Solutions

Each answer shows the steps, then the **result**.

2.1

- stabilising selection

2.2

- any two: large population; random mating; no mutation; no migration; no natural selection

3.1 B

- Directional selection shifts the mean towards one extreme

3.2 B

- A bottleneck leaves few survivors, reducing allele variety

3.3

(a)

- $q^2 = 0.16$, so $q = \sqrt{0.16} = 0.4$

(b)

- $p = 1 - q = 0.6$; $2pq = 2(0.6)(0.4) = 0.48$

3.4

- a chance mutation makes some bacteria resistant; using the antibiotic kills the non-resistant bacteria; the resistant ones survive and reproduce, so the resistant allele becomes more common

3.5

(a)

- The dark form already existed in the population, produced originally by **mutation**, so there was pre-existing variation; after the eruption the pale moths were conspicuous on dark bark and the dark moths were camouflaged; birds ate proportionally more pale moths — this is the **selection pressure**; the surviving dark moths were more likely to reach reproductive age and pass on the allele for dark colour; so the frequency of that allele rose generation by generation

(b)

- **Directional** selection. It favours one extreme of the range, so the mean shifts; stabilising selection favours the intermediate and acts against both extremes, so the mean stays put and the variation narrows

(c)

- The **founder effect**. The few individuals that arrive carry only a small, unrepresentative sample of the original population's alleles; so allele frequencies in the new population differ from the old one, some alleles are missing altogether, and genetic diversity is low

(d)

- In artificial selection a **human** chooses which individuals breed, according to a trait people want; in natural selection the environment does the selecting, and the trait that spreads is whichever improves survival and reproduction