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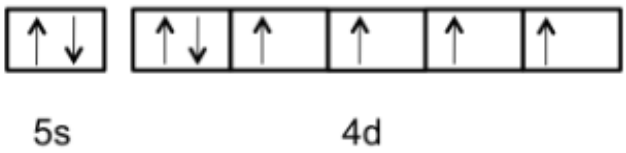
GAMSAT Chemistry

Question 1
Answer: C, 4

This question is probably best if we explain it in terms of a few diagrams. Since the question has already stated that Ruthenium has an electronic configuration of [Kr] $5s^1$ $4d^7$, we can begin to look at the Aufbau principle starting at electron energy levels of 4 and 5:

1s
2s 2p
3s 3p 3d
4s 4p 4d 4f
5s 5p 5d 5f
6s 6p 6d
7s 7p

Using both the Hund's rule and Aufbau principle, we can see that starting at [Kr], the next electron level to be filled will be 5s. According to the given configuration, we need to fill the next 8 electrons, so the theoretical configuration should be:



Which gives Ruthenium the configuration [Kr] $5s^2 4d^6$.

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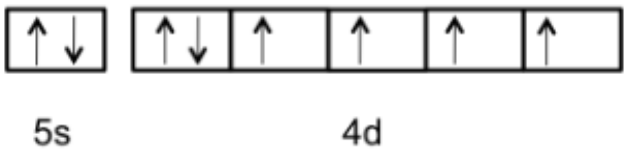
***Note for interest's sake: while this also gives us the correct answer in the question (4 unpaired electrons), the configuration is not correct in reality! In fact, the presence of two electrons occupying an s-orbital is actually higher in energy than having another d-orbital filled. Therefore, one of the electrons in the 5s orbital is more energetically favourable to be in a 4d orbital, resulting in 4 unpaired electrons, 1 in 5s, and 3 in 4d.**



Which gives Ruthenium the configuration [Kr] $5s^2 4d^6$.

Therefore option C is the correct answer.
This question is a medium question and 39% of the students can get this question correct.

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Question 2

Answer: D, 19 p+, 19 e-, 20 no

According to the given notation $_{19}K^{39}$, the atomic number is 19. Since the atomic number represents the number of protons as well as electrons of the element, both electron and proton number must be 19. As the mass number is 39 (i.e. proton number + neutron number = 39), and if there are 19 protons, there will be 20 neutrons. Therefore option D is the correct answer.
This question is an easy question and 84% of the students can get this question correct.

Question 3

Answer: A, +1

First, from the name of the atom potassium-19, we can tell the atomic number is 19 (i.e. The number of protons Z=19).

Then, from the question stem we were told that the screening factor S is approximately equal to the number of electrons that are closer to the nucleus(i.e. In the lower energy subshells) than the electrons of interest. Here, the electron of interest is the valence electron, which is the outermost electron. Given there is only 1 valence electron , there will be 18 other electrons which are closer to the nucleus, and these are screening electrons, so S = 18

Finally, we apply the formula mentioned in the question stem:
Zeff = Z - S = 19 - 18 = +1

Therefore option A is the correct answer.
This question is an easy question and 68% of the students can get this question correct.