ANSWERS AND EXPLANATIONS

1. The correct answer is A. The force of the object hitting the brick wall depends on the objects mass and acceleration. In both pictures, the incline of the hill is the same and the acceleration of each object rolling down the hill will be the same. The only difference will be the object's mass. The concrete truck will have greater mass than the sports car.

2. The correct answer is C. For the fan to work, it requires electricity flowing along a path of a closed circuit. If switch A is broken, electricity can still move through switch B or C when they are closed. With switch B closed, the electricity can bypass the fan altogether. Only switch C completes the electrical circuit from pole to pole to supply the fan.

3. The correct answer is A. If switch C is broken, electricity can still flow from the negative pole through switch A. Likewise, if switch B is broken, electricity can still flow from the negative pole through switch A. The electricity must flow through switch A to reach the positive pole.

4. The correct answer is C. As the fluid enters the pipe at A at a given speed such as feet per second, (velocity), it also has a flow rate (volume such as gallons per minute). The pipe is the same diameter throughout its length, so the flow rate of fluid exiting will be the same.

5. The correct answer is B. Although the truck B carries the same weight of cargo, the height of the cargo is higher. This raises the overall center of gravity of the truck and its load. To take a corner without risking movement of the load, the truck B requires a larger turning radius than truck A that has a lower center of gravity.

6. The correct answer is A. If both conveyors have the same length, are loaded equally, and begin moving at the same time, the conveyor A has to overcome a greater force of gravity because of its greater incline.

7. The correct answer is A. The fluid surfaces in tank X and Y are originally in equilibrium (water seeks its own level); however, as the weight is applied to the surface of tank X the pressure in the fluid increases and will raise the surface level in tank Y proportionately.

8. The correct answer is A. This question has to do with pulleys. The force required in picture A to keep the box from moving does not change by adding a rope for pulling. The two pulleys in B distribute the weight of the box and this means less force is required to keep the box from moving.

9. The correct answer is B. As the depth of a body of water increases, the pressure increases. More force will be exerted on the dam at point B than at point A.

10. The correct answer is A. In this question, you have two gas containers, with Container A having about double the volume of Container B. If the same volume of gas (quantity) were in each container, the smaller container would register a higher pressure reading. Since the pressure reading is the same, the smaller container has a smaller volume of gas than the bigger Container A.

11. The correct answer is A. Since Gear W is moving clockwise, it will move Gear X counterclockwise. Gear X will then move Gear Y clockwise, and finally Gear Y will move Gear Z counterclockwise, direction A.

12. The correct answer is A. Given an equal applied force, the shape of Object B will cause it to move along an arc-shaped path. Object A will move in a straighter line as each triangular plane of its shape touches a floor.

13. The correct answer is C. Above the level of C, the fluid in the beaker can still flow out the neck of the beaker.

14. The correct answer is C. This answer has to do with momentum of a heavier object. Cart X with its load has a greater mass than Cart Y.

15. The correct answer is A. Hydraulic lifts contain hydraulic fluid under pressure and when fully pressurized the fluid fills the lift cylinder. As the lift cylinder fills with hydraulic fluid, it pushes up a platform to lift the car. When the pressure releases, whether by opening a valve on purpose, or from a leak, the fluid takes the path of least resistance and the piston in the lift cylinder will lower.

16. The correct answer is A. When the skier's velocity at the jump off point is greater, their momentum is greater and the resultant landing point will extend further away from the jumping off point.

17. The correct answer is A. This question has to do with surface friction. As the Box A glides down the glass surface it will reach the bottom much more quickly than Box B because the cobblestone surface that Box B travels poses greater friction resistance.

18. The correct answer is B. This question has to do with levers. A lever is a simple machine that uses an immovable point of support called a fulcrum. The lengths of the areas to the right of the fulcrum are called the arms. As a rule, when arms are equal on each side of the fulcrum they will be level. When an equal weight is applied to the end of two arms of different lengths, the arm with the shortest length requires greater force to move.

19. The correct answer is B. At mid-day, the sun is almost directly above the earth. The shadows cast from any object will be minimal or none at all. Long shadows occur when the sun is lower in the sky and closer to the horizon.

20. The correct answer is B. The longer length of Screw B means it must be turned more rotations to fully embed into a material than Screw A

21. The correct answer is B. Valve B with the stem extended indicates the valve is further open than Valve A. The more open the valve handle, the greater the flow through the pipe.

22. The correct answer is B. Salt water is denser than fresh water. The bottle will be more buoyant on the salt water than in the fresh water. Increased buoyancy means the bottle will ride higher and thus have more of its surface exposed above the water.

23. The correct answer is A. As water is heated above its boiling point, it turns into steam. The longer the water boils, the more steam is created and the overall water volume will reduce, lowering the level of its surface.

24. The correct answer is B. As the top gear moves counterclockwise, it causes the lower gear to move clockwise. The flexible bar will move toward B while the gear is in motion.

25. The correct answer is B. As Plant A is watered, the soil medium will become saturated with the weight of the water. The drier Plant B will be easier to move.

26. The correct answer is A. The loaded cart in A will move more easily in the direction the wind is blowing. The Cart B must move against the force created by the wind.