Q1 (1 mark)
The variable that is changed

Q2 (1 mark)
Mitochondria

Q3 (1 mark)
Newton (N)

Q4 (1 mark)
Diffusion

Q5 (1 mark)
(Light) microscope

Q6 (1 mark)
Longitudinal wave

Q7 (1 mark)
7

Q8 (1 mark)
Gravity

Q9 (1 mark)
Ampere (A)

Q10 (1 mark)
Only one variable is changed

Q11 (1 mark)
Line graph

Q12 (1 mark)
Oxygen

Q13 (1 mark)
Thermometer

Q14 (1 mark)
A statement about what may happen

Q15 (1 mark)
Exothermic reaction

Q16 (1 mark)
Mg

Q17 (1 mark)
m/s

Q18 (1 mark)
Cell membrane

Q19 (1 mark)
To identify hazards and reduce risks

Q20 (1 mark)
Speed = distance ÷ time

Q21 (2 marks)
Improves reliability (1)
Allows anomalies to be identified / mean calculated (1)

Q22 (2 marks)
Different species photosynthesise at different rates (1)
Keeps investigation fair and acts as a control variable (1)

Q23 (3 marks)
Physical changes are reversible (1)
Chemical changes form new substances (1)
Combustion is chemical while melting is physical (1)

Q24 (3 marks)
Other scientists check evidence (1)
Mistakes can be identified (1)
Improves reliability of scientific knowledge (1)

Q25 (2 marks)
New evidence may be discovered (1)
DNA models developed over time using evidence (1)

Q26 (3 marks)
Acids/alkalis can splash (1)
Could damage eyes (1)
Eye protection reduces risk (1)

Q27 (3 marks)
Temperature affects particle movement (1)
Diffusion speed changes with temperature (1)
Keeps investigation fair so temperature is a control variable(1)

Q28 (3 marks)
Temperature changes continuously (1)

Line graphs show trends clearly (1)
Points can be connected (1)

Q29 (3 marks)
Random errors vary unpredictably (1)
Systematic errors affect all readings similarly (1)
Systematic errors reduce accuracy (1)

Q30 (3 marks)
Habitats are too large to count every organism (1)
Sampling saves time (1)
Provides representative data (1)

Q31 (3 marks)
Scientists use common units worldwide (1)
Results easier to compare (1)
Improves communication of data (1)

Q32 (3 marks)
Improves reliability (1)
Allows mean values to be calculated (1)
Helps identify anomalies (1)

Q33 (4 marks)
Independent variable: light intensity (1)
Dependent variable: rate of photosynthesis/bubbles produced (1)
Any valid control variable (1)
Second valid control variable (1)

Q34 (4 marks)
Repeat measurements (1)
Calculate mean (1)
Use same exercise duration (1)
Use same participant/conditions (1)

Q35 (4 marks)
Volume affects diffusion time (1)
Controls variables (1)
Only temperature should change (1)
Improves reliability (1)

Q36 (4 marks)
Different springs extend differently (1)
Controls variables (1)
Keeps investigation fair (1)
Improves reliability (1)

Q37 (4 marks)
22 + 24 + 26 = 72 (1)
72 ÷ 3 = 24°C (1)
Correct unit of measurement (1)

Q38 (4 marks)
Ramp height affects speed (1)
Speed affects friction investigation (1)
Controls variables (1)
Keeps test fair (1)

Q39 (4 marks)
Surface area affects evaporation rate (1)
More exposed particles can escape (1)
Controls variables (1)
Keeps investigation fair (1)

Q40 (4 marks)
Place quadrat randomly (1)
Count plants inside quadrat (1)
Repeat in several areas (1)
Calculate averages/patterns (1)

Q41 (4 marks)
Acid concentration affects reaction rate (1)
Controls variables (1)
Only magnesium amount should affect results (1)
Improves validity (1)

Q42 (4 marks)
Repeat measurements (1)
Calculate mean (1)
Use same starting temperature (1)
Use same volume of water (1)

Q43 (4 marks)
Voltage affects current (1)
Controls variables (1)
Only resistance should change (1)
Keeps investigation fair (1)

Q44 (4 marks)
Different sound sources produce different volumes/frequencies (1)
Controls variables (1)
Fair comparison of materials (1)
Improves reliability (1)

Q45 (4 marks)
Reduces effect of anomalies (1)
Provides representative data (1)
Improves reliability (1)
More valid conclusions (1)

Q46 (4 marks)
pH affects enzyme activity (1)
Controls variables (1)
Only temperature should affect results (1)
Keeps investigation fair (1)

Q47 (4 marks)
Different volumes require different energy (1)
Controls variables (1)
Fair comparison of foods (1)
Improves validity (1)

Q48 (4 marks)
Plant height is continuous data (1)
Scatter graphs show relationships/trends (1)
Bar charts are for categories (1)
Scatter graph more suitable (1)

Q49 (4 marks)
Light intensity affects photosynthesis rate (1)
Controls variables (1)
Only carbon dioxide concentration should change (1)
Keeps investigation fair (1)

Q50 (4 marks)
Systematic error (1)
Thermometer faulty each time (1)
All readings too high (1)
Results less accurate (1)

Q51 (6 marks)

Level 1 (1–2 marks)
Basic statements about photosynthesis investigation
Limited use of scientific method

Level 2 (3–4 marks)
Mentions variables and measurements
Some understanding of reliability or evaluation
Some scientific terminology used

Level 3 (5–6 marks)
Clear explanation of planning and carrying out investigation
Control variables identified
Repeat measurements and graphing explained
Evaluation of errors and improvements included
Logical scientific reasoning throughout

Model Answer:
The student should investigate how temperature affects photosynthesis by changing the temperature of the water around the pondweed. The rate of photosynthesis could be measured by counting oxygen bubbles produced each minute/ using a gas syringe.. Control variables such as light intensity, pondweed species and water volume should be kept constant. The investigation should be repeated and mean results calculated to improve reliability. Results should be shown on a graph to identify patterns. Errors such as inaccurate temperature readings should be evaluated and improvements suggested.

Q52 (6 marks)

Level 1 (1–2 marks)
Simple statements about springs or force
Limited scientific detail

Level 2 (3–4 marks)
Mentions measurements and graphs
Some understanding of reliability or conclusions

Level 3 (5–6 marks)
Clear explanation of collecting accurate measurements
Appropriate graph discussed
Patterns and anomalies analysed
Reliable conclusions linked to evidence
Scientific terminology used correctly

Model Answer:
A student would test the relationship between force and extension by hanging different masses on a spring and measuring the extension using a ruler. The force is calculated using mass × gravity and recorded in newtons. The same spring and ruler are used each time to keep the test fair. Each measurement is repeated and a mean is calculated to improve reliability and reduce random errors. The results are recorded in a table and plotted on a force–extension graph, which should show a proportional relationship if Hooke's Law is correct, allowing a valid conclusion to be drawn.

Q53 (6 marks)

Level 1 (1–2 marks)
Basic statements about acid rain or plants
Limited scientific understanding

Level 2 (3–4 marks)
Mentions observations and measurements
Some understanding of control variables or graphs

Level 3 (5–6 marks)
Clear explanation of scientific investigation methods
Control variables identified
Use of graphs/tables explained
Reliability and validity considered
Conclusions linked to evidence

Model Answer:
A scientist would grow identical plants in different pH conditions to model acid rain and measure their growth over time. All other variables such as light, water, soil type and temperature would be kept the same so only pH affects the results. The investigation would be repeated and mean values calculated to improve reliability and reduce random errors. The results would be plotted on a graph to show any pattern between acidity and plant growth, and any anomalies could be identified and considered when drawing conclusions.

Q54 (6 marks)

Level 1 (1–2 marks)
Basic statements about insulation investigation
Limited understanding of scientific improvements

Level 2 (3–4 marks)
Mentions repeats or measurements
Some understanding of accuracy or safety

Level 3 (5–6 marks)
Clear explanation of improving repeatability and reproducibility
Accurate measurements discussed
Risk assessment and safety considered

Control variables identified
Logical scientific reasoning throughout

Model Answer:
The student should use identical beakers containing the same volume of hot water and wrap them in different insulation materials. Temperature should be measured regularly using the same thermometer. Repeat measurements should be taken and averages calculated to improve repeatability. Other students could repeat the investigation to test reproducibility. A risk assessment should identify hazards such as hot water spills. Keeping variables such as starting temperature and beaker size constant improves accuracy and fairness.