

I. Match the words or phrases used in statistics (1-10) to the definitions (a-j)

1 Analysis of Variance (ANOVA)	a a relationship between two factors
2 coefficient	b small groups which should be representative of a whole population
3 correlation	c shows how much variation from the mean there is within the group
4 mean	d the average, found by adding all the values together and dividing by the number of values
5 p-value	e the measure of significance, which shows if it is likely that the variation in results is just chance
6 regression analysis	f the test used to compare whether the means of two groups are equal
7 samples	g the test used to produce an equation showing the relationship between two factors
8 standard deviation	h the test used to compare whether the mean values of more than two groups are all equal
9 t-test	i the things that change in an experiment
10 variables	j a mathematical value which is always written before another value it multiplies

II. Tiago is a marine biology student studying adaptations in shrimp living near hydrothermal vents. Listen to the conversation and answer the questions.

- 1 What two extreme conditions have the vent shrimp adapted to?
- 2 How does Tiago expect the levels of metal-binding proteins to change in the vent shrimp?
- 3 How will he use the two species of Rio Formosa lagoon shrimp in his research?
- 4 What other compounds is he looking at?

III. Based on statistical analysis in the table below, complete the following sentences using the words in the box.

		Hydrothermal vent species		Coastal (lagoon) species	
		<i>Rimicaris exoculata</i>	<i>Mirocaris fortunata</i>	<i>Palaemon elegans</i>	<i>Palaemonetes varians</i>
Metal binding protein	MT level (mg.g ⁻¹ w/w protein)	7.30 ± 0.66 a	1.27 ± 0.27 c	4.34 ± 0.99 b	1.65 ± 0.39 c
	Antioxidant enzymes	Cytosolic SOD (U mg ⁻¹ protein)	2.56 ± 0.66 c	16.15 ± 5.66 a	5.14 ± 1.58 b
Cytosolic CAT (mmoles min ⁻¹ mg ⁻¹ protein)		0.0042 ± 0.0005 a	0.0048 ± 0.0010 a	0.0014 ± 0.0005 b	0.0020 ± 0.0005 b
GPx (μmoles min ⁻¹ mg ⁻¹ protein)		0.010 ± 0.002 c	0.040 ± 0.010 a	0.023 ± 0.004 b	0.015 ± 0.007 bc

Values followed by the same letter are not significantly different ($p > 0.05$).

a significantly higher not significantly different from no significant differences
 approximately sixfold higher than in the lowest threefold higher in

- 1 MT levels in *Rimicaris exoculata* were _____ *Mirocaris fortunata*.
- 2 MT concentrations in *Palaemonetes varians* were _____ those in *M. fortunata*.
- 3 The hydrothermal vent shrimp *R. exoculata* exhibited _____ SOD activity.
- 4 _____ were found in the activity of cytosolic SOD between the two coastal shrimp species, *P. elegans* and *P. varians*.
- 5 The activity of cytosolic CAT was approximately _____ the two vent shrimp species compared with their coastal counterparts.
- 6 _____ GPx activity was observed in *M. fortunata* compared with all the other shrimp species.

IV. Read four captions (A-D) for four different figures. Then answer the questions that follow.

A

Fig. 3. The relationship between the weight of shell and strontium concentration in the shell of *B. azoricus* from the Mid-Atlantic Ridge (n = 51)

B

Table 1. Temperature, pH and concentration of chemical species in the end-member fluids of lagoon system Ria Formosa (South Portugal) and MAR vent field (Rainbow) compared with average seawater (adapted from Caetano *et al.*, 1997; Douville *et al.*, 2002)

C

Fig. 1. Thermal tolerances for the three symbiotic species under investigation (*Alviniconcha sp.*, *Ifremeria nautilei* and *Bathymodiolus brevior*). For all experiments each temperature was held for 1 h, then the temperature was reduced to the starting temperature, the animals removed and mortality assessed. If alive, animals were returned to the aquarium and temperature was increased to the next point.

D

Fig. 2. Metallothionein concentrations (MT) in the edible tissues of hydrothermal (*Rimicaris exoculata* and *Mirocaris fortunata*) and coastal shrimp (*Palaemon elegans* and *Palaemonetes varians*). The data represent average \pm standard deviation (SD), n = 16. Values followed by the same letter are not statistically different ($p > 0.05$).

1. What is the grammatical structure of the core information in each caption?
2. Which caption(s) relate(s) to data not collected by the author of the work?
3. Which two-word phrases explain the main purpose of the information in A and B?
4. What information does the second part of the caption in C and D give us?
5. Which phrases in C and D have similar meaning to:
being studied
the results show
the same for the purposes of the analysis

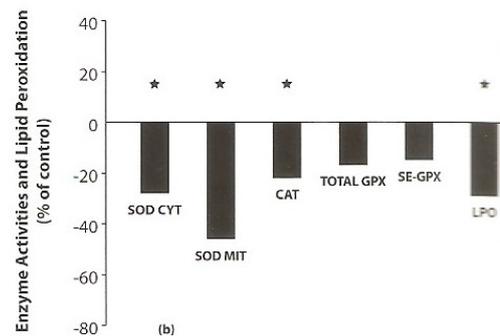
V. Remove four words from each sentence to make noun phrases that could serve as captions.

- 1 The figure depicts the length-frequency of four samples of mussels collected at three different sites of the Lucky Strike area.
- 2 The figure shows the copper concentration in the soft and exoskeleton tissues of four shrimp species.
- 3 The table presents a comparison of the physical and chemical characteristics of the hydrothermal fluids at Menez Gwen, Lucky Strike and Rainbow (adapted from Douville *et al.*, 2002).

VI. Complete the caption below with the words in the box.

($p < 0.05$) *B. azoricus* expressed Fig. 1 represent values

(1) _____ The activity of SOD cytosolic and mitochondrial, CAT, total and Se-dependent GPx, and lipid peroxidation in the gills of (2) _____ exposed to Cu 0.4 μM for 24 h in IPOCAMP and (3) _____ as percentage of unexposed gills $n=10$. (4) _____ marked * (5) _____ a significant difference between contaminated and control antioxidant enzyme activity or lipid peroxidation levels (6) _____

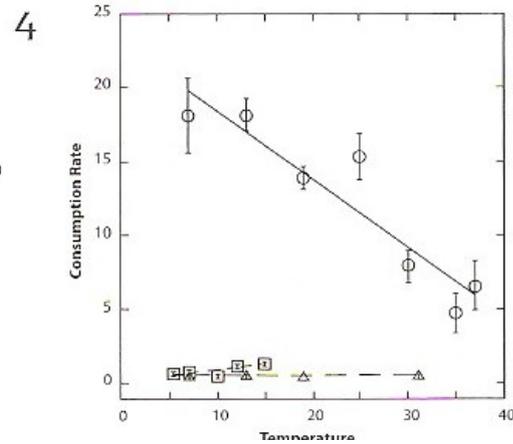
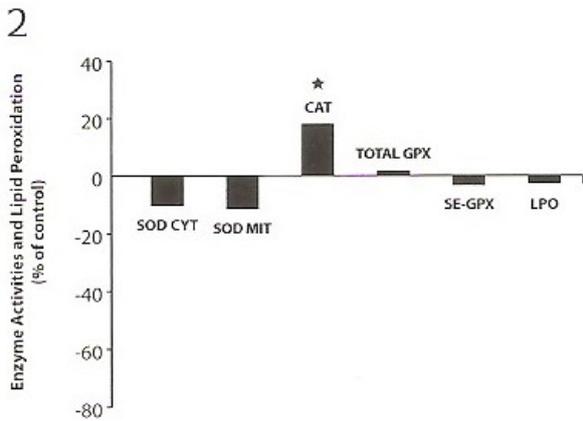
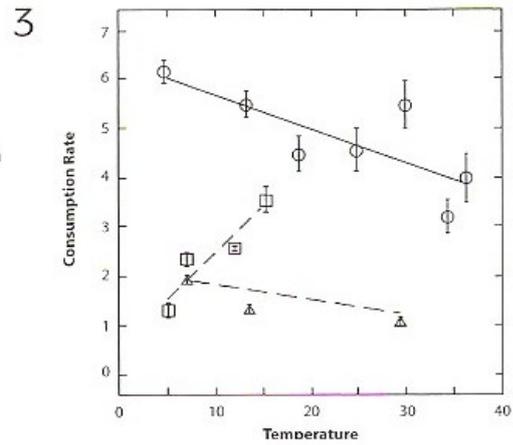
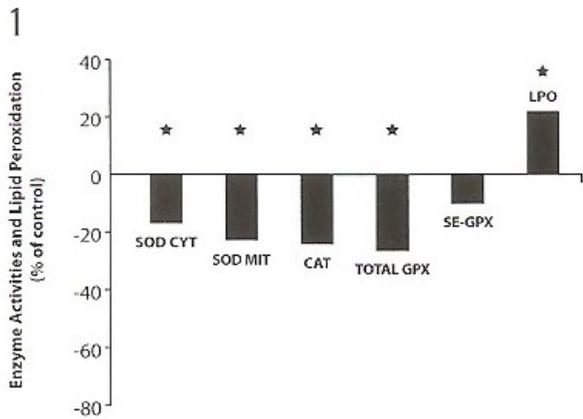


Look at Nour's caption again. Find three parts of the text which should have brackets (parentheses) added.

VII. Look at four graphs and read the two extracts from a paper.
a) Which graphs (1-4) are described in extracts A and B?

A The SOD, CAT, total and Se-dependent GPx activities and lipid peroxidation shown as a percentage of unexposed gills of *B. azoricus* are shown in Fig. 1. Cd exposure caused a significant inhibition of SOD (cytosolic and mitochondrial), CAT and total glutathione peroxidase activity (ANOVA, $p < 0.05$), while no significant change in Se-dependent glutathione peroxidase ($p > 0.05$) was seen.

B Elevated temperature changed H_2S uptake in the three species tested differently (Fig. 3A). As temperature increased, H_2S uptake in *Alviniconcha sp.* decreased, but stayed high at the highest test temperature of 37 °C. *Alviniconcha sp.* clearly had the fastest consumption of H_2S , consistently taking up 3–4 times the quantity per unit tissue compared with the other species. For *I. nautilei*, H_2S consumption also decreased as temperature increased. *B. brevior* showed a linear pattern of increasing consumption with temperature as high as 15 °C (Regression analysis, $R^2 = 0.86$). Higher temperatures were attempted with *B. brevior*, but any exposure at those temperatures of a sufficient duration to obtain steady rates resulted in death.



b Match the underlined words or phrases in extracts A and B to a word or phrase with a similar meaning (1–15).

- | | |
|---|--------------------------------------|
| 1 affected | 8 led to |
| 2 are presented | 9 reduction in |
| 3 expressed as a proportion of | 10 remained at a high level |
| 4 fell | 11 rose |
| 5 had the greatest rate of H ₂ S use | 12 showed a linear relationship of |
| 6 in comparison to | 13 up to |
| 7 produced | 14 was observed |
| | 15 whereas no significant difference |