D2.2 Gene expression (HL): data-based questions

What the Cell · DP Biology · data-based questions

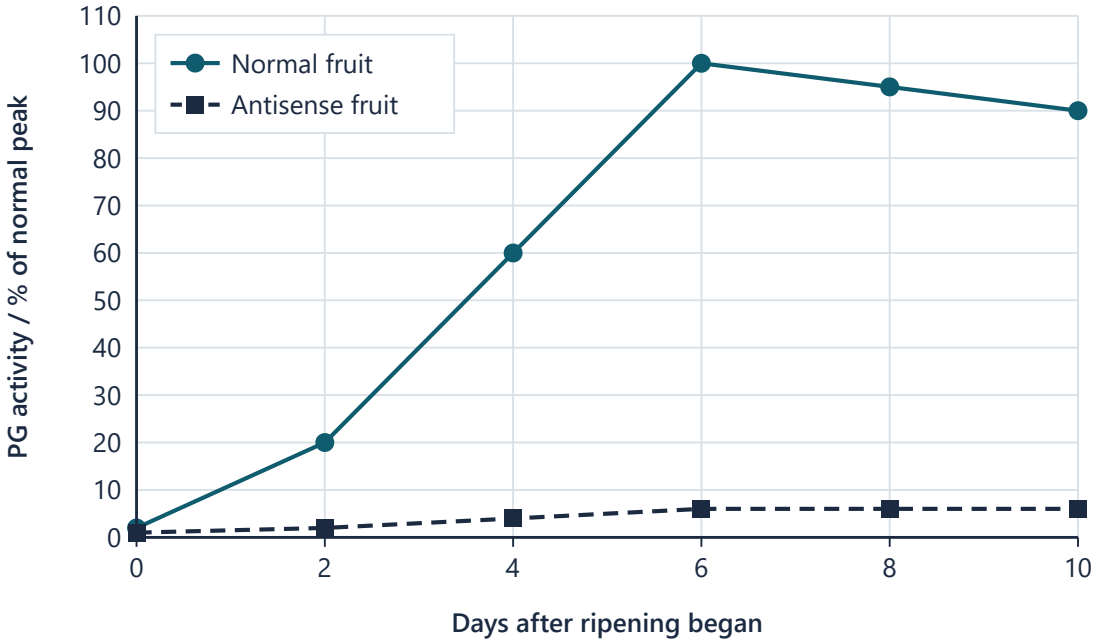
Name _____ **Date** _____ **Total** _____ / 19

Read the data carefully before you answer. The number of marks shows how many separate points to make. Show your working in calculations.

1 Antisense RNA and fruit softening

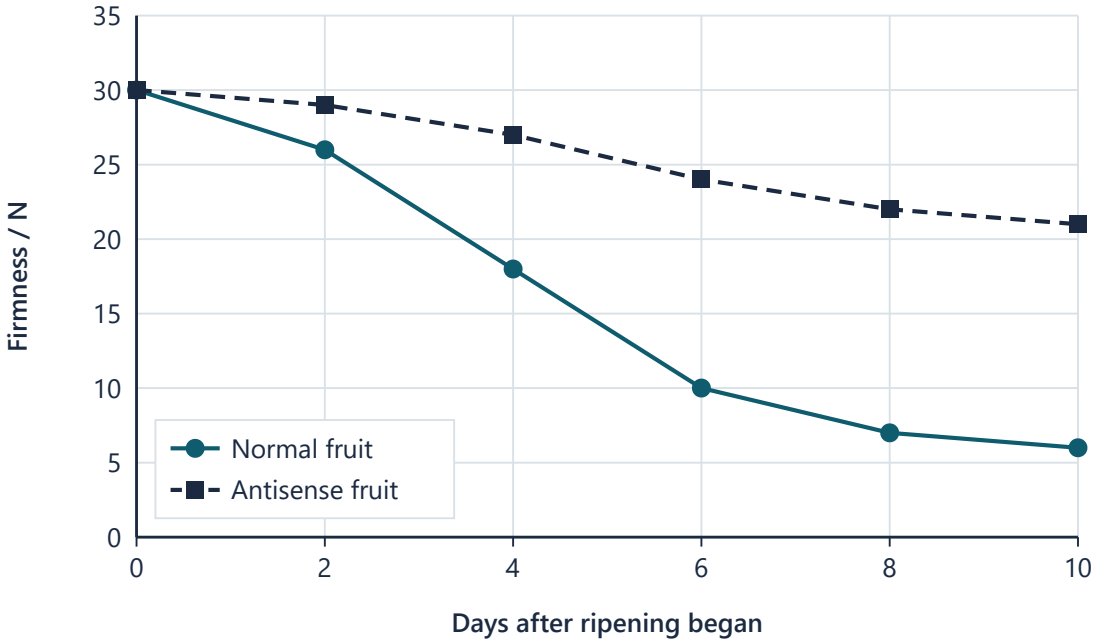
7 marks

The enzyme polygalacturonase (PG) breaks down pectin in cell walls as tomatoes ripen, making them soft. Tomato plants were genetically modified to produce antisense RNA, which is complementary to the mRNA for PG. PG activity and fruit firmness were measured as fruit ripened.



a **State** the PG activity of antisense fruit at day 6, as a percentage of normal fruit at day 6. **[1]**

b **Explain** how antisense RNA reduces the production of PG. **[2]**



c **Compare** the firmness of normal and antisense fruit. **[2]**

d **Suggest** why the antisense fruit still softens a little. **[1]**

e **Suggest** one advantage of these tomatoes for growers or shops. **[1]**

2 A brain chemical and alcohol

6 marks

Neuropeptide Y (NPY) is made by neurons in the brain. Three groups of mice were compared: knockout mice with the NPY gene removed, normal mice, and mice genetically modified to make extra NPY. Each mouse could choose between water and an alcohol solution. Sensitivity to alcohol was measured as how long mice slept after a fixed dose.

Mice	NPY in brain / % of normal	Alcohol drunk / g kg^{-1} day^{-1}	Sleep time after a dose / min
Knockout	0	12.5	18
Normal	100	7.1	31
Extra NPY	250	3.9	47

a **Identify** the relationship between NPY level and alcohol drunk. **[1]**

b **Calculate** the percentage difference in alcohol drunk by knockout mice compared with normal mice. **[1]**

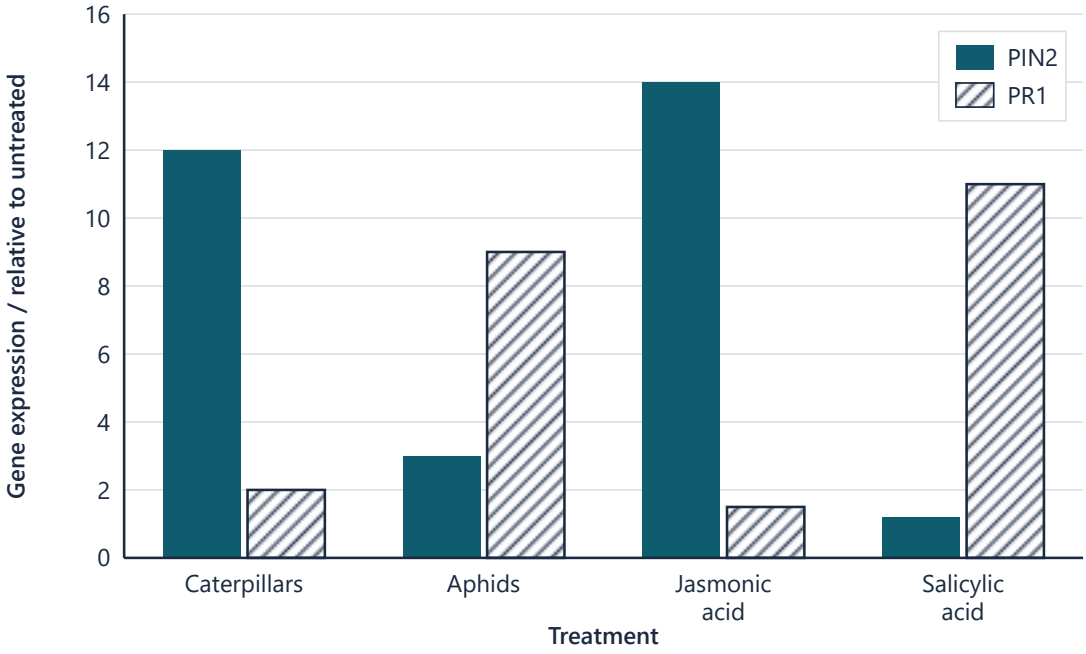
c **Outline** the relationship between sensitivity to alcohol and the amount drunk. **[2]**

d **Evaluate** the hypothesis that low levels of NPY cause a preference for alcohol. **[2]**

3 Plant defence genes

6 marks

Tomato leaves were attacked by caterpillars (which chew leaves) or aphids (which suck sap), or sprayed with one of two plant signalling chemicals, jasmonic acid or salicylic acid. After 24 hours, mRNA was extracted, converted to DNA by reverse transcription and copied by PCR to measure the expression of two defence genes. Expression is shown relative to untreated leaves (1.0).



a **Identify** the treatment that increases PIN2 expression most. **[1]**

b **Compare** the effects of caterpillars and aphids on the two genes. **[2]**

c **Deduce** which signalling chemical each herbivore causes the plant to produce. Give reasons. **[2]**

d **Explain** why the mRNA had to be converted to DNA before PCR. **[1]**

What the Cell. Original questions written for this course, with data based on published patterns.