Electrical fault finding

Just my thoughts on what and how you may be able to approach and break down electrical fault finding.

Always remember what training you have undergone or make sure you are under supervision if you do not feel confident.
Use approved terminology wherever possible (if still in training and reading this for exams), make a point of ensuring that you are working dead at all times, minimise the live testing required.
Always work logically in a fault diagnosis situation.
Consider the circuit design and function to ensure you know what items you are testing and why you are testing.
Also you should be aware of the nature and range of values you expect to find and the units in which those values are measured.

Loss of supply.

This is rather wide ranging and could cover local or installation wide loss of supply.
An initial practical assessment of items of functional equipment could indicate the range of the loss of supply.
If the entire installation has lost power then a test for voltage with an approved voltage indicator at the closest accessible point to the incoming supply should indicate if the fault lies with the supply equipment or the installation equipment. It will also confirm the supply polarity if live.
If a protective device has operated this should be, on a well designed system, the closest protective device (of that particular type e.g. MCB or RCD) to the fault.
Depending of the type of protective device the testing on the safely isolated circuit may be low ohm continuity to determine a short circuit fault or an overload fault where a circuit breaker has tripped, or insulation resistance testing, possibly followed by low ohm continuity testing, to determine an earth fault where an RCD has tripped.

Resetting or replacing a protective device before resolving the fault would be generally a futile exercise and may be considerably dangerous. Do not energize any circuit unless you know it is safe to do so. It is our responsibility as skilled/competent electricians to ensure the safety of others.

Overload

Where a circuit breaker has tripped due to overcurrent an initial assessment of the load of connected equipment may permit an initial diagnosis.
Failing that a low ohm continuity test on the safely isolated circuit between line and neutral would allow calculation of the expected current draw using I=V/R. Further splitting the circuit in stages and testing would narrow down the area to the point of the fault.
It should be noted that electronic equipment may give a false indicating of the connected load.
Where accessories get hot (e.g. incandescent lights or heaters) the measured resistance when cold will be lower than when the circuit is in operation.

Short circuit and earth fault

A typical short circuit is someone putting a nail or a screw through a cable so ask the home owner/manager/caretaker of the property if any works have been carried out recently. This can speed up the fault finding process and save us all a lot of frustration. Testing of the safely isolated circuit with a low ohm continuity tester and splitting down the circuit logically and testing would narrow down the area to the point of the fault, splitting the ring final circuit for example or breaking the radial circuit at the estimated half way point.

Earth faults, meaning a sufficiently low resistance to permit an RCD to trip, may be possible to determine with a suitably accurate insulation resistance tester. Reversed polarity would not normally cause short circuits but would generate a dangerous situation by leaving equipment live when switched off.

Transient voltage

Often a high transient voltage can be generated from electronic equipment producing harmonic currents or unstable voltage conditions, supply network faults, high voltage atmospheric conditions (lightning) or rapid heavy load switching (that can also cause transient low voltage on the supply).
Gaining reported information on the weather or equipment operating conditions at the time of the fault(s) may help with the diagnosis.
A data logger may be employed to determine voltage transients experienced over time and the speed, timing and regularity of the transients may permit a diagnosis of the cause.

Loss of phase / line

Loss of line in a single phase system will be similar to loss of supply.
Loss of a single phase in a three phase system can be indicated by motor faults, poor or non existent stating and irregularity in operation.
Continuity tests on a safely isolated circuit can identify the break point in a line conductor.
Voltage testing using a suitably rated volt meter with probes meeting GS38 requirements to determine the voltage at each phase should identify the faulty phase. Each phase should be a nominal 230V to earth and a nominal 400V to another phase.

Incorrect phase rotation

Incorrect phase rotation can be identified as it can cause motors to run in reverse.
Test with a phase rotation tester at the supply and load ends of a circuit, this will confirm incorrect phase rotation if the two results do not match.
If the circuit is safely isolated then a low ohm continuity check of the line conductors from supply to load can identify reversed phases.

High resistance joints

High resistance joints are characterised by an increased temperature at the point of resistance due to power dissipation in that resistance and in severe cases heat damage and burning of the accessories and cables, which may then be identified by sight and smell.
Use of thermographic surveying may identify such areas of increased temperature.
Logical staged measurement of low ohm continuity on a safely isolated circuit will also permit identification of the point of the fault.

Component, accessory or equipment failure

Component, accessory or equipment faults can be identified by loss of power and/or intermittent or uncharacteristic operation of equipment.
Total loss of power to equipment can be narrowed down to the point of fault by the use of voltage indicating equipment, suitable for the supply voltage, at accessible points on the supply route up to the equipment.
Monitoring or receiving accurate reports of the nature and frequency of intermittent or uncharacteristic operations can give an indication of the type and location of the fault.
Component or equipment failure can be determined by a logical step by step approach that is dependent on the nature of the equipment and the manufacturer's instructions.
Wherever possible, diagnosis techniques should be restricted to work on safely isolated equipment.
Visual inspection can also identify burnt out components and damaged contacts.

I should stress that these are only my thoughts about possible ways of responding to fault finding and are not approved answers for C&G exams.
They are not necessarily correct, particular requirements for exams on which you have been trained could well override these thoughts.
The above is useful information and a step by step breakdown for fault finding and should be used as such.

Thinking is also a good method of fault diagnosis!!!