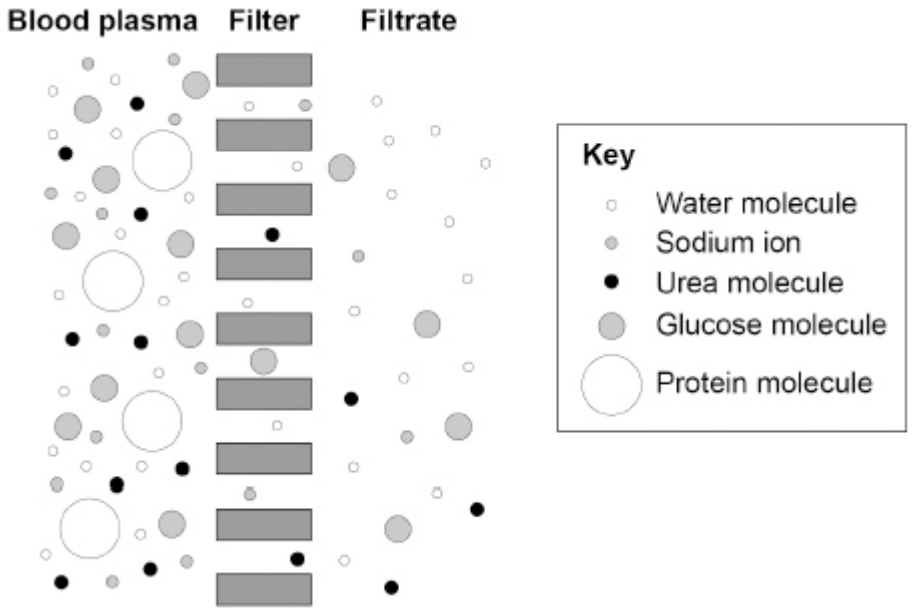
(Total 13 marks)

Q3.

The kidneys filter the blood.

Figure 1 shows filtration in the kidney.

Figure 1



(a) Glucose molecules are found in the blood plasma **and** in the filtrate.

Protein molecules are **only** found in the blood plasma.

Draw **one** line from each substance to the reason for where the substance is found. **(biology only)**

Substance	Reason
Glucose	The molecules are too large to pass through the filter
	The molecules are small enough to pass through the filter
Protein	The molecules are too small to pass through the filter

(2)

(b) The kidneys control the volume of water in the body.

The table below shows information about a person on one day.

	Volume in dm^3
Water filtered from blood	160.0
Water lost in urine	1.9

Calculate the volume of water reabsorbed into the blood. **(biology only)**

_____

_____

Volume = _____ dm^3

(1)

(c) A person with kidney disease may be treated by dialysis or by having a kidney transplant.

Figure 2 gives information about dialysis and kidney transplants.

Figure 2

Dialysis

- A person needs 3 dialysis sessions a week, with each session lasting about 8 hours.
- Most patients have dialysis in hospital.
- Protein and salt levels in food must be kept low.
- Dialysis costs £35 000 per year for each patient.

Kidney transplant

- In a surgical operation the use of a general anaesthetic can occasionally cause damage to other organs.
- After a transplant the patient must take drugs for the rest of their life to suppress the immune system.
- A transplant costs £17 000 in the first year and then £5 000 in each of the following years for drugs.
- The transplanted kidney will work well for about 10 years.

A doctor states:

‘It is better to treat a person with kidney disease by using a kidney transplant rather than by dialysis.’

Evaluate the doctor’s statement. **(biology only)**

Use information from **Figure 2**.

(6)

(d) A kidney transplant costs £17 000 in the first year and then £5 000 in each of the following years for drugs.

Calculate the total cost of treatment by kidney transplant over the first 5 years. **(biology only)**

Total cost = £ _____

(3)

(Total 12 marks)

Q4.

In the human female, an egg is released from one of the ovaries about once every four weeks.

During the four weeks, the lining of the uterus thickens and then breaks down.

This is called the menstrual cycle.

(a) Which **two** hormones are female reproductive hormones?

Tick (✓) **two** boxes.

Adrenaline	☐
Oestrogen	☐
Progesterone	☐
Testosterone	☐
Thyroxine	☐

(2)

(b) Follicle stimulating hormone (FSH) is another female reproductive hormone.

What is the function of FSH in the menstrual cycle?

Tick (✓) **one** box.

FSH causes an egg to mature in the ovary.	☐
FSH causes breast development.	☐
FSH causes the uterus lining to break down.	☐

(1)

(c) Sperm cells can survive inside a woman's reproductive organs for five days.

An egg cell can survive for one day after ovulation.

In one woman ovulation occurred on day 14.

Give the range of days on which sexual intercourse could result in fertilisation.

From day _____ to day _____

(1)

(d) If a man and a woman have sexual intercourse and do **not** want to produce a baby, they may use contraception.

Explain how different methods of contraception prevent pregnancy.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

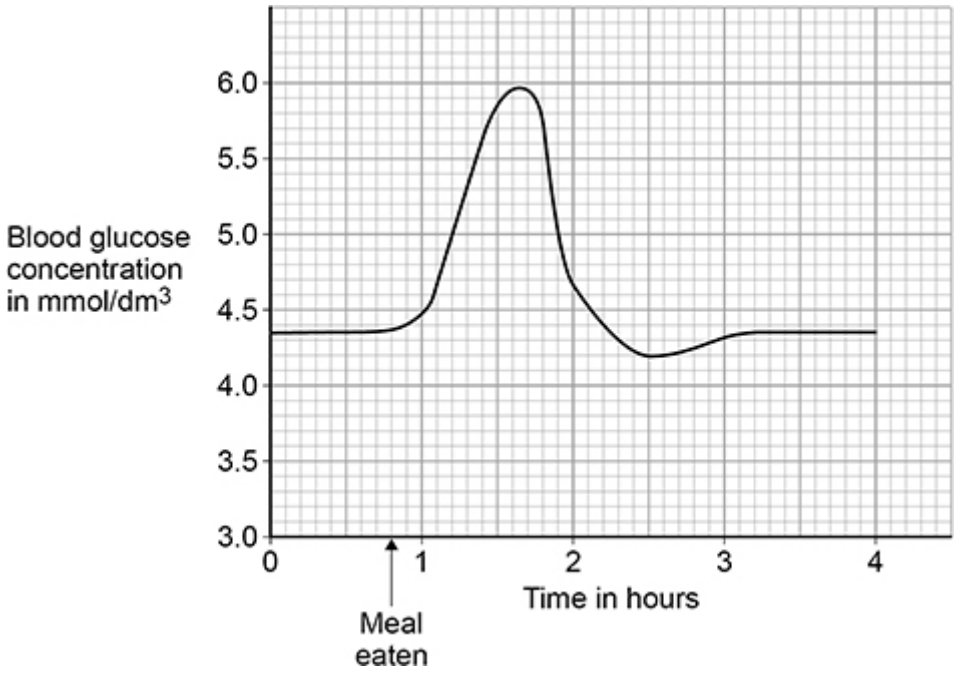
(Total 10 marks)

Q5.

It is important to control the concentration of glucose in the blood.

Figure 1 shows how the concentration of glucose in the blood of a person changed over 4 hours.

Figure 1



(a) Give **one** time when the concentration of **insulin** in the person's blood would be high.

Use **Figure 1**.

Time = _____hours

(1)

(b) Explain the effect a high concentration of insulin has on blood glucose concentration.

Effect _____

Explanation _____

_____

_____

_____

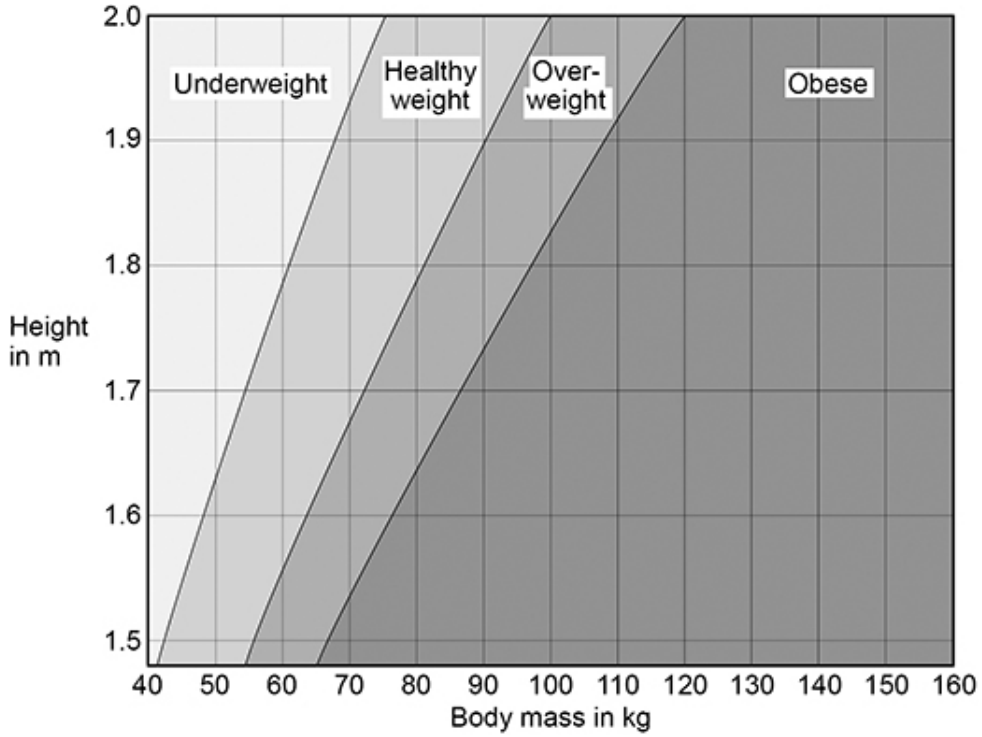
(3)

People with diabetes have difficulty controlling the concentration of glucose in their blood.

Type 2 diabetes is linked to obesity.

Figure 2 shows how to find if an adult's body mass is healthy for their height.

Figure 2



(c) Person **A**:

- is 1.75 m in height
- has a body mass of 52 kg.

What is person **A**'s weight category?

Tick (✓) **one** box.

Underweight ☐

Healthy weight ☐

Overweight ☐

Obese ☐

(1)

(d) Person **B** is 1.9 m in height.

Give the range of body masses that would put person **B** in the healthy weight category.

Range from _____ kg to _____ kg

(1)

(e) Person **C** is obese.

A doctor thinks that person **C** has Type 2 diabetes.

The doctor tests a sample of blood from person **C**.

The table below shows:

- the results of the blood test
- the mean results for people who do **not** have diabetes.

	Concentration in blood	
	Person C	**Mean for people who do not have diabetes**
Cholesterol in mmol/dm^3	6.21	5.20
Glucose in mmol/dm^3	9.56	4.51
Insulin in arbitrary units	24.32	14.83

Type 2 diabetes occurs when body cells have a reduced response to insulin.

Give **two** ways the results of the blood test show that person **C** might have Type 2 diabetes.

1 _____

_____

2 _____

(2)

(f) Give **two** ways that a person can reduce the chance of developing Type 2 diabetes.

1 _____

_____

2 _____

(2)

(Total 10 marks)