

### PART THREE

Questions 25 to 35 carry a total of 31 marks.

#### Question 25

- (a) During the last century, the physicist Albert Abraham Michelson conducted extensive series of experiments to determine the speed of light. One set of experiments yielded 100 measurements. Using these data and assuming that they are normally distributed about the true value, a 95% confidence interval for this true value is (299 836.6, 299 868.0) km/sec. Explain, briefly, what this means.
- (b) If you had to give a single value as the best estimate of the true speed of light, based on Michelson's results, what value would you give?
- (c) The currently accepted value for the speed of light is 299 792.458 km/sec. How can you explain the fact that this lies outside Michelson's confidence interval?

[5]

b) 
$$\frac{299836.6 + 299868.0}{2} = 299852.3$$

c)

#### Question 26

Suppose that we model the intervals between emissions of particles from a radioactive substance by an exponential distribution and that a single interval of 3 seconds is observed. The corresponding 90% confidence interval for the mean of the exponential distribution is (1.00, 58.5). In one or two sentences comment on the usefulness of this interval and say how a narrower interval could be obtained.

[2]

The confidence interval is very wide, its usefulness is limited therefore