

Question 1: What is the primary function of a sensor in a robot?

- a) Store electrical energy
- b) Detect changes in the environment and convert them to signals
- c) Amplify the robot's power output
- d) Provide structural support

Question 2: What does an actuator do in a robotic system?

- a) Stores data in memory
- b) Receives electrical signals and converts them into physical movement
- c) Measures temperature changes
- d) Acts as the central controller

Question 3: In the engineering design process, what is typically the first step?

- a) Making a prototype model
- b) Testing solutions
- c) Defining the problem to be solved
- d) Communicating results

Question 4: Which best describes the “brainstorming” step in design?

- a) Listing many possible solutions without judgment
- b) Building the final product
- c) Writing the project report
- d) Purchasing materials

Question 5: During design, what does “establishing criteria and constraints” involve?

- a) Identifying the requirements and limitations of the design
- b) Testing the prototype
- c) Getting patents
- d) Marketing the product

Question 6: Why do engineers build prototypes?

- a) To sell immediately
- b) To test how the design performs and identify improvements
- c) To finalise production
- d) To use all available materials

Question 7: After testing a prototype, engineers often:

- a) Launch mass production
- b) Refine and improve the design based on test results
- c) Ignore test data
- d) Discard the project entirely

Question 8: In a series electrical circuit, if one bulb fails, what happens to the others?

- a) All bulbs go out
- b) Only the failed bulb goes out
- c) Bulbs remain lit without change
- d) They get brighter

Question 9: In a parallel circuit, if one branch's bulb fails, what happens to the other bulbs?

- a) They continue to operate independently
- b) They all go out
- c) They reverse brightness
- d) The circuit explodes

Question 10: What is true about current in a series circuit?

- a) It is the same through each component
- b) It is zero everywhere
- c) It is different in each component
- d) It only flows in one bulb

Question 11: What is true about the voltage across components in a parallel circuit?

- a) Each branch has the same voltage across it
- b) The total voltage is zero
- c) Voltage drops to half in each branch
- d) Only one branch has voltage

Question 12: Which law states that the current through a conductor is proportional to the voltage across it?

- a) Newton's Law
- b) Ohm's Law
- c) Hooke's Law
- d) Coulomb's Law

Question 13: In a scientific experiment, what is the independent variable?

- a) The factor changed or controlled by the scientist
- b) The factor measured as the outcome
- c) The factor kept constant
- d) An error in measurement

Question 14: What is a dependent variable in an experiment?

- a) Random noise in data
- b) The factor changed by the researcher
- c) The factor that remains constant
- d) The outcome that is measured and depends on the independent variable

Question 15: What is a controlled variable?

- a) A factor kept the same throughout the experiment
- b) The main factor being tested
- c) A random factor
- d) The outcome measured

Question 16: What best describes a scientific hypothesis?

- a) A proven fact
- b) A random guess with no evidence
- c) A testable prediction based on prior knowledge
- d) A type of experiment

Question 17: A student tested two fertilizers (A – blue bars, B – red bars) and measured plant growth over 4 weeks. Which fertilizer produced greater plant growth by week 4?

- a) Fertilizer A
- b) Fertilizer B
- c) They produced the same growth
- d) Cannot be determined from the data given

Question 18: What is the innovation in technology?

- a) A type of computer virus
- b) Doing things exactly the old way
- c) The practical implementation of new or improved ideas and products
- d) A finished invention

Question 19: What does the Smog Free Tower do?

- a) Cleans pollution from the air
- b) Generates electricity
- c) Captures rainfall
- d) Produces smog

Question 20: Safer cookstoves are designed to reduce which problem?

- a) Fuel efficiency increase
- b) Cooking time only
- c) Food taste change
- d) Harmful indoor smoke and emissions

Question 21: What is AirCarbon plastic made from?

- a) Recycled water bottles
- b) Captured carbon emissions converted by microorganisms
- c) Tree cellulose
- d) Animal fat

Question 22: What is the purpose of the Seabin device?

- a) To collect plastic and trash from water
- b) To generate wave power
- c) To desalinate seawater
- d) To grow seaweed

Question 23: Wind turbine towers are built tall. Why are taller towers used?

- a) Wind speed is higher at greater heights
- b) To save on tower material cost
- c) Turbines prefer colder air
- d) To block sunlight

Question 24: Which sensor is best for measuring the precise rotational position of a robot joint (angle) in a control loop?

- a) Accelerometer
- b) Optical encoder
- c) Ultrasonic sensor
- d) Temperature sensor

Question 25: Two resistors, $6\ \Omega$ and $12\ \Omega$, are connected in parallel and this parallel combination is then placed in series with a $4\ \Omega$ resistor. What is the total resistance of the circuit?

- a) $6\ \Omega$
- b) $8\ \Omega$
- c) $10\ \Omega$
- d) $12\ \Omega$

Question 26: A hobby robot needs an actuator that accepts a PWM command and moves to — and holds — a precise angle (e.g., 0° – 180°) without an external controller. Which actuator is the typical choice?

- a) Solenoid
- b) DC motor without feedback
- c) Servo motor (RC-type)
- d) Hydraulic piston

Question 27: A student investigates two fertilizers (A, B) and three light levels (low, medium, high) to measure plant height. To test only whether fertilizer affects growth, which of the following must be treated as a controlled variable?

- a) Fertilizer type
- b) Light level
- c) Plant species
- d) Measurement instrument

Question 28: Prototypes are often built differently from the final product. Which of the following is true about prototypes?

- a) They are usually rough models made from different material
- b) They are sold directly to customers
- c) They use the exact final materials and finish
- d) They must be perfect

Question 29: AirCarbon is produced when microorganisms convert certain greenhouse gases into a polymer. Which greenhouse gas is commonly used as a feedstock in that microbial conversion?

- a) Methane (CH_4)
- b) Nitrogen (N_2)
- c) Argon (Ar)
- d) Helium (He)

Question 30: When resistors are connected in parallel, how does the total resistance compare to the individual resistances?

- a) It is equal to the sum of resistances
- b) It is greater than the largest resistor
- c) It is less than the smallest individual resistor
- d) It is equal to the largest resistor

Question 31: When resistors are connected in series, how does the total resistance change?

- a) It increases
- b) It decreases below each individual value
- c) It stays the same
- d) It becomes zero

Question 32: The power extracted by a wind turbine is proportional to the cube of wind speed ($P \propto v^3$). If a turbine produces power P at 6 m/s wind, what power will it produce at 12 m/s?

- a) $2P$
- b) $4P$
- c) $6P$
- d) $8P$

Question 33: In the series circuit ($R_1 = 3\text{ k}\Omega$, $R_2 = 10\text{ k}\Omega$, $R_3 = 5\text{ k}\Omega$), what is the total resistance?

- a) $18\text{ k}\Omega$
- b) $10\text{ k}\Omega$
- c) $15\text{ k}\Omega$
- d) $8\text{ k}\Omega$

Question 34: Why is electricity transmitted at high voltage over long distances?

- a) To increase current flow
- b) To reduce current and minimize energy loss
- c) For no particular reason
- d) To lower the voltage in homes

Question 35: What does a wind turbine do?

- a) Stores wind energy as heat
- b) Converts wind energy into electricity
- c) Pumps water uphill
- d) Generates fossil fuels

Question 36: What step in the scientific method comes immediately after forming a hypothesis?

- a) Performing an experiment
- b) Writing a hypothesis
- c) Stating a conclusion
- d) Publishing the results

Question 37: Which of the following is an example of a controlled variable?

- a) Keeping the room temperature constant during an experiment
- b) The outcome measured at the end
- c) The equipment used to measure
- d) A random fluctuation

Question 38: In a science lab, which safety equipment is most essential when working with chemicals?

- a) Ear plugs
- b) Flip-flops
- c) Sunglasses
- d) Safety goggles

Question 39: What do photovoltaic cells produce when exposed to sunlight?

- a) Heat only
- b) Wind
- c) Electricity
- d) Mechanical motion

Question 40: Which component of a robot is often referred to as its “brain”?

- a) Controller
- b) Motor
- c) Battery
- d) Frame

Question 41: In programming, what is a loop that repeats until a condition is met?

- a) While loop
- b) Function
- c) Variable
- d) Array

Question 42: What is CAD (Computer-Aided Design) commonly used for?

- a) Measuring temperatures
- b) Creating and modelling design prototypes
- c) Text editing
- d) Playing music

Question 43: What is 3D printing typically used for in engineering?

- a) Performing complex calculations
- b) Cooking food
- c) Creating prototypes from digital models
- d) Generating electricity

Question 44: Which electrical component stores energy in an electric field?

- a) Inductor
- b) Resistor
- c) Switch
- d) Capacitor

Question 45: Which of the following is an example of wearable technology?

- a) Smartwatch
- b) Mechanical abacus
- c) Gasoline car
- d) Typewriter

Question 46: What is a solar panel?

- a) A device that converts sunlight into electricity
- b) A rotating wind device
- c) A type of battery
- d) A reflective mirror

Question 47: The term “sustainable” most closely means:

- a) Capable of meeting present needs without harming future needs
- b) Cheap and easy
- c) Lasting forever
- d) New and innovative

Question 48: Which gas is the main contributor to the greenhouse effect?

- a) Nitrogen
- b) Oxygen
- c) Carbon dioxide
- d) Argon

Question 49: An invention that significantly improves quality of life is often called a form of:

- a) Fantasy
- b) Myth
- c) Innovation
- d) Legend

Question 50: What is the function of a fuse in an electrical circuit?

- a) To prevent excessive current flow by “blowing”
- b) To increase current
- c) To convert AC to DC
- d) To store energy

Question 51: Which material is commonly used for low-cost prototype models?

- a) Cardboard or plastic
- b) Diamonds
- c) Glass panels
- d) Gold

Question 52: Which instrument measures the electric current in a circuit?

- a) Ammeter
- b) Voltmeter
- c) Thermometer
- d) Odometer

Question 53: In programming, what is a “bug”?

- a) A small insect
- b) An error or flaw in the code
- c) A new software tool
- d) A programming language

Question 54: Which sensor detects obstacles by emitting ultrasonic sound waves?

- a) Temperature sensor
- b) Infrared sensor
- c) Ultrasonic sensor
- d) Light sensor

Question 55: What kind of diagram shows the top view of an object?

- a) Section view
- b) Elevation view
- c) Plan view
- d) Perspective view

Question 56: A fair scientific test must have:

- a) Only one independent variable changed
- b) No controls at all
- c) Multiple independent variables at once
- d) No hypothesis

Question 57: Which circuit symbol is represented by a zigzag line?

- a) Resistor
- b) Battery
- c) Switch
- d) Diode

Question 58: A technology that displaces older ones and significantly changes an industry is called:

- a) Disruptive
- b) Incremental
- c) Obsolete
- d) Conformist

Question 59: Which is a major benefit of using renewable energy?

- a) Decreasing energy efficiency
- b) Unlimited pollution
- c) Rapid depletion of resources
- d) Reducing greenhouse gas emissions

Question 60: Which practice is most sustainable for the environment?

- a) Overexploiting natural resources
- b) Burning fossil fuels recklessly
- c) Single-use plastics everywhere
- d) Recycling materials to reduce waste

ROUGH WORK

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