1. Why are dams thicker at their bottoms than at their tops?
   (A) Water is denser at the bottom.
   (B) Water pressure is higher at the bottom.
   (C) The temperature is higher at the bottom.
   (D) Water weighs more at the bottom.

2. If the temperature is $-22^\circ F$, what is the temperature in C and K?

   \begin{tabular}{|l|l|}
   \hline
   T(C) & T(K) \\
   \hline
   (A) 95 & 308 \\
   (B) 298 & -25 \\
   (C) 15 & 288 \\
   (D) -30 & 243 \\
   \hline
   \end{tabular}

3. A 25 N weight having a volume of 2 liters is suspended underwater from a rope as shown. What is the tension in the rope?
   (A) 5 N  (B) 10 N  (C) 15 N  (D) 35 N

4. Why can a tornado cause the roof of a house to pop off?
   (A) Wind pushes against the roof, blowing it off.
   (B) High-speed wind outside the house lowers the air pressure outside compared to the inside.
   (C) This can only happen if high-speed wind enters the house, raising the pressure inside.
   (D) Turbulent air flow creates lower pressure outside the house than inside.

5. A harmonic wave on a string travels at 4 m/s and has a wavelength of 2 m. What is its frequency?
   (A) 2 Hz  (B) 8 Hz  (C) ½ Hz  (D) 0.5 s

6. What principle explains why airplanes can fly and curveballs curve?
   (A) Pascal  (B) Bernoulli  (C) Archimedes  (D) Torricelli

7. Why does an ice cube feel cold?
   (A) Heat from your hand enters the cube by convection.
   (B) Cold from the cube enters your hand by convection.
   (C) Heat from your hand enters the cube by conduction.
   (D) Cold from the cube enters your hand by conduction.

8. A block of wood and a block of copper of identical volumes are both held in place at the same level in a tank of water. Which one experiences a larger buoyant force?
   (A) the wood  (B) the copper  (C) they both experience the same buoyant force
9. How much heat is required to raise the temperature of 3 kg of water by 15 degrees C? The specific heat of water is 1 Calorie per gram per degree C.  
(A) 45 Cal  (B) 45,000 Cal  (C) 15 Cal  (D) 3 Cal

10. You are choosing the filament for a light bulb and want it to emit visible light as efficiently as possible when it becomes very hot. You should make that filament  
(A) black.   (B) shiny like a mirror.  
(C) gray.   (D) white.

11. If you blow across the top of a half full bottle of pop you can produce a clear tone. If you take a drink of pop to reduce the amount of liquid in the bottle and try this again the pitch (frequency) of the sound produced will  
(A) increase  (B) stay the same  (C) exactly double  (D) decrease

12. If the period of a wave is 1/3 sec, what is its frequency?  
(A) 1/3 Hz  (B) 9 Hz  (C) 3 Hz  (D) 1 Hz

13. Sound travels fastest in a  
(A) liquid  (B) solid  (C) gas  (D) it travels at the same speed in all three

14. Object A has a charge of –10 C and object B has a charge of –20 C. If –5 C of charge is transferred from object A to object B what is the final charge on A and B?  
(A) –15C –15C  
(B) –5C –25C  
(C) +5C +25C  
(D) –10C –25C

15. Hot air rises and mixes with cold air. This is an example of heat transfer by  
(A) convection  (B) conduction  (C) radiation

16. A paperclip can sit on the surface of water due to  
(A) surface tension  (B) viscosity  (C) buoyancy  (D) atmospheric pressure

17. A mass of \( m = 8 \) kg executes harmonic oscillations when connected to a spring of spring constant \( k = 2 \text{ N/m} \). What is the period of oscillation in seconds?  
(A) \( \pi \)  (B) \( 2\pi \)  (C) \( \pi/2 \)  (D) \( 4\pi \)

18. A heat engine operating in a cycle absorbs 10,000 J of heat from a high temperature reservoir and discards 4000 J to a low temperature reservoir. What is the efficiency of this engine?  
(A) 0.6%  (B) 6%  (C) 14%  (D) 60%
19. To double the period of a pendulum you should
   (A) double its length  (B) quadruple its length  (C) halve its length
   (D) double the mass  (E) halve the mass

20. Which statement is FALSE concerning the electrical charging process?
   (A) both conductors and nonconductors can be changed
   (B) when plastic is rubbed with fur it gets a negative charge
   (C) conductors have free electrons that can carry the flow of current
   (D) when glass is rubbed with silk, the glass gets positively charged because protons are
       transferred to it

21. You observe that a pendulum takes 2 s to swing from one side to the other side. What is the
    period of this pendulum?
    (A) 1 s  (B) 2s  (C) 4 s  (D) ½ s  (E) 8 s

22. The phenomenon that caused the failure of the Tacoma narrows bridge was
    (A) harmonic oscillation  (B) resonance  (C) wind  (D) poor engineering

23. In a thermodynamic process, 3000 J of heat is added to a gas while it does 2000 J of work.
    What is the change in internal energy of the gas?
    (A) 5000 J  (B) −1000 J  (C) 2/3 J  (D) 1000 J  (E) −5000 J

24. A rectangular block of steel has dimensions of 1 m × 2 m × 3 m and weighs 500,000 N.
    How should this block be placed on a surface to exert the least pressure on the surface?
    A) on the 1 m by 2 m side B) on the 1 m by 3 m side C) on the 2 m by 3 m side

25. A hydraulic lift operates on what principle?
    (A) Archimedes  (B) Bernoulli  (C) Pascal  (D) Coulomb

(The actual exam will have 30 questions)
Answers

1. B
2. D
3. A
4. B
5. A
6. B
7. C
8. C
9. B
10. A
11. D
12. C
13. B
14. B
15. A
16. A
17. D
18. D
19. B
20. D
21. C
22. B
23. D
24. C
25. C