

Form 5 Electrostatics Revision Items

Item 1

In a bustling physics class, a student rubs a polythene rod with fur to show negative charging, but it fails to attract paper bits. The humid Kampala air causes charge leakage, and handling the rod with sweaty hands dissipates the charge. A nearby metal sphere mysteriously attracts paper, baffling peers. The teacher must unravel the mystery and fix the demo.

Tasks:

1. Why does humid air prevent the rod from attracting paper bits?
2. What two precautions ensure the rod retains its charge?
3. How does the metal sphere gain an induced charge to attract paper?
4. How can a gold leaf electroscope confirm the rod's negative charge?

Item 2

At a school science fair, a student's electrophorus demo fails to charge a metal disc positively, disappointing onlookers. The ebonite base is charged, but the student skips earthing the disc during induction. A cracked insulating handle leaks charge to the student's hand. The teacher needs to salvage the demonstration.

Tasks:

1. Why does skipping earthing prevent the disc from gaining positive charge?
2. What steps charge the disc positively using the electrophorus?
3. How does the cracked handle cause charge loss?
4. How can the electrophorus setup be tested to ensure proper charging?

Item 3

During a stormy night, a school's lightning conductor fails, causing a power surge that fries computers. The copper strip is disconnected from the ground plate, and blunt spikes reduce corona discharge. Sparks flicker near the spikes before the failure. The headteacher demands a fix to protect the school.

Tasks:

1. Why do blunt spikes weaken the lightning conductor's effectiveness?
2. How does the disconnected strip lead to power surges?
3. Why are sparks seen near the spikes before failure?
4. What does a functional lightning conductor diagram show?

Item 4

In a dusty lab, a charged pear-shaped conductor sparks at its sharp end, startling students during an experiment. It rests on a conductive table, leaking charge, and the dry air amplifies corona discharge. The teacher must explain the sparks. Students want to stop the disruptive sparking.

Tasks:

1. Why does the sharp end produce sparks?
2. How does the conductive table cause charge loss?
3. What modification prevents sparking in this setup?
4. How is charge distributed on the pear-shaped conductor?

Item 5

A gold leaf electroscope behaves erratically when a charged rod is brought near, frustrating students in a humid lab. The metal case isn't earthed, picking up stray atmospheric charges, and touching the brass cap discharges it. Results are inconsistent. The teacher must restore reliability.

Tasks:

1. Why does an unearthed case cause erratic divergence?
2. How does touching the brass cap affect the electroscope's charge?
3. What two improvements ensure consistent results in humidity?
4. How can the electroscope be charged negatively by induction?

Item 6

During a lab session, a student tries to charge two metal spheres oppositely by induction, but both end up with the same charge. The spheres aren't separated during the process, and the charged rod is removed too early. The insulating stand is properly set. The teacher must correct the error.

Tasks:

1. Why do both spheres gain the same charge if not separated?
2. What steps charge the spheres oppositely by induction?
3. Why is the insulating stand critical for this experiment?
4. What are the charge signs if a negative rod is used correctly?

Item 7

In a lively demo, a negatively charged ebonite rod attracts a neutral metal sphere, puzzling students who expect only charged objects to interact. The sphere sits on an insulating stand, and the rod is held close without touching. The attraction fades quickly. The teacher must clarify the phenomenon.

Tasks:

1. Why is the neutral sphere attracted to the charged rod?
2. How are charges distributed on the sphere near the rod?
3. How can a gold leaf electroscope show this induced charge?
4. How can the attraction be demonstrated without direct contact?

Item 8

A student tests a graphite rod with a positively charged electroscope, expecting it to be an insulator, but the leaf collapses, surprising her. The dry lab prevents humidity interference, yet graphite's conductivity is unexpected. The setup is correct. The teacher must explain and verify.

Tasks:

1. Why does the graphite rod cause the leaf to collapse?
2. How can an electroscope distinguish conductors from insulators?
3. Which two conductors and insulators are listed in the PDF?
4. How can a metal can and electroscope confirm graphite's conductivity?

Item 9

In a group project, students rub a glass rod with silk and a polythene rod with fur, expecting equal but opposite charges, but get unequal results. Handling the rods during rubbing leaks charge. Electroscope divergences vary widely. The teacher must ensure balanced charging.

Tasks:

1. Why are the charges on the rods unequal after rubbing?
2. How can a metal can and electroscope show equal but opposite charges?
3. What precaution ensures equal charge transfer during rubbing?
4. How can the rods' charges be compared using an electroscope?

Item 10

A polythene rod rubbed with fur picks up paper bits but drops them quickly, confusing students in a dry lab. Touching the rod after rubbing neutralizes its charge. The papers fall due to this neutralization. The teacher must explain and extend the effect.

Tasks:

1. Why does the polythene rod initially attract paper bits?
2. Why do the papers fall after contacting the rod?
3. What prolongs the rod's ability to pick up papers?
4. How can a neutral electroscope test the rod's charge?

Item 11

A Van de Graaff generator sparks wildly instead of building steady charge, alarming students at a science expo. The silk belt is misaligned, and blunt lower electrode spikes reduce ionization. Poor sphere insulation leaks charge. The teacher must restore smooth operation.

Tasks:

1. Why do blunt spikes reduce charge buildup?
2. How does a misaligned silk belt affect charge transfer?
3. What two fixes ensure steady charge without sparks?
4. What does a working Van de Graaff generator diagram show?

Item 12

A student's shielding demo fails when a charged rod outside a hollow can causes the inside electroscope to diverge, confusing peers. The can isn't earthed, allowing field penetration, and sits on a conductive table. The setup is flawed. The teacher must correct it.

Tasks:

1. Why does the unearthed can fail to shield the electroscope?
2. What steps ensure effective electrostatic shielding?
3. How does the conductive table affect the demo?
4. How are charges distributed on an earthed can with a positive rod outside?

Item 13

A student attempts to charge a metal sphere positively by contact with a glass rod, but it stays neutral, frustrating her. Handling the rod leaks charge, and the sphere is on a conductive wooden table. The experiment fails repeatedly. The teacher must fix the setup.

Tasks:

1. Why does handling the rod prevent sphere charging?
2. What ensures successful contact charging?
3. How does the conductive table cause charge loss?
4. How can the sphere's charge be verified after contact?

Item 14

In a Faraday's ice pail experiment, the electroscope's leaf diverges when a charged sphere is lowered into the can but collapses when withdrawn, surprising students. They expect the can to retain charge. The setup is correct. The teacher must clarify the results.

Tasks:

1. Why does the leaf diverge with the sphere inside?
2. Why does the leaf collapse when the sphere is withdrawn?
3. What does Faraday's experiment conclude about charge location?
4. How can an experiment show charge resides on the can's outer surface?

Item 15

A charged pear-shaped conductor sparks at its sharp end due to high charge density, worrying students in a dry lab. It's on an insulating stand, but a mishandled proof plane gives inconsistent readings. Corona discharge is noticeable. The teacher must stabilize the experiment.

Tasks:

1. Why is charge density higher at the sharp end?
2. How should a proof plane measure charge distribution?

3. What precaution ensures accurate proof plane use?
4. How do electric field lines appear around the conductor?

Item 16

In a humid rural lab, a gold leaf electroscope barely detects charge, frustrating students. A charged rod causes weak leaf divergence, and a dirty brass cap reduces sensitivity. The case is earthed, but results are poor. The teacher must improve detection.

Tasks:

1. Why does humidity weaken the electroscope's performance?
2. How does a dirty brass cap affect charge detection?
3. What two fixes improve accuracy in humid conditions?
4. How can the electroscope be charged positively by contact?

Item 17

A village house without a lightning conductor catches fire during a storm, terrifying residents. A negatively charged cloud induces positive charges on the tin roof, sparking a fire. Poorly conducting mud walls worsen damage. The homeowner needs protection.

Tasks:

1. Why does the charged cloud cause a fire on the roof?
2. How does a lightning conductor prevent such damage?
3. What shows charge flow in a lightning conductor diagram?
4. How can the lightning conductor's effectiveness be tested?

Item 18

A student tries to charge two metal spheres positively by induction but gets negative charges, confusing the class. The negatively charged rod is misplaced, and earthing is mistimed. The insulating stand is correct. The teacher must correct the procedure.

Tasks:

1. Why do the spheres gain negative charges instead?
2. What steps charge both spheres positively?
3. Why is earthing timing critical in this process?
4. How can the spheres' charges be verified after induction?

Item 19

A student's proof plane gives inconsistent charge readings on a pear-shaped conductor, frustrating the lab group. The conductive handle leaks charge, and the electroscope isn't discharged between tests. The conductor is insulated. The teacher must fix the setup.

Tasks:

1. Why does the conductive handle cause inconsistent results?
2. How should the proof plane be used correctly?
3. What ensures accurate measurements between tests?
4. How is charge transferred from conductor to electroscope?

Item 20

A driver gets a painful static shock touching the car's metal door after driving on a dry day in Jinja. Synthetic seats and rubber tires build charge. The shock occurs when grounding. The driver wants to prevent future shocks.

Tasks:

1. Why does the car build up static charge during driving?
2. How can a metallic chain prevent static shocks?
3. What other method reduces static charge buildup?
4. How can the car's charge be neutralized before exiting?

Item 21

In a dry lab, a student struggles to identify a material's charge with a positively charged electroscope, as divergence decreases. The material is a conductor, causing unexpected results. The student is puzzled. The teacher must clarify the outcome.

Tasks:

1. Why does the leaf's divergence decrease with the material?
2. How can the material's charge sign be confirmed?
3. How is the material's conductivity tested?
4. What is one use of the gold leaf electroscope?

Item 22

Students rub insulators for a demo, expecting equal but opposite charges, but one charges weakly. Handling during rubbing and humid air leak charge. Electroscope divergence is inconsistent. The teacher must improve the technique.

Tasks:

1. Why do the insulators have unequal charges after rubbing?
2. How can equal but opposite charges be verified?
3. What two precautions improve charging by friction?
4. How can the insulators' charges be tested for equality?

Item 23

A charged conductor on a slightly conductive wooden table loses charge quickly, disappointing students in a humid lab. The charge fails to attract paper bits. Leakage ruins the demo. The teacher must prevent charge loss.

Tasks:

1. Why does the conductor lose charge on the table?
2. How can the conductor be charged without leakage?
3. What prevents charge loss in this setup?
4. How does charge flow from the conductor to the table?

Item 24

A Gulu factory's electrostatic painting system leaves uneven paint on metal parts due to corona discharge at sharp edges. Poor earthing and high spray gun charge worsen the issue. Product quality suffers. The manager needs solutions.

Tasks:

1. Why does corona discharge cause uneven painting?
2. How does earthing prevent discharge in painting?
3. What two fixes improve paint coverage?
4. How does the electric field look around a sharp edge?

Item 25

A gold leaf electroscope gives inconsistent charge readings due to a dirty brass cap, frustrating students in a dry lab. Residual charges linger from not discharging between tests. Measurements are unreliable. The teacher must standardize the setup.

Tasks:

1. Why does a dirty brass cap cause inconsistent divergences?
2. How can charges be compared accurately?
3. What ensures consistent electroscope results?
4. How can the electroscope be calibrated with known charges?

Item 26

A student charges a hollow can by induction, but charge resides inside, contradicting expectations. The can isn't earthed, and the rod touches it briefly. The electroscope shows internal charge. The teacher must correct the method.

Tasks:

1. Why does the charge reside inside the can?
2. What charges the can's outer surface by induction?
3. What does Faraday's experiment conclude about hollow conductors?
4. How is charge distributed on a correctly charged can?

Item 27

Books with synthetic covers in a Mbarara library attract dust due to static charge, annoying staff. Dry air and wooden shelves worsen buildup, and rubbing covers increases charge. The librarian needs to reduce dust attraction.

Tasks:

1. Why do synthetic covers build static charge?
2. How does rubbing covers increase the charge?
3. What two methods reduce static on books?
4. How can static charge on books be neutralized?

Item 28

A student charges a metal sphere negatively by induction but gets a positive charge, confusing peers. The positively charged rod is removed before earthing, and the sphere is insulated. The result is unexpected. The teacher must fix it.

Tasks:

1. Why does the sphere gain a positive charge?
2. What charges the sphere negatively by induction?
3. Why is the insulating stand important here?
4. How can the sphere's charge be confirmed after induction?

Item 29

During a thunderstorm, a gold leaf electroscope diverges randomly without a charged object, alarming students. The metal case isn't earthed, and open windows allow atmospheric charges. Humidity is high. The teacher must stabilize the setup.

Tasks:

1. Why does the electroscope diverge randomly in the storm?
2. How does earthing the case prevent interference?
3. What precaution improves electroscope use in storms?
4. How can atmospheric charges be detected?

Item 30

Two insulators rubbed together produce unequal charges, disappointing students in a dry lab. Uneven rubbing and handling leak charge. Electroscope divergences vary. The teacher must ensure equal charging.

Tasks:

1. Why do the insulators gain unequal charges?
2. How can equal but opposite charges be confirmed?
3. What ensures uniform charge during rubbing?
4. How can the insulators' charges be compared accurately?

Item 31

A charged metal sphere on a slightly conductive stand loses charge rapidly in a humid lab, frustrating students. Paper attraction fails due to leakage. The demo is ruined. The teacher must prevent charge loss.

Tasks:

1. Why does the sphere lose charge in humid air?
2. How can the sphere retain its charge?
3. What prevents charge leakage in this setup?
4. How does charge leak through the stand and air?

Item 32

A Kampala bicycle factory's electrostatic painting leaves gaps on frames, hurting sales. Poor frame earthing causes charge buildup, and high spray gun charge triggers corona discharge. Paint coverage is uneven. The factory needs fixes.

Tasks:

1. Why does poor earthing cause painting gaps?
2. How does corona discharge affect paint application?
3. What two improvements ensure even painting?
4. How does the electric field look between gun and frame?

Item 33

A gold leaf electroscope is overly sensitive, diverging with tiny charges, complicating lab measurements. The thin leaf amplifies responses, and the unearthed case picks up stray charges. The dry lab is ideal. The teacher must adjust sensitivity.

Tasks:

1. Why does a thin leaf increase electroscope sensitivity?
2. How does earthing the case improve accuracy?
3. What reduces the electroscope's sensitivity?
4. How can a small charge be measured accurately?

Item 34

A student charges a metal can by contact, but charge concentrates at a sharp edge, sparking dangerously. The rod isn't held long enough, and electroscope divergence is weak. The can is insulated. The teacher must ensure uniform charging.

Tasks:

1. Why does charge concentrate at the sharp edge?
2. What ensures uniform contact charging?
3. What prevents sparking at the sharp edge?

4. How is charge density distributed on the can?

Item 35

Students' synthetic school uniforms cling after machine drying, causing discomfort in dry weather. The unearthed dryer builds static, and rubbing clothes worsens cling. The issue persists. Students need to eliminate static.

Tasks:

1. Why do synthetic clothes gain static charge?
2. How can earthing the dryer reduce cling?
3. What two methods prevent static cling?
4. How can static charge on clothes be neutralized?

Item 36

An electrophorus produces weak charge on a metal disc, disappointing students at a science club. The ebonite base is undercharged from brief rubbing, and the disc is earthed too long. The insulating handle is fine. The teacher must optimize it.

Tasks:

1. Why does an undercharged base limit disc charge?
2. What is the correct earthing timing for the disc?
3. How can the ebonite base be fully charged?
4. How can the disc's charge be verified after charging?

Item 37

A charged conductor is neutralized by a neutral rod's sharp end, surprising students in a lab. The conductor is insulated, and corona discharge at the rod's tip causes charge loss. The result is unexpected. The teacher must explain.

Tasks:

1. Why does the rod's sharp end neutralize the conductor?
2. How does corona discharge cause this neutralization?
3. What prevents the conductor's charge loss?
4. How do charges interact between rod and conductor?

Item 38

Students comparing charges on two conductors get inconsistent electroscope divergences, confusing the class. Both conductors touch the cap simultaneously, mixing charges. The electroscope isn't discharged. The teacher must ensure accuracy.

Tasks:

1. Why does simultaneous contact cause inconsistent results?

2. What compares charges accurately with the electroscope?
3. What ensures reliable charge comparison?
4. How can the electroscope be standardized for comparison?

Item 39

A factory's lightning conductor in Mbale has rusted spikes and a loose copper strip, weakening storm protection. Sparks show partial corona discharge, but equipment damage occurs. Safety is compromised. The manager needs urgent fixes.

Tasks:

1. Why do rusted spikes reduce conductor effectiveness?
2. How does a loose copper strip risk damage?
3. What two maintenance steps restore protection?
4. What does a maintained lightning conductor diagram show?

Item 40

A student induces charge on a sphere, but the charged rod loses charge, weakening the experiment in a dry lab. The rod is held too close, causing air ionization, and earthing is mistimed. The insulated stand is correct. The teacher must improve it.

Tasks:

1. Why does the rod lose charge during induction?
2. What ensures correct sphere charging by induction?
3. What prevents rod charge loss in this setup?
4. How can the sphere's charge be confirmed after induction?