



Astronomers classify stars so that they can study their similarities and differences. A very common way to classify stars is by their temperature. This scale assigns a letter from the set [O, B, A, F, G, K, M] to represent stars with temperatures from 30,000 C (O-type) and 6,000 C (G-type), to 3,000 C (M-type).

**Problem 1** – An astronomer studies a sample of stars in a cluster and identifies 6 as G-type like our Sun, 12 as M-type like Antares, and 2 stars as O-type like Rigel. Circle the pattern, above, that represents this sample.

**Problem 2** – What fraction of the stars in the sample are G-type?

- A)  $6/9$                       B)  $20/6$                       C)  $6/20$                       D)  $6/8$

**Problem 3** – What fraction of the G and M-type stars in the cluster are G-type?

- A)  $12/18$                       B)  $6/12$                       C)  $12/6$                       D)  $6/18$

**Problem 4** – If you selected 2 stars randomly from this cluster, which calculation would give the probability that these would both be O-type stars?

- A)  $1/20 \times 1/20$               B)  $2/20 \times 1/20$               C)  $1/20 \times 1/19$               D)  $2/20 \times 1/19$

**Problem 5** – A second star cluster has a total of 2,040 stars. If the proportion of O, G and M-types stars is the same as in the first cluster, how many G-type stars would be present?

- A) 612                          B) 340                          C) 1428                          D) 680

## Answer Key

1 – The boxes are colored red for M-type stars, yellow for G-type stars and blue for O-type stars. Count the boxes carefully. Only C) has the correct number of star boxes colored. **Answer: C)**

2 – There are 6 G-type stars in the cluster, which contains 20 stars, so the answer is C)  $6/20$ . **Answer: C)**

3 – There are a total of 18 G and M-type stars in the sample, and since only 6 are G-type, the correct fraction is D)  $6/18$ . **Answer: D)**

4 – There are 2 O-type stars in a sample of 20 stars. On the first draw, the probability is  $2/20$  that an O-type star will be selected. Now there are only 19 stars left and only 1 O-type, so the probability that the next star selected is an O-type star is now  $1/19$ . The probability that both O-type stars are drawn in the first two draws is then D)  $2/20 \times 1/19$ . **Answer: D)**

5 – The correct answer is A) given by  $2040 \times 6/20 = 612$  stars. The fraction  $6/20$  represents the proportion of 6 G-type stars out of the 20 stars in the first sample, and we are assuming that this proportion is the same for the second cluster. The incorrect answers come about by B) dividing 2040 by the number of G-type stars; C) multiplying 2040 by the fraction of stars that are O and M-class and; D) dividing 2040 by the number of star classes, which incorrectly assumes an equal number in each class. **Answer: A)**