How Science Works / Practical / Maths Questions from June 2016

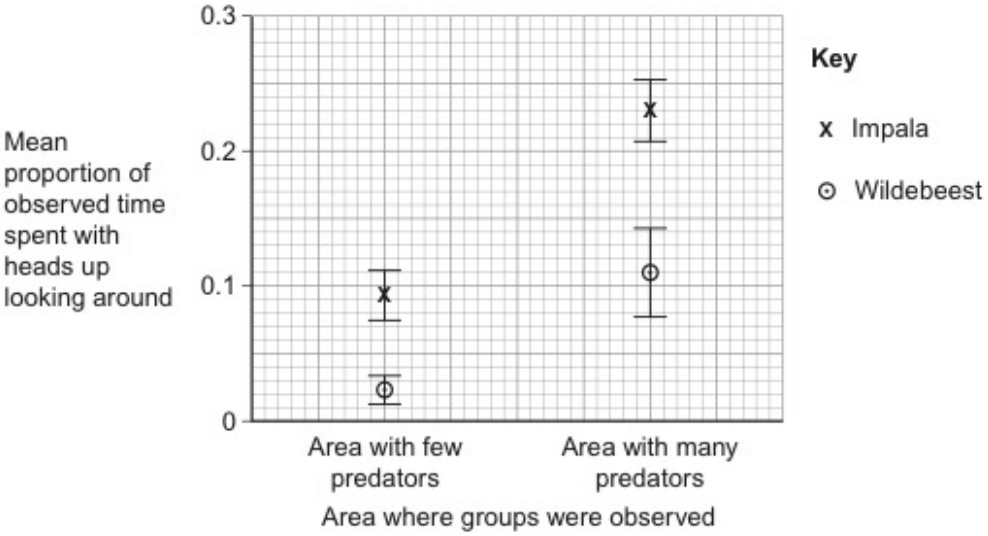
Question 3 Biol5

3 Impala and wildebeest are species of herbivore that live in large groups. They spend most of their time feeding with their heads near the ground.

Scientists investigated the relationship between the number of predators in an area and the mean proportion of time these herbivores spent with their heads up, looking around rather than feeding. They obtained data from groups of impala and wildebeest in two areas. In one area there were few predators and in the other area there were many predators.

Figure 2 shows their results. The bars show standard deviations.

Figure 2



3 (a) The scientists observed both groups of animals for 75 hours.

Use data from **Figure 2** to calculate the difference in the mean number of hours spent by each species looking around in the area where there were **many** predators.

Show your working.

[2 marks]

Difference _____ hours

3 (b) The scientists concluded that these herbivores spend more time looking for predators in areas where there are many predators.

Do these data support this conclusion? Give reasons for your answer.

[4 marks]

3 (c) The behaviour of the herbivores in having their heads up has a benefit but it also has costs. The benefit is being able to see, and escape from, predators.

Suggest and explain **one** cost to the herbivores of this behaviour.

[2 marks]

8

Question 9 Biol5

9 Multiple sclerosis (MS) is a condition caused when the body's own immune system attacks the myelin sheath around axons. The cell bodies of the neurones themselves can also be damaged or destroyed. People with MS usually have periods of time when their MS gets no worse, followed by relapses when it gets worse.

Scientists investigated the effects on neurones of damage to myelin. The scientists obtained a modified antigen from the myelin sheath of humans and injected it into mice. After a number of days, this injection of antigen resulted in the myelin sheaths in the mice being damaged. Some cell bodies of neurones were also damaged.

9 (d) Another group of scientists investigated the use of a drug called teriflunomide to treat MS. They recruited a large number of volunteers who had MS and divided them into three groups, **A**, **B** and **C**, at random. For each group, they recorded factors such as age, how many relapses they had and how long it was since they were diagnosed with MS.

9 (d) (i) Explain why the scientists made these comparisons.

[1 mark]

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9 (d) (ii) Each group of volunteers was given a different treatment for 2 years. The treatment given to each group was as follows.

- **Group A** was given a placebo that contained no drug.
- **Group B** was given 7 mg of teriflunomide per day.
- **Group C** was given 14 mg of teriflunomide per day.

The scientists determined the mean number of relapses per person, per year for each group.

Table 1 shows their results.

Table 1

Group	Mean number of relapses of MS per person per year (± 95% confidence limits)
A (placebo)	0.55 (± 0.10)
B (7 mg teriflunomide)	0.37 (± 0.07)
C (14 mg teriflunomide)	0.36 (± 0.06)

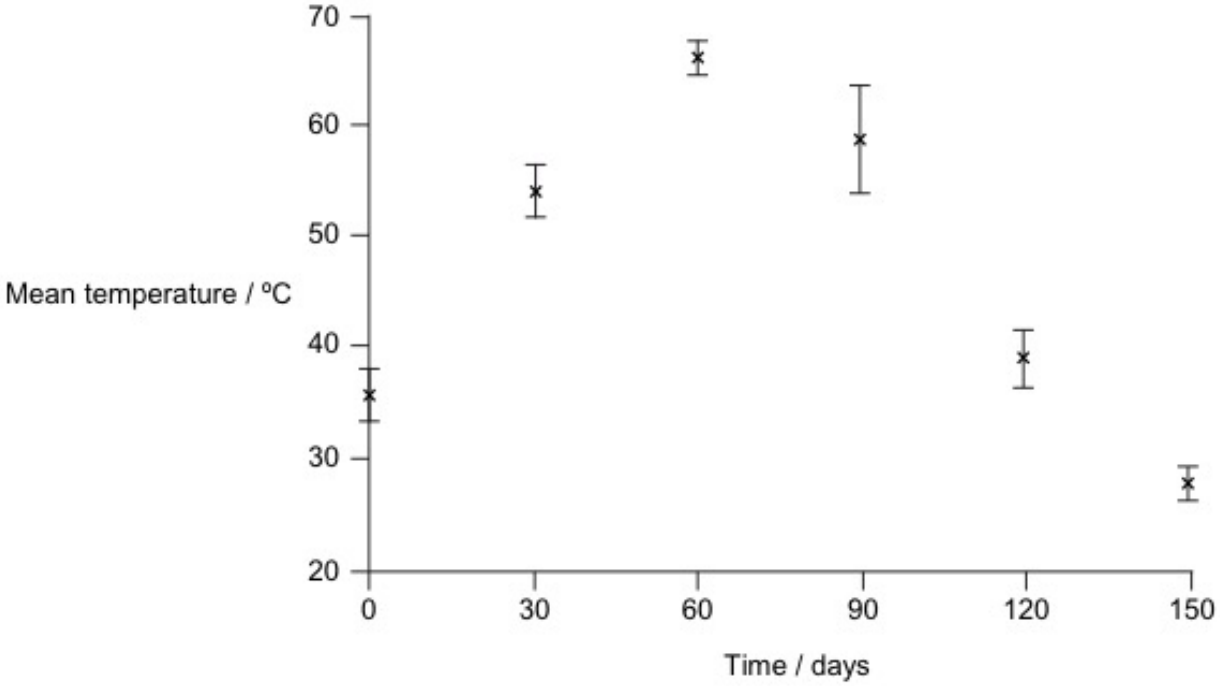
The scientists concluded that teriflunomide was effective in the treatment of MS.
Evaluate this conclusion.

[4 marks]

5 The organic material in household waste can be used to make compost for use as a fertiliser. Scientists investigated changes during one process used to make this compost. The method involved placing the waste in large containers for 150 days. At regular intervals the containers were rotated. The scientists measured the temperature of samples of waste during the investigation.

Figure 4 shows the results they obtained. The vertical bars show standard deviations.

Figure 4



5 (b) Explain the advantage of showing the data using standard deviations rather than ranges.

[2 marks]

7 (e) The scientists also investigated the algae eaten by two consumers found on the rocky shore, the sea slug and the shore crab. The scientists carried out their investigation in a laboratory.

- They put each consumer into a separate tank through which aerated seawater flowed slowly.
- Each tank contained 5 grams of one species of alga.
- After 50 hours, they measured the mass of the alga remaining in each tank.
- They repeated this procedure several times using a different sea slug and a different shore crab each time.

The scientists then calculated the mean mass of each species of alga eaten by the consumers. They used a statistical test to determine the P value.

Table 2 shows some of the results they obtained.

Table 2

Species of alga	Mean mass eaten / g		P value
	Sea slug	Shore crab	
Laurencia pacifica	4.42	0.22	<0.01
Egregia leavigata	0.12	0.08	>0.05
Microcystis pyrifera	0.19	0.14	>0.05
Cystoseira osmondacea	0.17	0.04	<0.05

7 (e) (i) The consumers were starved for 5 days before the investigation.

Explain why.

[2 marks]

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7 (e) (ii) The data in **Table 2** for the mean mass of alga eaten were adjusted for loss of mass by the alga due to respiration.

Suggest how the scientists were able to determine the loss of mass due to respiration of a sample of alga.

[3 marks]

7 (e) (iii) Suggest what conclusions the scientists could have made from this investigation when using the probability values in **Table 2**.

[3 marks]

6 Scientists investigated whether people who are lactose intolerant can drink small volumes of milk without developing symptoms.

The scientists recruited a large number of volunteers who were lactose intolerant. They asked each person to drink 240 cm^3 milk every morning and to record their symptoms each day. The scientists told them to record their symptoms using a scale from 0 to 5.

The scientists split the volunteers into two groups, **A** and **B**.
For the first week, they gave:

- untreated milk containing lactose to group **A**
- lactose-free milk to group **B**.

After 1 week, the scientists changed the type of milk given to the volunteers.

Table 2 summarises the treatment.

Table 2

Group	Week 1	Week 2
A	Untreated milk	Lactose-free milk
B	Lactose-free milk	Untreated milk

6 (a) Suggest how the scientists may have treated the milk to remove lactose.

[1 mark]

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6 (b) The scientists told the volunteers to drink the milk first thing in the morning rather than at bedtime.

Suggest why.

[1 mark]

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6 (c) Suggest **one** instruction that the scientists would have given the volunteers about what they should **not** eat or drink each day, during this investigation.

[1 mark]

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6 (d) Suggest why the scientists changed the type of milk they gave each group after one week.

[1 mark]

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Question 6 Biol1

6 (e) The volunteers were asked to record three symptoms. They used a scoring scale from 0 to 5, where 0 indicates no symptoms and 5 indicates severe symptoms.

Table 3 shows the scientists' results.

Table 3

	Mean symptom score	
Symptom	**Drinking untreated milk**	**Drinking lactose-free milk**
Bloating	1.6	0.5
Stomach pain	0.4	0.3
Diarrhoea	0.1	0.3

6 (e) (i) What can you conclude from the scientists' results in **Table 3**?

[3 marks]

6 (e) (ii) Suggest why the scientists' results might be unreliable.

[1 mark]

8