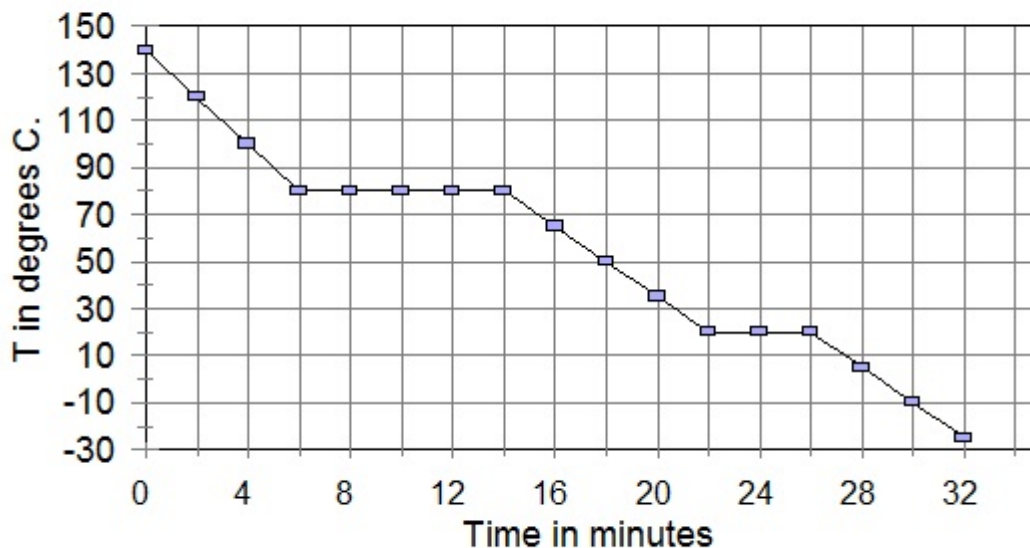


Cooling curve of a pure substance



Base your answers to questions 1 to 7 on the cooling curve above.

The substance was cooled at standard pressure, at 20 joules per min.

1. The normal boiling point of this substance is a) 80°C b) 100°C c) 20°C d) 140°C
2. The freezing point of this substance is a) 80°C b) 100°C c) 20°C d) -25°C
3. The melting point of the substance is a) 80°C b) 100°C c) 20°C d) -25°C
4. At the 18 minute mark, the substance is a) a gas b) a liquid c) a solid
d) both solid and liquid
5. As the substance is cooled between the 8 and 12 minute marks, its average kinetic energy a) increases b) decreases c) stays the same
6. Between the 22nd and 26th minute the system undergoes a) an exothermic physical change b) an exothermic chemical change c) an endothermic physical change d) an endothermic chemical change.
7. Which process releases 160 joules, according to this graph?
a) condensation of the entire sample of substance. b) cooling the substance from 80° to 50° c) freezing the entire sample of substance d) cooling the substance from 140° to 80°

8. What is the normal boiling point of water ? a) 100 K b) 273 K c) 373 K d) 474 K
9. How much heat is needed to raise the temperature of 10.0 grams of water from 30.0°C to 40° C ? a) 418 J b) 100. J c) 41.8 J d) 1672 J
10. How many grams of ice can be melted at its melting point by 3340 joules of heat?
a) 1.0 gram b) 10.0 grams c) 334 grams d) 1000. grams
11. Based on the vapor pressure curves on table H, which liquid has the **strongest** intermolecular attractions? a) propanone b) ethanol c) water d) ethanoic acid
12. How many kilojoules are there in 318 joules ? a) 0.318 kJ b) 31.8 kJ
c) 318,000 kJ d) 3180 kJ
13. Which is a correct unit of density? a) grams per liter b) joules per gram
c) liters per centimeter d) centimeters per liter
14. Gases become **least** ideal under conditions of a) low temperature and low pressure
b) low temperature and high pressure c) high temperature and low pressure
d) high temperature and high pressure
15. All of the following are correct assumptions about **ideal** gases except
a) the molecules move in random, straight line motion
b) the size of the molecules themselves is negligible compared to the amount of space in the container
c) the molecules collide with the container walls, exerting pressure
d) there are strong intermolecular attractions.
16. A gas has a volume of 12.0 liters at standard pressure. In order to compress the gas to a new volume of 6.0 liters, at the same temperature, the new pressure must be
a) 101.3 kP b) 202.6 kP c) 50.65 kP d) 72.0 kP
17. Which is considered a mixture? a) water b) air c) gold d) dry ice
18. Which species represents a chemical compound? a) N₂ b) NH₄⁺ c) Na d) NaHCO₃
19. Which statement correctly describes the liquid state?
a) no definite shape, and no definite volume b) definite shape, no definite volume
c) takes shape of container, definite volume d) definite shape, definite volume.
20. The vapor pressure of a liquid is 0.92 atm. at 60°C. The normal boiling point of the liquid could be a) 35° b) 45° c) 55° d) 65°

21. How many valence electrons are there in an atom of oxygen in the ground state ?
a) 2 b) 4 c) 6 d) 8
22. How many neutrons are there in a particle with the symbol ^{14}C ?
a) 4 b) 6 c) 8 d) 14
23. What is the nuclear charge of an atom with an atomic number of 12 ?
a) +12 b) -12 c) 24 d) 0
24. How many occupied principal energy levels are there in a phosphorous atom in the ground state? a) 2 b) 3 c) 5 d) 15
25. What is the total number of protons in the nucleus of an atom of potassium-42?
a) 15 b) 19 c) 39 d) 42
26. Which species does **not** have a noble gas configuration? a) Na^+ b) Mg^{2+} c) Ar d) S
27. Which electron configuration is correct for a potassium **ion** ? a) 2-8-8-1
b) 2-8-8 c) 2-8-7 d) 2-8-8-2
28. What is the mass number of a particle that contains 13 protons, 14 neutrons, and 10 electrons?
a) 13 b) 14 c) 23 d) 27
29. The nucleus of the atom contains a) protons only b) protons and electrons only
c) protons and neutrons only d) protons, neutrons, and electrons
30. The table below shows the normal boiling point of four compounds.

Compound	Normal boiling point. ($^{\circ}\text{C}$)
HF	19.4
CH_3Cl	-24.2
CF_3F	-78.6
HCl	-83.7

- Which compound has the strongest intermolecular forces? a) HF b) CH_3Cl
c) CH_3F d) HCl
31. Compared to the metals in period 2, the nonmetals in period 2 generally have smaller
a) ionization energies b) electronegativities c) atomic radii d) atomic numbers

32. A chemist compares two metals, we shall call metal X, and metal Y. She finds that metal X has a smaller ionization energy than metal Y. It is most likely that metal X
- is a more active metal than metal Y
 - has a larger electronegativity than metal Y
 - has a smaller atomic radius than metal Y
 - has more valence electrons than metal Y.
33. In a polar covalent bond, there is a slight negative charge on the atom with the
- larger atomic radius
 - higher electronegativity
 - greater atomic mass
 - larger number of neutrons.
34. Which of the following molecules is polar? a) CCl_4 b) H_2 c) CO_2 d) HBr
35. Which substance is a poor conductor of electricity in the solid state, but an excellent conductor in the liquid state? a) Hg b) CO_2 c) KCl d) NH_3
36. Which substance forms a solid characterized by a sea of mobile electrons?
- Au
 - CuO
 - I_2
 - CO_2
37. Which ion contains exactly the same total number of electrons as an S^{2-} ion?
- O^{2-}
 - Na^+
 - Ti^{2+}
 - Ca^{2+}
38. Which element generally forms ions that are larger than its neutral atoms?
- O
 - Ca
 - Fe
 - Al
39. Which element normally consists of diatomic molecules?
- bromine
 - neon
 - magnesium
 - phosphorous
40. Which molecule has a tetrahedral shape? a) H_2O b) NH_3 c) CH_4 d) CO_2
41. Hydrogen bonds explain the comparatively high boiling point of
- water
 - hydrogen sulfide
 - hydrogen
 - all of these
42. When comparing molecules of similar structure, we generally find that larger molecules, with more electrons, have
- stronger attractions, and higher boiling points
 - stronger attractions and lower boiling points
 - weaker attractions, and higher boiling points.
 - weaker attractions, and lower boiling points.
43. Compared with ionic solids, molecular solids generally have
- stronger attractions, and higher melting points.
 - weaker attractions and higher melting points.
 - stronger attractions and lower melting points
 - weaker attractions and lower melting points.
44. Colored compounds, and multiple positive oxidation states are characteristics associated with
- alkali metals
 - alkaline earth metals
 - transition metals
 - noble gases

45. Alkaline earth elements generally form ions that have a charge of a) 1+ b) 2+
c) 3+ d) 2-
46. The least reactive element in period 3 is a) Na b) Ne c) Ar d) Cl
47. The most active of the following metals is a) Al b) Mg c) Na d) K
48. In each period, the element with the largest atomic radius is a) a halogen
b) a noble gas c) an alkali metal d) a transition metal
49. Which element is most chemically similar to phosphorous? a) sodium b) sulfur
c) arsenic d) germanium
50. Which group on the periodic table contains two metalloids? a) group 2
b) group 10 c) group 14 d) group 17
51. All of the elements in group 13 have the same a) number of neutrons
b) electronegativity c) number of valence electrons d) atomic radius
52. The correct formula for calcium nitrate is a) CaNO_3 b) Ca_3NO c) $\text{Ca}(\text{NO}_3)_2$
d) $\text{Ca}(\text{NO})_2$
53. The compound FePO_4 is called a) iron (I) phosphate b) iron (II) phosphate
c) iron (III) phosphate d) iron (IV) phosphate
54. What is the oxidation number of the nitrogen in the compound NaNO_3 ?
a) +3 b) +5 c) -3 d) -5
55. The particle with the symbol S^{2-} contains a) 16 protons, and 14 electrons
b) 16 protons and 18 electrons c) 14 protons and 16 electrons
d) 18 protons and 16 electrons
56. An isotope of ^{32}S could have the symbol a) ^{32}P b) $^{32}\text{S}^{2-}$ c) ^{33}S d) $^{32}\text{S}^{4+}$
57. As the elements in group 17 are considered in order of increasing atomic number, the strength of the elements' attractions for electrons a) decreases b) increases
c) remains the same
58. At constant temperature, as the volume of a confined gas is increased, the pressure exerted by that gas a) decreases b) increases c) stays the same
59. As the temperature increases, the vapor pressure of a liquid a) decreases b) increases
c) stays the same
60. As the pressure on the surface of a liquid decreases, the temperature at which the liquid will boil a) decreases b) increases c) stays the same