**1. What is the concept of human learning? Please give two examples.**

It is the form of learning which requires higher order mental processes like thinking, reasoning, intelligence, etc. we learn different concepts from childhood. The process of human learning builds upon pre-existing knowledge, where the knowledge is either modified or reinforced to make it more accurate, and subsequently used to improve decision making and problem solving.

For example, we learn particular shape as rectangle, we then classify shapes with different color, size etc but has the characteristics of rectangle as rectangle.

When we learn mathematical formulas, we apply thinking and reasoning to apply the formula in relevant situations and get the required results.

**2. What different forms of human learning are there? Are there any machine learning equivalents?**

**Concept learning equivalent to Supervised learning:**

As a child, we learn looking at particular picture as duck and then we classify similar images as duck. i.e., classify new objects into existing categories, by matching the features of the new objects to examples in the categories.

**Hebbian Learning equivalent to artificial neural networks and unsupervised learning:**

Neurons that activate simultaneously strengthen the synaptic link between each other. Same technique used in unsupervised learning.

**Operant conditioning equivalent to reinforcement learning:**

Experiments conducted on animals under operant conditioning is similar to reinforcement learning used in ML.

**3. What is machine learning, and how does it work? What are the key responsibilities of machine learning?**

Machine Learning is a form of programming computers so that they learn from data instead of hard coded rules. Its key responsibility include automating various processes that need human like intelligence such as image classification, speech recognition, market forecasting, fraud/anomaly detection etc.

**4. Define the terms "penalty" and "reward" in the context of reinforcement learning.**

In reinforcement learning, the agent learns by receiving penalty or reward. A penalty is received for a behaviour that should be avoided and reward is received for a behaviour that is promoted. The goal is to minimize penalty and maximize reward.

**5. Explain the term "learning as a search"?**

The conceptualization of machine learning as a search helps to rationalize the use of ensembles, the spot checking of algorithms and the understanding of what is happening when algorithms learn.

**6. What are the various goals of machine learning? What is the relationship between these and human learning?**

The goal of ML is to learn from data, without being given explicit instructions as to how to do it. This is done utilizing previous experience. Human brain also learn from birth in a similar way, building on top of what is already learnt.

**7. Illustrate the various elements of machine learning using a real-life illustration.**

Image recognition or to be specific tagging. Once we are given with a photo and name of the person in that photo, we use that reference when we look at other photos to identify that person.

ML also uses similar concept. First, it is trained using available data. Then the performance is evaluated and once it is in production, new data is presented which is handled based on previously acquired knowledge.

**8. Provide an example of the abstraction method.**

The most widely used abstraction approaches are feature selection and feature discretization

**9. What is the concept of generalization? What function does it play in the machine learning process?**

Generalization is the concept of extracting useful info from training data, so that it can be used for similar but new data fetched into the system. Example, in a classification problem, generalizing the characteristics of a particular class so that when a new data with similar characteristics is encountered, it can be classified accordingly.

**10. What is classification, exactly? What are the main distinctions between classification and regression?**

Classification is identifying the label of a particular class. The main difference with regression is that, regression predicts a numerical value where as, classification predicts a categorical class name.

**11. What is regression, and how does it work? Give an example of a real-world problem that was solved using regression**.

Regression involves predicting a value of something based on information gathered on similar data. Example, predicting the price of a car based on its characteristics like make, model, etc.

**12. Describe the clustering mechanism in detail.**

Clustering is the grouping data into clusters based on similar characteristics. Example, grouping into male and female, youth, adult and senior etc.

**13. Make brief observations on two of the following topics:**

**i. Machine learning algorithms are used**

* Fraud detection or anomaly detection – identifying fraudulent credit card transactions.
* Recommendation systems – based on user category and their interests, recommend movies, videos, advertisements etc.

ii. Studying under supervision

iii. Studying without supervision

**iv. Reinforcement learning is a form of learning based on positive reinforcement.**

Reinforcement learning uses rewards and penalty to enforce learning. It uses positive reinforcement as whenever the system learns something correctly, it is rewarded. The aim is to maximize rewards.

This is particularly useful in AI fields like design of robots, self driving cars etc.