

Notetaking Guide for the movie about the Samurai Sword.

1. What is the title of the movie: \_\_\_\_\_
2. Where is the Samurai Sword from? \_\_\_\_\_
3. What are samurai? \_\_\_\_\_
4. How do modern samurai test their swords? \_\_\_\_\_
5. How old is the Samurai Sword? \_\_\_\_\_
6. What are two abilities of swords? \_\_\_\_\_

In the traditional smelting method,

7. Where does the iron ore sand come from? \_\_\_\_\_
8. How many days does the traditional iron maker stay awake to make steel? \_\_\_\_\_
9. What is the worker doing with the furnace? \_\_\_\_\_
10. What happens in the center of the furnace? \_\_\_\_\_

A Materials Science Engineer explains what happens with iron at high temperatures:

11. What happens with the iron atoms at high temperatures? \_\_\_\_\_
12. What happens when the iron cools?  
\_\_\_\_\_

Circle Yes or No

13. People can control mechanical properties by heating and cooling metal. YES or NO
14. People can control metal properties by heat treating. YES or NO

In the traditional smelting process . . .

15. Does the iron ever reach a liquid state? YES or NO
16. Does the traditional smelting process produce only one kind of steel? YES or NO

There is a limit between hardness and brittleness.

17. What test method is used to test toughness? \_\_\_\_\_

Tough metal: it bends doesn't break. It tears apart.

e.g., taffy or tootsie rolls, bends before it breaks

Back to the traditional smelting

18. How does the traditional iron maker know when the process is complete?

---

Furnace broken apart to extract steel. Ingot is cooled.

Pieces that fall off easily are brittle.

The good steel pieces are sent to the sword maker.

A Materials Science Engineer explains what the shape of the sword.

19. What sword shape is good for slashing? \_\_\_\_\_

20. What sword shape is bad for slashing? \_\_\_\_\_

The sword maker is a traditional blacksmith.

21. How does the blacksmith shape the steel into a sword? \_\_\_\_\_

It takes brute strength to hammer the hot metal.

22. What do the texture and color of the steel indicate? \_\_\_\_\_

The hammer releases sparks.

23. What are the sparks? \_\_\_\_\_

The bend of the softened steel indicates quality.

Brutal level of hammering and bending

24. What happens to the steel after the hammering and bending?

---

Bending makes metal get harder.

The Materials Science Engineer makes a demonstration about bending.

25. What happens every time the metal is bent?

---

Back to the traditional blacksmith (sword maker)

26. Why does the metal get reheated after hammering?

\_\_\_\_\_

One steel is hard. Another type is tough but cannot hold an edge.

27. Which steel goes on the outside of the sword? \_\_\_\_\_

28. What goes in the middle of the sword? \_\_\_\_\_

Hard steel outside for cutting edge  
Core is tougher to bend to absorb impact  
Same method used for modern structural steel.

Traditional rating system of swords is no longer performed.

Quenching process

29. What indicates that it is time to quench? \_\_\_\_\_

30. What does the quenching do to the hard steel? \_\_\_\_\_

Quenching affects outer metal not tough metal in center

31. What does the quenching do to the soft steel?  
\_\_\_\_\_  
\_\_\_\_\_

Core has a face on the top of sword which pulls the hard steel into curve.

After the sword maker is done . . .

32. Where does the sword go? \_\_\_\_\_