



National 5 Problem Solving Booklet

Marking Scheme

Averages, Number of time greater, Calculating Change

Question	Paper	Past Paper Question	Answer	Mark	Additional Guidance
1	2019	1b	285	1	
2	2019	2c	29	1	
3	2018	1b	100	1	
4	2018	6a(ii)	4	1	
5	2018	13a(i)	19	1	
6	2018	14b(ii)	15	1	
7	2017	5a(i)	1.3	1	
8	2017	8a	150	1	
9	2017	11b	175	1	
10	2017	15b	6	1	
11	2016	11a(i)	30	1	Accept correct answer if not written in table (units not required).
12	2016	12a(i)	2	1	
13	2015	6c	0.01	1	
14	2015	12a	36	1	Units required (mm) if answer not in table.
15	2014	Paper 1 Q9	A	1	
16	2014	2c	0.9	1	
17	2014	10a(i)	3	1	

Percentages

Question	Paper	Past Paper Question	Answer	Mark	Additional Guidance
18	2019	6b	30	1	
19	2019	11b	15	1	
20	2019	14a(i)	7.2 (million)	1	If answer not in the table then million is required
21	2018	16a(i)	20	1	
22	2016	8c(i)	80	1	
	2016	8c(ii)	8400	1	
23	2015	2a(i)	+25	1	+ symbol must be included. Accept answer not written in table (don't need % sign).
24	2015	13a(i)	65	1	



Graphs and Interpreting Information (from experiments)

Question	Paper	Past Paper Question	Answer	Mark	Additional Guidance														
25	2019	4b	Scale, label (1) Points plotted and line drawn (1) <table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Time (minutes)</th> <th>Volume of dough (cm³)</th> </tr> </thead> <tbody> <tr><td>10</td><td>8</td></tr> <tr><td>20</td><td>14</td></tr> <tr><td>30</td><td>22</td></tr> <tr><td>40</td><td>26</td></tr> <tr><td>50</td><td>28</td></tr> <tr><td>60</td><td>28</td></tr> </tbody> </table>	Time (minutes)	Volume of dough (cm ³)	10	8	20	14	30	22	40	26	50	28	60	28	2	
Time (minutes)	Volume of dough (cm ³)																		
10	8																		
20	14																		
30	22																		
40	26																		
50	28																		
60	28																		
26	2019	6a	19:00		Acceptable: 7pm														
27	2019	9	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; padding: 5px;">(a)</td> <td style="width: 10%;"></td> <td style="width: 80%; padding: 5px;">30</td> <td style="width: 10%; text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="padding: 5px;">(b)</td> <td></td> <td style="padding: 5px;">27</td> <td style="text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="padding: 5px;">(c)</td> <td></td> <td style="padding: 5px;"> Any one of: The 1st injection takes 28 days to reach the maximum (concentration), whereas the 2nd injection takes 27 days (to reach the maximum concentration) OR The 1st injection <ul style="list-style-type: none"> increases slower takes longer to reach its maximum (concentration) is slower to reach its maximum (concentration) </td> <td style="text-align: center; padding: 5px;">3</td> </tr> </table>	(a)		30	1	(b)		27	1	(c)		Any one of: The 1 st injection takes 28 days to reach the maximum (concentration), whereas the 2 nd injection takes 27 days (to reach the maximum concentration) OR The 1 st injection <ul style="list-style-type: none"> increases slower takes longer to reach its maximum (concentration) is slower to reach its maximum (concentration) 	3		(c) Any 2 marks from 3 Not acceptable (in question stem): 1 st injection produces less antibodies/2 nd injection produces more antibodies Not acceptable: 1 st injection longer/slower/takes 28 days Not acceptable: 2 nd injection shorter/faster/takes 27 days Not acceptable: 1 st /2 nd injection higher/increases		
(a)		30	1																
(b)		27	1																
(c)		Any one of: The 1 st injection takes 28 days to reach the maximum (concentration), whereas the 2 nd injection takes 27 days (to reach the maximum concentration) OR The 1 st injection <ul style="list-style-type: none"> increases slower takes longer to reach its maximum (concentration) is slower to reach its maximum (concentration) 	3																



					<p>OR</p> <p>The 2nd injection</p> <ul style="list-style-type: none"> • increases faster • takes less time to reach its maximum (concentration) • is quicker to reach its maximum (concentration) (1) <p>Any one of:</p> <p>1st injection - higher for a shorter period of time/decreases faster</p> <p>OR</p> <p>2nd injection - higher for a longer period of time/decreases slower (1)</p> <p>OR</p> <p>Any other suitable difference (1)</p>	1	
			(d)	84			
28	2019	10	(a)	Does exercise reduce/affect the risk/chance of cancer?		1	
			(b)	Bar		1	
			(c)	Participants could have forgotten/exaggerated/under-estimated/not told the truth (about recording their own exercise)		1	
			(d)	Age - participants should be the same age/similar ages		1	
				Duration - participants should exercise for the same length of time			
				Type - participants should carry out the same exercise			
29	2019	12	(a)	As the soil moisture increases, the (percentage) ground cover/moss increases		1	
				OR			
				The higher the soil moisture, the higher the ground cover			
				OR			
				The lower the soil moisture, the lower the ground cover			
			(b)	Repeat the (whole) investigation		1	
				OR			
				Do more quadrats AND soil moisture readings			
				OR			
				(Use) more sample sites			
							Not acceptable: Repeat it/repeat the experiment/ take more measurements/readings/ samples



			(c)	(i)	Insert thermometer into soil same depth each time OR Leave for a time to adjust before reading	1	Not acceptable: Light
				(ii)	pH/light intensity/wind speed/humidity/mineral concentration/nitrate concentration	1	
			(d)	(i)	Species that by their presence or absence indicate (levels of) pollution/environmental quality	1	
				(ii)	4		
30	2019	13a	(a)	(i)	Control	1	Extra boxes ticked negates Not acceptable: For comparison
				(ii)	To allow a comparison to those where carbon dioxide and/or light have been removed OR To show that carbon dioxide and/or light are required	1	
				(iii)	There are two variables altered/ both carbon dioxide and light are absent OR Carbon dioxide is absent/a chemical is absorbing carbon dioxide AND light absent/in a black box	1	
				(iv)	Light		
31	2018	6	(a)	1.5	Temperature Volume of pepsin/solution Concentration of pepsin Spacing of holes Size/depth/diameter/volume of holes/wells Any two for 1 mark each	1	Acceptable: amount of pepsin/solution. Not acceptable: - time left for - level of solution - depth of agar.
			(b)			2	
32	2018	10	(b)	(i)	As the heart rate increases the volume of blood (pumped) increases until 100(bpm) and then decreases.	2	1 mark for correct description of increase and then decrease (without mention of 100(bpm)).
				(ii)	6.0 / 6	1	
33	2018	13a	(ii)		(Up to 10 seeds sown, the percentage of seedlings surviving remains constant and thereafter) as the number of seeds (sown) increases the percentage (of seedlings) surviving decreases.	1	Also acceptable: as the number of seeds (sown) decreases the percentage (of seedlings) surviving increases (until 10 seeds and then it remains constant). Not acceptable: percentage of seeds surviving decreases.



34	2018	14	(ii)	1. Springtail 2. Woodlice	(1) (1)	2	Not acceptable: - repeat in different areas.
			(iii)	Set several traps. Check traps more often. Repeat the investigation/experiment.		1	
			(b) (i)	E		1	
35	2018	15	(a)	X-axis scale and label including units. Plotting and joining points accurately.	(1) (1)	2	Scale - any three values to establish a linear scale. If a bar chart is drawn, only the second mark can be accessed. Any extrapolation beyond 50°C in the graph should be ignored. Not acceptable: values below zero.
			(b)	Any value less than 0.4 (including 0).			
36	2017	4	(a)	Appropriate scale and label Scale must have 0, 108 or 120 and one other number in between Label - Time (taken) for disc(s) to return to (the) surface s/seconds Bars correctly plotted	(1) (1)	2	Not acceptable - common zero on scale Not acceptable - 'secs' as an abbreviation If incorrect scale but plot is accurate to that scale (1 mark)
			(b)	Liver has the highest catalase activity/apple has the lowest catalase activity/different tissues have different catalase activity/ animal tissue has higher catalase activity (than plants) or other appropriate conclusion			
37	2017	5a	(iv)	To show it is the germinating/live peas that are producing the result/using oxygen/respiring OR To show that <u>dead</u> peas do not respire		1	Reference to 'temperature having no effect on dead peas' does not negate an otherwise correct answer
38	2017	10b	(i)	S		1	
			(ii)	P		1	
39	2017	11a		Set up more than one field for each variety/ Repeat the (whole) investigation/ Use more potatoes/plants in each field		1	If 'both varieties' are mentioned, it must be clear that each variety is grown in a separate field Not acceptable - repeat it/ repeat the experiment
		c		Number of potatoes/plants; Spacing between potatoes/plants; pH of soil; Nutrient content of soil; Moisture content of soil; Fertility of soil; Type of soil		1	Not acceptable- Amount of potatoes Temperature Humidity Light intensity Rainfall CO ₂ concentration Area/size of field



40	2017	15a(i)	Has most crusty lichen and these are common/found in high pollution		1	
41	2016	8a	Medium (salt)		1	
42	2016	11b(i)	Flat (periwinkle) Don't live on/occupy the same position on the shore/ live on different/separate parts of the shore/small live at high tide and flat live at low tide/one lives at low tide and one at high tide		1	Not acceptable: <ul style="list-style-type: none"> • don't live in the same place • they are further or furthest apart/away from each other
43	2016	12a(ii)	Increased competition from Meadow grass or appropriate description of the increased competition; eg less space for Ragwort to grow		1	Not acceptable: <ul style="list-style-type: none"> • Meadow grass is increasing/overgrown/dominant (with no mention or description of competition) • NO space for Ragwort to grow
44	2016	13b	(i)	Different numbers released/marked/captured OR to compare results	1	Not acceptable: different numbers recaptured Must have reference to being eaten or predators/birds. Must be comparative. 'Evolution' not acceptable
			(ii)	Fewer were eaten (by predators/birds)/ better camouflaged so not eaten/camouflaged from predators/birds less likely to be eaten/seen by predators or birds/more dark moths eaten by predators or birds	1	
			(iii)	Natural selection/survival of the fittest	1	
45	2016	14a	(i)	When predators are present (the number of red spider) mites decrease / there are more (red spider) mites when there is no predator OR converse	1	Additional correct information would not negate. Not acceptable: for comparison.
			(ii)	To allow it to be compared to the one with the predator/to compare the number of (red spider) mites with and without the predator/to show any difference is due to the predator	1	
46	2015	2a(i)	To remove excess/surface water/liquid/solution OR So water/liquid/solution doesn't affect the results or alter the mass/weight		1	To remove excess <u>vinegar</u> is not acceptable, but answer must refer to water/liquid/solution.



47	2015	8a	Both scale and axis label completed correctly (1) Points plotted correctly and joined (1)	2	At least half of the grid must be used. Do not penalise for extrapolation all the way to 35°C.
48	2015	11	(a) (i) As the (number of) bacteria increases, the oxygen (level in the water) decreases OR As the (number of) bacteria decreases, the oxygen (level in the water) increases	1	Do not accept 'as the oxygen (level) decreases, the (number of) bacteria increases'. Only one of these organisms necessary to gain mark. Additional wrong answers negate. Results in fewer/less organisms/animals is not acceptable.
			(ii) 2	1	
			(b) (i) Mayfly nymphs/stonefly nymphs/caddis fly larvae	1	
			(ii) (The pollution/sewage results in) fewer/less types (of organism/animals) OR (Pollution) decreases biodiversity OR 'They would decrease' (as this refers to the types of organisms)	1	
49	2015	12c	Too few leaves/taken/sampled OR More than 5 leaves should be measured OR Only five leaves were taken OR Too small a sample	1	Did not repeat it/experiment is not acceptable. Answer should refer to leaves. 'Only one stem of each type taken' is not acceptable but would not negate. Any reference to accuracy, fairness or validity negates.
50	2015	13a(ii)	To prove that the mutation was causing the effect/high bone density (or equivalent description)	1	As a control/to compare is not acceptable.
51	2014	1b	Y axis scale and label, including units 1 Bars correctly plotted 1	2	Tops of bars clearly shown Label copied exactly
52	2014	2d	Description of concentration change - must be a smaller concentration gradient than shown/ lower temperature/ wider capillary tube/ seal not tight/ less water in the beaker/bag not fully submerged	1	



53	2014	3a	(ii)	Numbers (in each group) different OR Overall numbers used too small	1	Acceptable - use of actual numbers / comparative words such as less / more Not Acceptable - 'Amount' instead of number
			(iii)	If they have a low level of catalase/ only use sheep with low levels of catalase/ don't use sheep with high levels of catalase	1	Answer must relate level of catalase
54	2014	10a(i)	<ul style="list-style-type: none"> (The general trend is) as the distance increases, numbers/population/ lugworms increases up to 12 metres 1 After that, numbers/ population remains steady/ stays the same 1 		Must mention change point at 12 metres for both marks For example 'numbers increase then levels off' = 1 mark If the candidate accurately describes the pattern from 1m to 4m that is acceptable, but wrongly described will forfeit 1 mark.	

Ratios

Question	Paper	Past Paper Question	Answer	Mark	Additional Guidance
55	2019	7b(ii)	5:2	1	
56	2017	7a	11:7	1	
57	2016	6b(i)	13:5	1	
58	2017 SP	4b	1:3	1	
59	2012 SGC	16a(v)	1:180	1	
60	2011 SGC	10b	2:5	1	
61	2010 SGC	6e	29:21:1	1	
62	2009 SGC	15a(iii)	3:2	1	

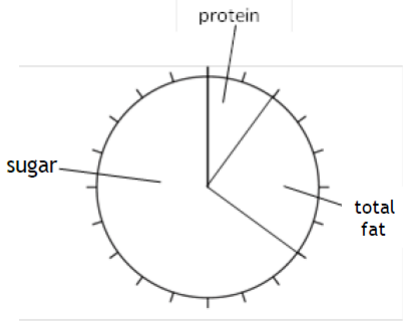
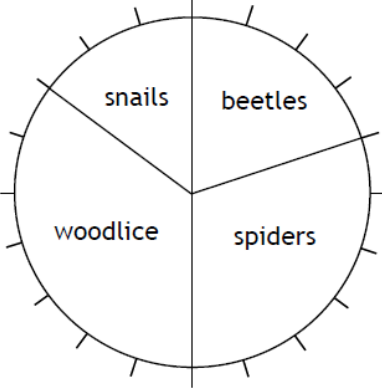
Keys

Question	Paper	Past Paper Question	Answer	Mark	Additional Guidance
63	2017	Paper 1 Q20	C	1	
64	2016	12c	Go to 3 (1)	3	
			Buttercup (1)		
			Pink Campion (1)		

Pie Charts

Question	Paper	Past Paper Question	Answer	Mark	Additional Guidance



65	2016	8b		2	<p>1 mark for divisions</p> <p>1 mark for labels</p> <p>Mark for labels can be awarded if divisions are wrong but in correct proportions.</p> <p>Additional sections (labelled or not) = 0 marks</p>
66	2014	11b(i)		2	<p>1 mark for appropriate sized sections (Segments do not need to be in order shown here)</p> <p>1 mark for labels (Mark for labels can be given if sections are incorrect but proportions correct)</p> <p>If pie chart is complete but 'slugs' are labelled on it, do not award labelling mark</p>