

Unit 14 - Week 12

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Assignment 12

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2020-12-09, 23:59 IST.

Figure 1 shows the Time-Temperature-Transformation (isothermal transformation) diagram for a plain carbon steel with 1.13 wt% carbon. Based on the diagram, answer the following questions.

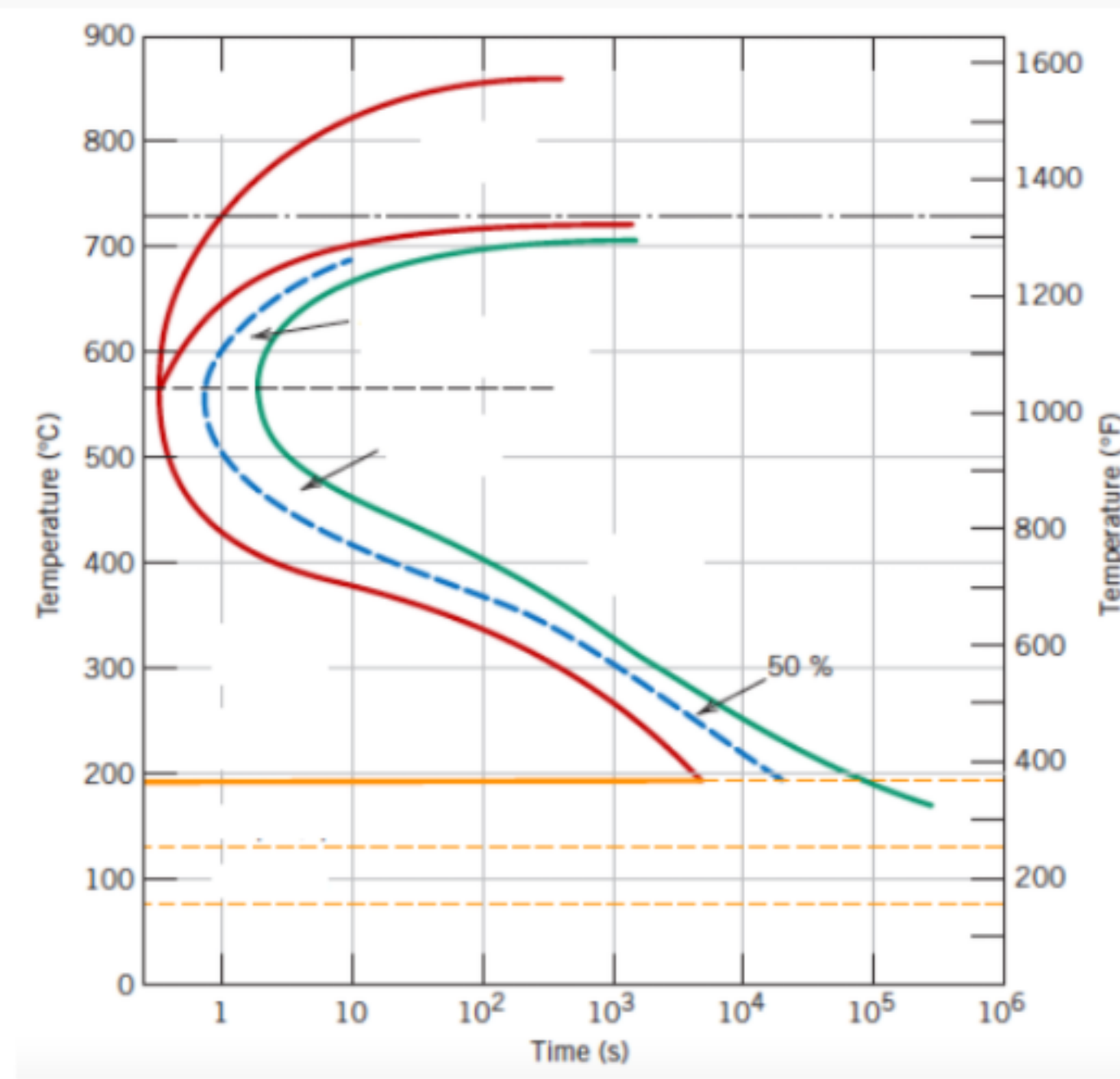


Figure 1: Isothermal transformation diagram for a plain carbon steel with 1.3 wt% Carbon.

1) The microstructure of steel cooled down rapidly from 800°C to 500°C and held there for 1 second followed by rapid cooling to 50°C. **1 point**

- 50% Proeutectoid ferrite + 25% Bainite + 25% Martensite
- 50% Bainite + 50% Martensite
- 50% Proeutectoid cementite + 25% Bainite + 25% Martensite
- 50% Proeutectoid cementite + 50% Bainite

No, the answer is incorrect.
Score: 0
Accepted Answers:
50% Bainite + 50% Martensite

2) The process: "rapidly cool to 250°C, hold for 10³ s, then quench to room temperature" results in **1 point**

- 100% Martensite
- 100% Upper Bainite
- 100% Lower Bainite
- Bainite + Martensite

No, the answer is incorrect.
Score: 0
Accepted Answers:
100% Martensite

3) The process: "rapidly cool to 775°C, hold for 500 s, then quench to room temperature" results in **1 point**

- Cementite
- Cementite + Pearlite
- Cementite + Martensite
- Pearlite + Martensite

No, the answer is incorrect.
Score: 0
Accepted Answers:
Cementite + Martensite

4) The process: "rapidly cool to 700°C, hold at this temperature for 10³ s, then quench to room temperature" results in **1 point**

- Pearlite
- Proeutectoid Cementite + Pearlite + Martensite
- Proeutectoid Cementite + Bainite + Martensite
- Proeutectoid Cementite + Pearlite

No, the answer is incorrect.
Score: 0
Accepted Answers:
Proeutectoid Cementite + Pearlite

5) The process: "rapidly cool to 400°C, hold for 500 s, then quench to room temperature" results in **1 point**

- Cementite
- Bainite
- Pearlite
- Bainite + Martensite

No, the answer is incorrect.
Score: 0
Accepted Answers:
Bainite

Figure 2 shows the continuous cooling transformation diagram of a 4340 alloy steel. Answer the following questions based on the figure. Assume the initial temperature of the alloy is 750°C.

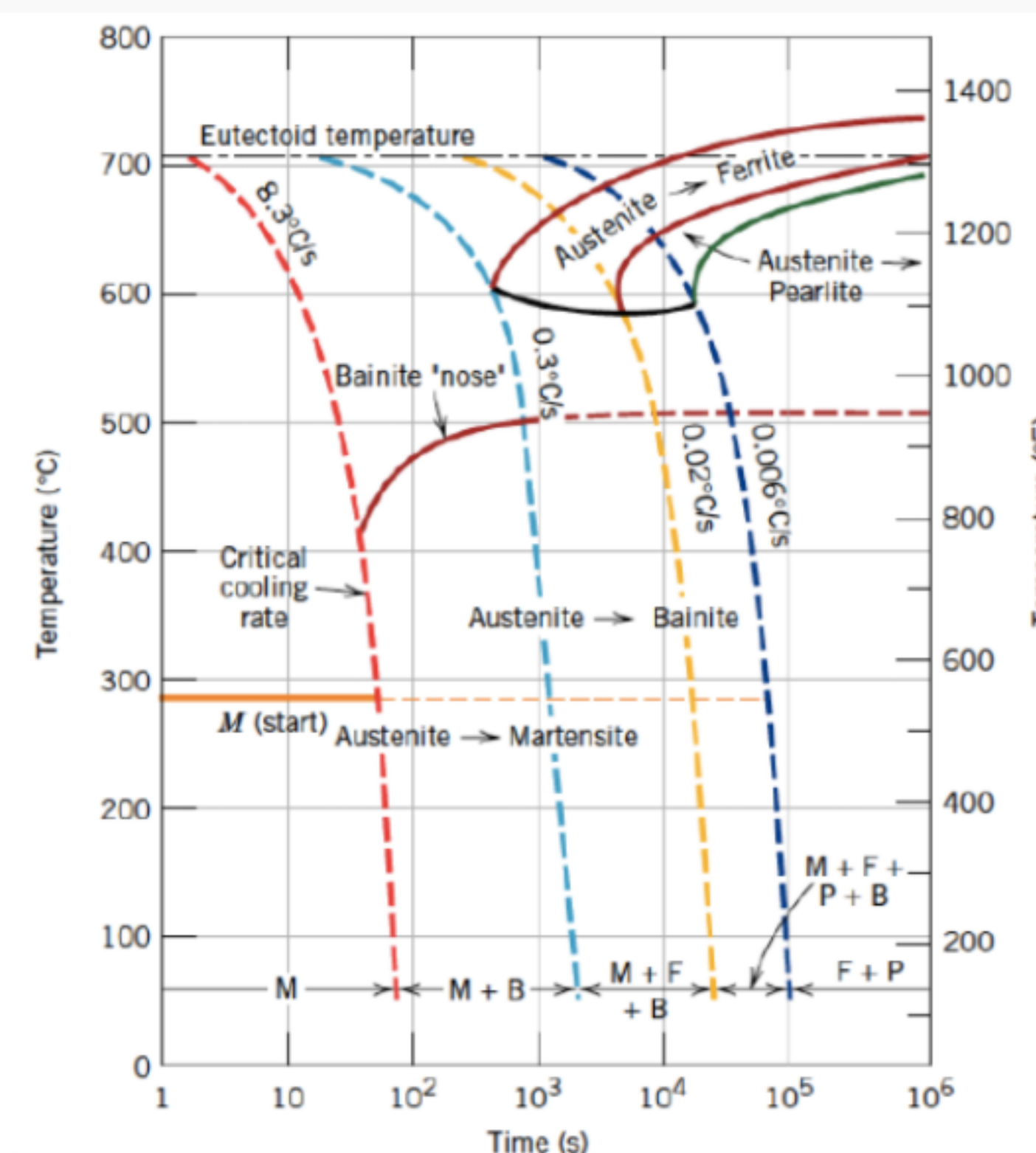


Figure 2: Continuous Cooling Transformation Diagram of 4340 alloy steel.

6) The microstructural constituents of the alloy obtained with a cooling rate of 10³ C/s. **1 point**

- Martensite
- Martensite + Bainite
- Martensite+Ferrite+Bainite
- Martensite+Ferrite+Bainite+Pearlite

No, the answer is incorrect.
Score: 0
Accepted Answers:
Martensite

7) The microstructural constituents of the alloy obtained with a cooling rate of 0.1³ C/s. **1 point**

- Martensite
- Martensite + Bainite
- Martensite+Ferrite+Bainite
- Martensite+Ferrite+Bainite+Pearlite

No, the answer is incorrect.
Score: 0
Accepted Answers:
Martensite+Ferrite+Bainite

8) The microstructural constituents of the alloy obtained with a cooling rate of 1³ C/s. **1 point**

- Martensite
- Martensite + Bainite
- Martensite+Ferrite+Bainite
- Martensite+Ferrite+Bainite+Pearlite

No, the answer is incorrect.
Score: 0
Accepted Answers:
Martensite + Bainite

9) The microstructural constituents of the alloy obtained with a cooling rate of 0.01³ C/s. **1 point**

- Martensite
- Martensite + Bainite
- Martensite+Ferrite+Bainite
- Martensite+Ferrite+Bainite+Pearlite

No, the answer is incorrect.
Score: 0
Accepted Answers:
Martensite+Ferrite+Bainite+Pearlite

10) An annealed 0.3% carbon steel contains approximately 30% pearlite and 70% ferrite. The approximate tensile strength of the alloy is _____ kpsi.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 64

2 points

11) Identify the CORRECT statement(s). **2 points**

- Annealing is used to relieve stresses and increase ductility.
- Normalized steel is harder than annealed steel
- Annealing can be a final heat treatment process for hypereutectoid steels
- The cementite plates are closer together in a normalized medium pearlite compared to annealed steel.

No, the answer is incorrect.
Score: 0
Accepted Answers:
Annealing is used to relieve stresses and increase ductility.
Normalized steel is harder than annealed steel
The cementite plates are closer together in a normalized medium pearlite compared to annealed steel.

12) Identify the CORRECT statement(s). **2 points**

- The crystal structure of Martensite is Hexagonal Close Packed
- The crystal structure of Martensite is Body Centered Tetragonal
- The crystal structure of Fe₃C is Orthorhombic
- The transformation of Austenite to Martensite is a diffusional transformation.

No, the answer is incorrect.
Score: 0
Accepted Answers:
The crystal structure of Martensite is Body Centered Tetragonal
The crystal structure of Fe₃C is Orthorhombic