

Name \_\_\_\_\_ Date \_\_\_\_\_

## End of Chapter 3 test

*This test and its sample answers have been written by the authors. IB may award marks differently.*

- 1 Which of the following statements is correct about the hydrogen emission spectrum?
  - A The lines are produced when electrons moved from a lower energy level to a higher energy level.
  - B The lines get closer at higher frequencies.
  - C The lines get closer at lower frequencies.
  - D Electron transitions to the  $n = 2$  level are responsible for lines in the UV region.
- 2 Which electronic transition in the hydrogen atom requires the most energy?
  - A  $n = 2 \rightarrow n = 6$
  - B  $n = 6 \rightarrow n = 1$
  - C  $n = 1 \rightarrow n = 4$
  - D  $n = 4 \rightarrow n = 1$
- 3 Which of the following species has/have a similar emission spectrum to a hydrogen atom?  
I  $\text{Li}^{2+}$    II He   III  $\text{He}^+$ 
  - A I only
  - B II only
  - C I and II only
  - D I and III only
- 4 Which of the following ions has the least number of valence electrons?
  - A  $\text{CO}_3^{2-}$
  - B  $\text{SO}_4^{2-}$
  - C  $\text{NO}_2^+$
  - D  $\text{ClO}_2^-$
- 5 Which is the correct order of filling orbitals according to the Aufbau principle?
  - A 3d 4p 4d 5s
  - B 4p 3d 5s 4d
  - C 4s 3d 3p 4p
  - D 4s 3d 4p 5s

- 6 Which of the following atoms has/have one or more unpaired electrons?
- I cobalt
  - II copper
  - III calcium
- A I only  
B III only  
C I and II only  
D I, II and III
- 7 Which of the following atoms/ions has the greatest number of unpaired electrons?
- A Cr  
B Mn  
C  $\text{Cu}^+$   
D  $\text{Co}^{3+}$
- 8 Which of the following atoms has the least number of unpaired electrons?
- A Cl  
B Ca  
C Ga  
D O
- 9 Which of the following is the correct electronic configuration of the  $\text{Cr}^{2+}$  ion?
- A  $[\text{Ar}]3\text{d}^4$   
B  $[\text{Ar}]3\text{d}^5$   
C  $[\text{Ar}]4\text{s}^13\text{d}^3$   
D  $[\text{Ar}]4\text{s}^23\text{d}^2$
- 10 How many occupied p orbitals are there in a ground-state bromine atom?
- A 3  
B 5  
C 8  
D 9

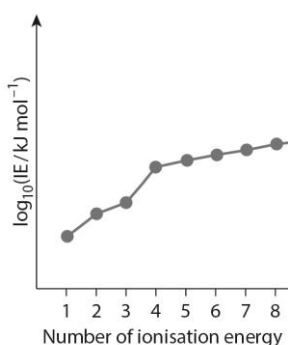
**11** Which of the following statements about the element vanadium is correct?

- A** A vanadium atom has 22 electrons in total.
- B** The maximum number of electrons in one d orbital of vanadium is 10.
- C** The highest occupied energy level in vanadium is  $n = 3$ .
- D** The number of unpaired electrons in a vanadium atom is 3.

**12** The first five ionisation energies for an element are: 786, 1580, 3230, 4360 and 16 000 kJ/mol. From which group is the element from in the periodic table?

- A** 4
- B** 13
- C** 14
- D** 15

**13** The graph represents the first eight successive ionisation energy of an element. Not all of the electrons are removed. What is the element?



- A** Na
  - B** Al
  - C** P
  - D** K
- 14** Which element has the greatest first ionisation energy?

- A** Ar
- B** Ne
- C** Na
- D** K

> **15** Which of the following atoms/ions has the greatest second ionisation energy?

- A** Na
- B** Mg
- C** K
- D** Ca

**END OF TEST**