A level Biology A

H420/03 Unified biology

Question Set 6

6* A student investigated the heart rates of smokers and non-smokers.

- Each test subject had their resting heart rate measured using an electronic heart rate monitor.
- They ran 1 km on a running track and their heart rate after running 500 m was recorded.
- Their heart rate was recorded for a third time 3 minutes after the completion of the exercise.

All test subjects were 18 years old. Subjects were tested between 9 am and 4 pm on one day, one at a time. Each test lasted approximately 20 minutes in total. The tests were repeated one week later using the same method. Mean heart rates were calculated for each subject.

The student's plan was to compare the heart rates of smokers and non-smokers using Student's *t*-test.

The student's results are shown in Table 6.

Student	Smoker?	Gender	Resting heart rate (bpm)	Heart rate during exercise	Heart rate after exercise
1	Y	Male	60.5	130.0	66.5
2	N	Female	67.0	145.5	73
3	Y	Male	70.0	120	77.0
4	Y	Male	65.5	100	69
5	Y	Male	66.0	128.5	75.5
6	Y	Female	65.5	115.5	74.5
7	Y	Female	73.5	120.5	81
8	N	Female	63.0	118	66
9	N	Female	71.0	95.5	80.5
10	N	Female	65.5	110	71
11	N	Male	64.0	145.5	68
12	N	Male	52.5	140.0	58.5
13	N	Male	54.0	137.5	63
14	N	Female	73.0	130.5	81
15	N	Female	61.5	124	67
16	N	Female	71.0	130	81.5
17	N	Male	60.0	122.5	63
18	N	Female	64.5	118	69
19	N	Female	67.5	130.5	73.5
20	Y	Male	72.0	135	82
21	Y	Female	69.5	110	75.5

Table 6

Suggest and explain improvements that the student could make to his experimental method **and** his presentation of data.

In your answer you should explain the benefits of your suggested improvements. **[6]**

METHOD OF IMPROVEMENT

- sample sizes should be increased to improve accuracy & repeatability of the results
- same number of subjects (smoker, non-smoker, gender) to make valid comparisons
- gender should be controlled as heart rates can depend on gender
- other factors controlled (diet, exercise, health issues) as can influence heart rate
- time of day should be standardised as can influence heart rate
- more repeats before calculating mean to identify anomalies
- level of smoking should be considered (continuous instead of discrete variable)

PRESENTATION OF DATA

- smokers & non-smokers should have been presented as separate columns to make comparisons easier
- units to be included for final 2 columns to show that 3 heart rate measurements were made using same method
- same number of significant figures for each measurement to standardise level of precision
- present data graphically for ease in identifying trends
- label heart rates as mean heart rates for clarity

Total Marks for Questions Set 6: 6