Directions For Numbers 1-25: Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. Remember: Make no marks on this test.

1. What is the study of how a product will be used and how it effects people?
   A. Utilities
   B. Cyronomics
   C. Ergonomics
   D. Someone else’s problem

2. The maximum density for a building material should be no greater than 200 kg per cubic meter. This is a design:
   A. Control.
   B. Criteria.
   C. Refinement.
   D. Constraint.

3. Before they can be solved, technological problems must be:
   A. Constrained.
   B. Graphically communicated.
   C. Documented.
   D. Researched.

4. Design problems usually have:
   A. Multiple solutions.
   B. Only one possible solution.
   C. Clear solutions.
   D. Quantified solutions.

5. An engineer must design a booster rocket system capable of launching a load 3.7 times the mass of the space shuttle. This is an example of a design:
   A. Control.
   B. Criteria.
   C. Refinement.
   D. Constraint.

6. Requirements of a design such as criteria, constraints, and efficiency:
   A. Never conflict.
   B. Are independent of each other.
   C. Always conflict.
   D. Sometimes conflict.

7. Communication systems allow information to be:
   A. Transferred.
   B. Edited.
   C. Understood.
   D. Prototyped.

8. What is the first step in the design process?
   A. Refine the solution.
   B. Communicate the results.
   C. Define the problem.
   D. Identify the criteria.
9. A conceptual model:
   A. Is a scientific way to describe work, force, and power.
   B. Explains an idea that cannot be easily described by written text.
   C. Is a visual technique using only three dimensions.
   D. Has at least one dependent and one independent variable.

10. Graphic communication systems involve the design, development, and production of what?
    A. Written text
    B. Machines
    C. Visual images
    D. Procedures

11. Scientific visualization can be:
    A. Conceptual.
    B. Data-driven.
    C. Both conceptual and data-driven.
    D. Neither conceptual or data-driven.

12. What is the last step in the design process?
    A. Refine the solution.
    B. Communicate the results.
    C. Define the problem.
    D. Identify the criteria.

13. A product’s design needs to be continually:
    A. Built upon.
    B. Observed.
    C. Checked and critiqued.
    D. Manufactured.

14. Design problems are almost NEVER:
    A. Difficult.
    B. Clearly defined.
    C. Solvable.
    D. Addressed by a group.

15. What is a prototype?
    A. Single-cell organism
    B. Design style
    C. Working model
    D. 2-D model

16. If the mechanical advantage of a machine is 1, then:
    A. The machine does not work.
    B. The machine does not multiply force.
    C. The machine is 100% efficient.
    D. The work output is greater than the work input.

17. What is the definition of power?
    A. Work times time
    B. Force times time
    C. Work divided by time
    D. Distance divided by force

18. What is the definition of work?
    A. Force times distance
    B. Power times distance
    C. Efficiency divided by force
    D. Power divided by force
19. What is the definition of force?
A. Work times distance
B. Mass times acceleration
C. Effort times mass
D. Mass times time

20. (Fill in the blank) ________________ is how many times the effort force is multiplied.
A. Resistance
B. Efficiency
C. Power
D. Mechanical advantage

21. The effort force on a lever being used to move a rock is 700 N. This force is applied through a distance of 0.8 m. What is the work input in Joules?
A. 420
B. 560
C. 780
D. 875

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23. On a pulley, if the input work is 5000 J and the resistance distance (how far something is moved) is 0.5 m, what is the resistance force?
A. 100
B. 1,000
C. 10,000
D. 100,000

24. If the resistance force applied by an object being moved is 3000 N, what is the object’s mass in kilograms? (Using \(a = 10 \text{ m/s}^2\))
A. 300
B. 600
C. 1200
D. 6000

25. The amount of output work required to lift a crate with a pulley system is 2200 J. The effort force on the pulley is 40 N. What is the effort distance in meters?
A. 35
B. 55
C. 72
D. 250
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