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

**Solution -** Learning is the process of acquiring new understanding, knowledge, behaviours, skills, values, attitudes, and preferences. Example would be Learning to drive a motor-car, typewriting, singing or memorizing a poem or a mathematical table, and music etc

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

**Solution –**

1) Learning through association - Classical Conditioning
2) Learning through consequences – Operant Conditioning
3) Learning through observation – Modelling/Concept Learning

Supervised learning is like concept learning where a person is required to classify new objects into existing categories, by matching the features of the new objects to examples in the categories.

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

**Solution -** Machine learning is a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy.

Machine learning algorithms use computational methods to “learn” information directly from data without relying on a predetermined equation as a model.

Key responsibilities of machine learning would be Regression, Classification, Clustering, Transcription, Machine translation, Anomaly detection, Synthesis & sampling, Estimation of probability density and probability mass function, Similarity matching, Co-occurrence grouping, Causal modelling, Link profiling

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

**Solution -** Reinforcement learning is all about gamifying the learning process. This type of machine learning uses a reward-penalty method to teach an AI system. If it makes the right move, it gets rewarded. If it makes a mistake, it receives a penalty.

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

**Solution -** Learning can be viewed as a search through the space of all sentences in a concept description language for a sentence that best describes the data.

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

**Solution -** The goal of ML, in simple words, is to understand the nature of learning, and to build learning capability in computers. To be more specific, there are three aspects of the goals of ML.

1. To make the computers smarter, more intelligent. The more direct objective in this aspect is to develop systems (programs) for specific practical learning tasks in application domains.

2. To develop computational models of human learning process and perform computer simulations. The study in this aspect is also called cognitive modelling.

3. To explore new learning methods and develop general learning algorithms independent of applications.

Relation between human learning and machine learning is that Humans acquire knowledge through experience either directly or shared by others. Machines acquire knowledge through experience shared in the form of past data.

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

**Solution -** There are three main elements to every machine learning algorithm, and they include:

Representation: what the model looks like; how knowledge is represented

Evaluation: how good models are differentiated; how programs are evaluated

Optimization: the process for finding good models; how programs are generated

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

**Solution -** Abstraction is defined as dealing with ideas instead of events. In the context of AI, that means worrying more about what the right algorithm is and less about how to implement it.

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

**Solution -** Generalization refers to your model's ability to adapt properly to new, previously unseen data, drawn from the same distribution as the one used to create the model.

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

**Solution -** In machine learning, classification refers to a predictive modelling problem where a class label is predicted for a given example of input data. The most significant difference between regression vs classification is that while regression helps predict a continuous quantity, classification predicts discrete class labels.

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

**Solution -** A regression is a statistical technique that relates a dependent variable to one or more independent (explanatory) variables. A regression model is able to show whether changes observed in the dependent variable are associated with changes in one or more of the explanatory variables.

Example: we can say that age and height can be described using a linear regression model.

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

**Solution -** Clustering or cluster analysis is a machine learning technique, which groups the unlabelled dataset. It can be defined as a way of grouping the data points into different clusters, consisting of similar data points. The objects with the possible similarities remain in a group that has less or no similarities with another group.

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

**i. Machine learning algorithms are used**

**Solution -** A machine learning algorithm is the method by which the AI system conducts its task, generally predicting output values from given input data.

**ii. Studying under supervision**

**Solution -** study or preparation of lessons by a class or group in the presence of a teacher who maintains order and may assist individual pupils in improving methods and habits of study. Analogous to Supervised learning.

**iii. Studying without supervision**

**Solution -** Unsupervised learning is the training of a machine using information that is neither classified nor labeled and allowing the algorithm to act on that information without guidance.

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

**Solution -** Reinforcement learning is a machine learning training method based on rewarding desired behaviors and/or punishing undesired ones.