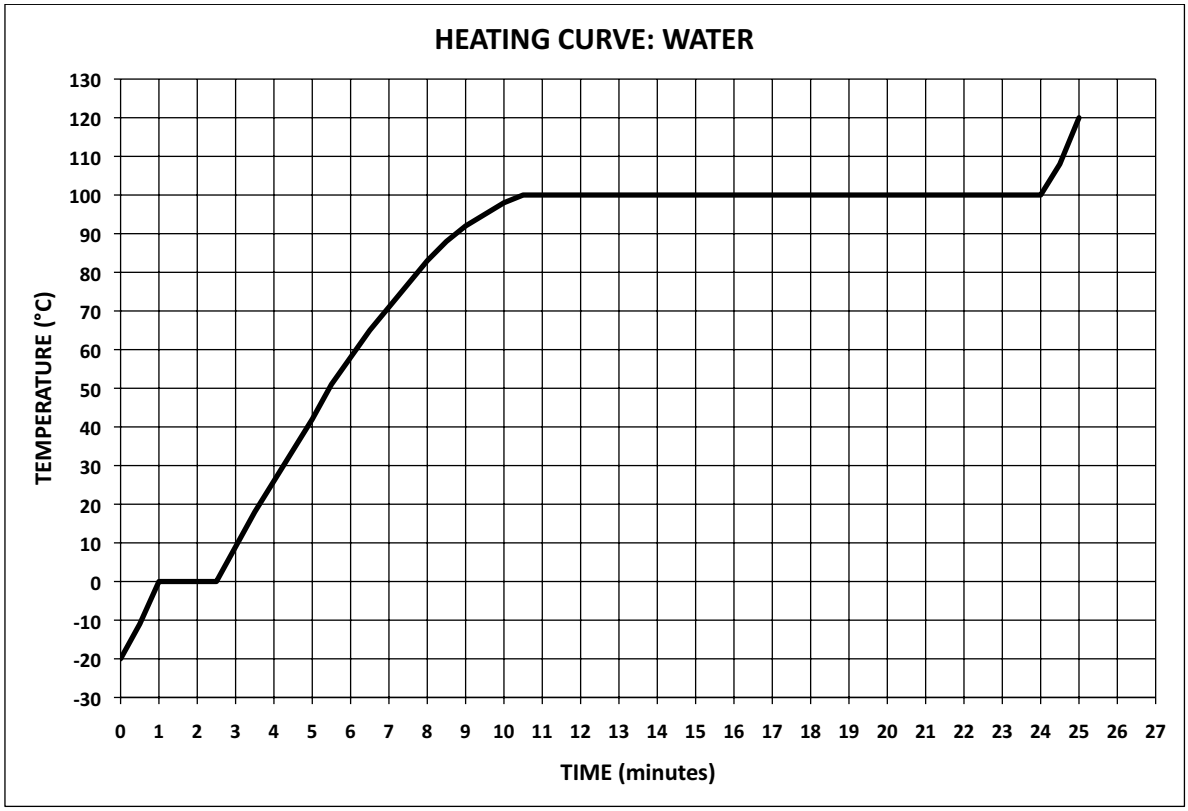
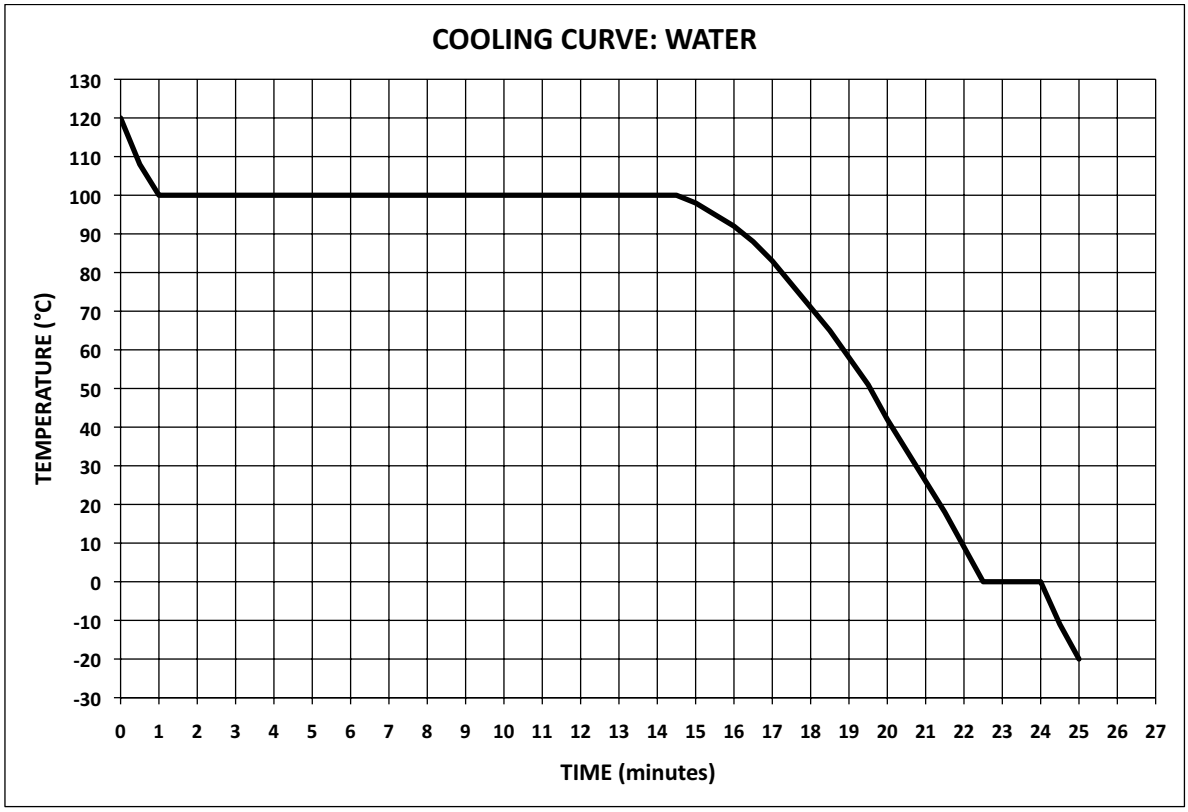

HEATING CURVE: WATER
TEMPERATURE (°C)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
TIME (minutes)


COOLING CURVE: WATER
TEMPERATURE (°C)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
TIME (minutes)

HEATING CURVE OF WATER

TIME RANGE	WHAT IS HAPPENING TO THE WATER DURING THIS PERIOD OF TIME?	IS TEMPERATURE **INCREASING** OR **DECREASING** OR **NOT CHANGING**? HOW MUCH?	IS ENERGY **GAINED** OR **RELEASED**? HOW MUCH?
A	**Ice is heating up.**	**Temperature is increasing from -20°C to 0°C.**	**Energy is gained:** **(2.11 J/g•°C) • (20 °C) = +42.2 J/g**
B	**Ice is melting.**	**Temperature is not changing.**	**Energy is gained:** **+334 J/g**
C	**Liquid water is**		
D			
E			

COOLING CURVE OF WATER

TIME RANGE	WHAT IS HAPPENING TO THE WATER DURING THIS PERIOD OF TIME?	IS TEMPERATURE **INCREASING** OR **DECREASING** OR **NOT CHANGING**? HOW MUCH?	IS ENERGY **GAINED** OR **RELEASED**? HOW MUCH?
F			
G			
H			
I			
J			

By Charles Burrows

Name: _____

1) What is the minimum amount of heat required to completely melt 20.0 grams of ice at its melting point?

A) 45,200 J B) 20.0 J C) 83.6 J D) 6,680 J

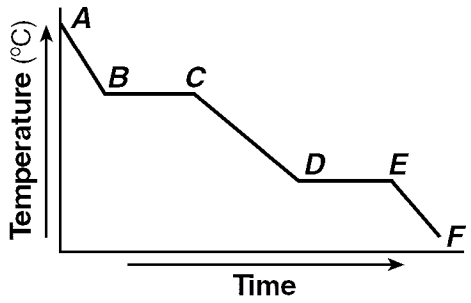
2) Which change results in a release of energy?

A) the boiling of $H_2O(\ell)$
B) the condensation of $H_2O(g)$
C) the melting of $H_2O(s)$
D) the evaporation of $H_2O(\ell)$

3) The solid and liquid phases of water can exist in a state of equilibrium at 1 atmosphere of pressure and a temperature of

A) 0°C B) 273°C C) 100°C D) 373°C

4) The graph below represents the uniform cooling of water at 1 atmosphere, starting with water as a gas above its boiling point.

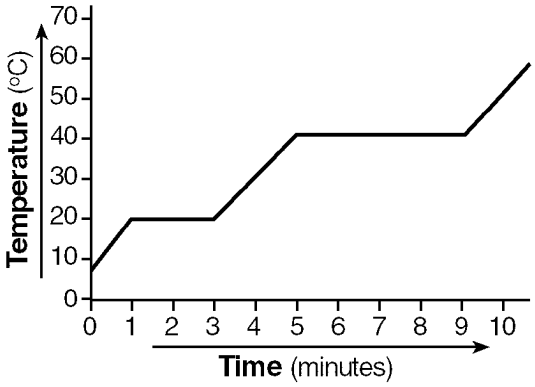


What segments of the cooling curve represent the fixed points on a thermometer?

A) *AB* and *CD* B) *CD* and *EF* C) *AB* and *EF* D) *BC* and *DE*

5) Calculate the heat released when 25.0 grams of water freezes at 0°C. [*Show all work. Record your answer with an appropriate unit.*]

6) The graph below represents changes of state for an unknown substance.

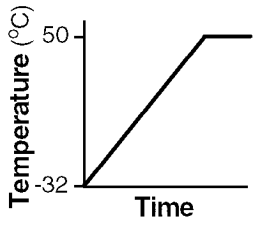


What is the boiling temperature of the substance?

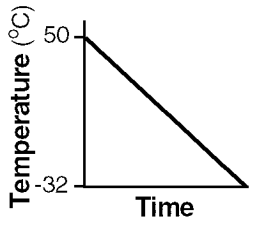
A) 20°C B) 40°C C) 0°C D) 70°C

7) A student collected data in an experiment in which the uniform cooling of a water sample was observed from 50° C to -32° C. Which graph *most* likely represents the results obtained by the student?

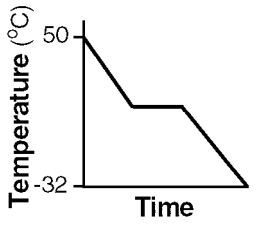
A)



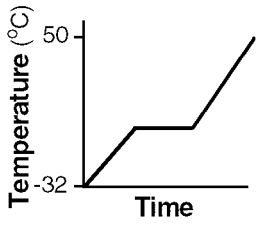
B)



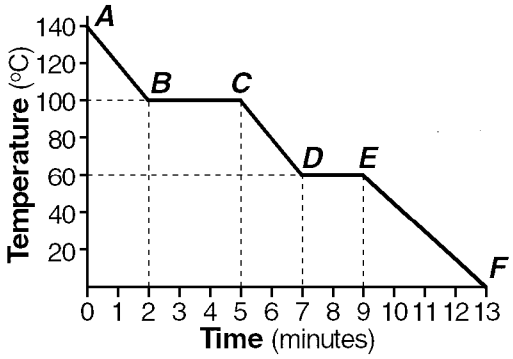
C)



D)



8) The graph below represents the uniform cooling of a sample of a substance, starting with the substance as a gas above its boiling point.



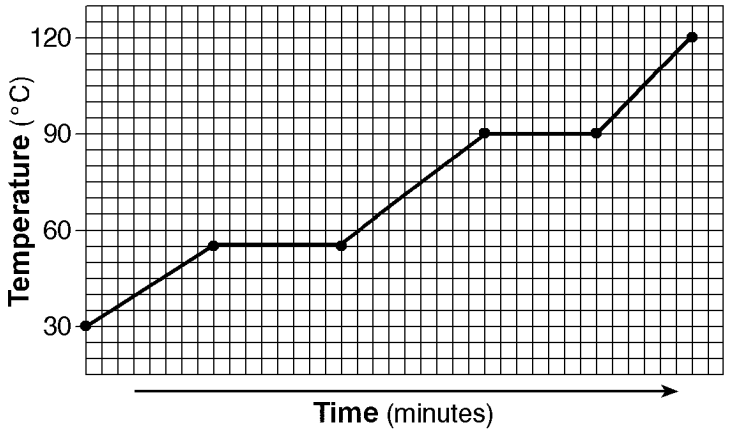
What segment of the curve represents a time when *both* the liquid and the solid phases are present?

A) *EF* B) *DE* C) *BC* D) *CD*

9) What amount of heat is required to completely melt a 29.95-gram sample of $H_2O(s)$ at 0° C?

A) 1.00×10^4 J B) 334 J C) 2,260 J D) 1.00×10^3 J

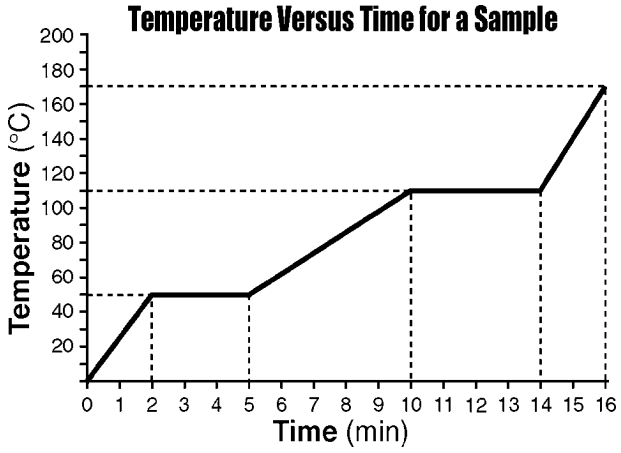
10) The graph below represents the heating curve of a substance that starts as a solid below its freezing point.



What is the melting point of this substance?

A) 90° C B) 55° C C) 120° C D) 30° C

11) Starting as a solid, a sample of a substance is heated at a constant rate. The graph below shows the changes in temperature of this sample.



What is the melting point of the sample and the total time required to completely melt the sample after it has reached its melting point?

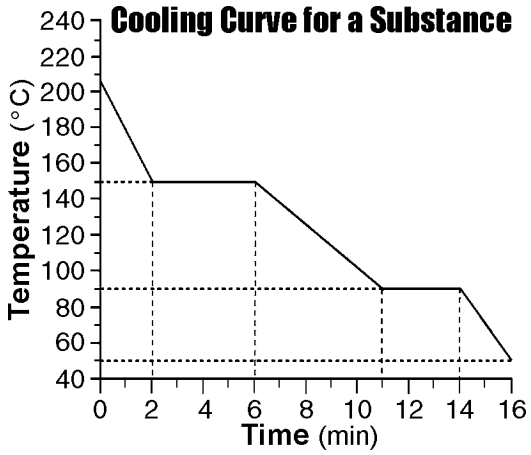
A) 50° C and 5 min B) 110° C and 14 min C) 110° C and 4 min D) 50° C and 3 min

12) Which phase change results in the release of energy?

A) $H_2O(g) \longrightarrow H_2O(\ell)$ C) $H_2O(s) \longrightarrow H_2O(\ell)$

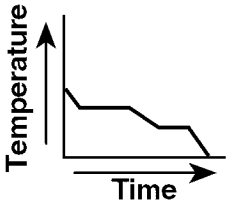
B) $H_2O(\ell) \longrightarrow H_2O(g)$ D) $H_2O(s) \longrightarrow H_2O(g)$

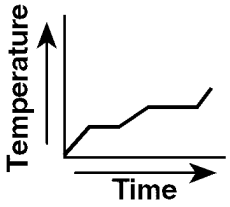
13) Starting as a gas at 206° C, a sample of a substance is allowed to cool for 16 minutes. This process is represented by the cooling curve below.

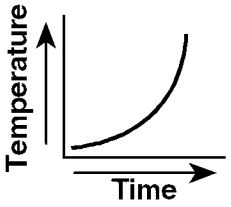


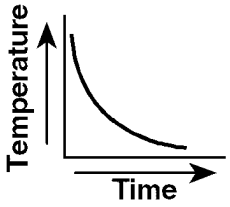
According to the cooling curve shown, what is the melting point of the substance?

14) Which graph *best* represents a change of phase from a gas to a solid?

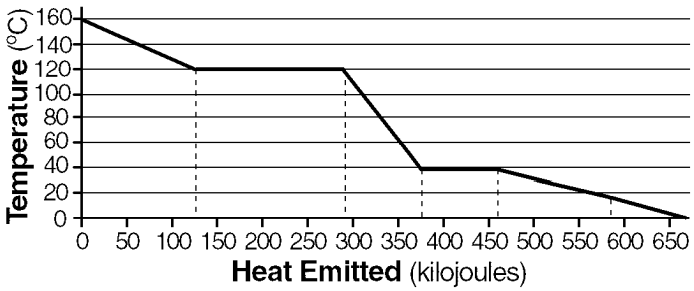
A)


C)


B)


D)


15) The graph below represents the uniform cooling of a substance starting as a gas at 160° C.



At which temperature does a phase change occur for this substance?

A) 0° C B) 140° C C) 80° C D) 40° C