

# **Unit 1**

# **Subject Verb Agreement**

**Semester 2 – Advanced Communication and Interpersonal Skills**

**(03010002HM01)**

# Learning Objectives

*In this session, students will :*

1. Identify the subject and verb of a sentence.
2. Recall and explain the rules of subject–verb agreement in clear and effective communication.
3. Apply these rules correctly in academic and technical writing.
4. Analyze and correct errors in written work (peer or sample texts) for subject–verb agreement consistency and justify corrections.
5. Draft error- free technical paragraphs /lab reports or essays that demonstrate mastery of subject - verb agreement rules.

# Topics to be covered

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1. What we already know:
  - a) Countable & Uncountable Nouns    (b) Singular Verb and Plural Verb
1. Introduction : What is Subject - Verb Agreement (SAV)?
2. 17 Basic Rules of SVA
4. Advance Cases of SVA
5. Common Agreement Errors
6. How to overcome SVA errors?
7. Why does it matter?
8. Activities
9. Assignment
10. Learning Outcomes

# 1. What we already know

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# What we already know

## 1.1. What are Countable Nouns?

**Countable nouns** are objects, people, or things that can be counted individually or separately. They take indefinite articles ‘a/an’. There are two forms of countable nouns: *singular nouns* and *plural nouns*.

<i>Example: Countable Nouns</i>	<i>Singular Nouns</i>	<i>Plural Nouns</i>
<i>Bench (An Object)</i>	<i>A bench</i>	<i>Benches</i>
<i>Friend (A person)</i>	<i>A friend</i>	<i>Friends</i>
<i>Engineer (A profession)</i>	<i>An engineer</i>	<i>Engineers</i>

# What we already know

## 1.2. What are Uncountable Nouns?

**Uncountable nouns** are substances, qualities or concepts that can not be counted individually or separately. They do not take indefinite articles ‘a/an’.

<i>Example: Uncountable Nouns</i>	<i>Quantifiers</i> <i>(Some, Much, Little, A little, A bit of, A good/great deal of, Any, A lot of, Less)</i>	
<i>Water, Air (Substance)</i>	<i>Some water</i>	<i>A little bit of air</i>
<i>Information, Time, Money (Concept)</i>	<i>Little information</i>	<i>A great deal of money</i> <i>Less time</i>
<i>Happiness, Wisdom (Quality)</i>	<i>A lot of happiness</i>	<i>Any wisdom</i>

# Let's Practice it...

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# Let's Practice it...

**Is it Countable Noun or Uncountable Noun?**

**PEN**

**Countable Noun**

**Uncountable Noun**

# What we already know

## 1.1. What is a Singular Verb?

A **singular verb** refers to an action performed by a single subject.

- ❖ If the subject is singular, the verb must be singular.

<i>Example:</i>	<i>Subject</i>	<i>Verb</i>
1. <i>My brother <u>is</u> an engineer.</i>	<b>Brother</b> (3rd Person Singular)	<u>is</u> (‘be’ Verb Singular)
2. <i>Tina <u>likes</u> to read novels.</i>	<b>Tina</b> (3rd Person Singular)	<u>likes</u> (Main Verb Singular)

\* Subjects are in bold typeface and verbs are underlined

# What we already know

## 1.2. What is a Plural Verb?

A **plural verb** indicates an action carried out by more than one subject.

- ❖ If the subject is plural, the verb must be plural.

<i>Example:</i>	<i>Subject</i>	<i>Verb</i>
1. <i>My friends <u>are</u> engineers.</i>	<b><i>Friends</i></b> <i>(3rd Person Plural)</i>	<u><i>are</i></u> <i>('be' Verb Plural)</i>
2. <b><i>They <u>like</u> to read novels.</i></b>	<b><i>They</i></b> <i>(3rd Person Plural)</i>	<u><i>like</i></u> <i>(Main Verb Plural)</i>

\* Subjects are in bold typeface and verbs are underlined

# What we already know

- ❖ Singular and Plural Rules- Personal Pronouns

Person	Number	
	Singular Subject	Plural Subject
First Person	I	We
Second Person	You	You
Third Person	He, She, It	They

# Singular and Plural Rules- Noun

Rules	Singular Noun	Plural Noun
1. A noun is made plural by adding ‘-s’ at the end of the noun.	bird student	birds students
2. It is made plural by adding ‘-es’ at the end of the noun that has <u>a sibilant sound</u> - <i>( a type of consonant that produces high amplitude and pitch with hissing or buzzing sound.)</i> <b>s, ss, ch, x, tch, sh, and zz</b>	bus glass bench box batch brush quiz	buses glasses benches boxes batches brushes quizzes
3. If a noun ends with ‘y’ and a consonant comes before ‘y’ then the noun is made plural by replacing ‘y’ with ‘-ies’ at the end of the noun (‘ly’, ‘by’, ‘dy’ , ‘py’ or ‘ry’).	fly baby lady puppy library	flies babies ladies puppies libraries

# What we already know

## ❖ Singular and Plural Rules- Noun

Rules	Singular Noun	Plural Noun
4. If a noun ends with ‘y’ and a vowel comes before ‘y’ then the noun is made plural by simply adding ‘-s’ at the end of the noun (‘ay’, ‘ey’, or ‘oy’ ).	day key boy	days keys boys
5. If a noun ends with ‘f’ then the plural form is written by changing ‘f’ to ‘v’ and by adding ‘-es’ at the end of the noun. ( <b>in some cases</b> )	calf thief leaf	calves thieves leaves
6. If a noun ends with ‘f’ then the plural form is written by just adding ‘-s’ at the end of the noun. ( <b>in some cases</b> )	chef chief cliff dwarf	chefs chiefs cliffs dwarfs/ dwarves

# What we already know

## ❖ Singular and Plural Rules- Verbs

Rules ( Present Simple Tense)	Infinitive (to do)	Singular Verb	Plural Verb
1. Most regular verbs are made singular by adding ‘-s’ at the end of the verb.	To work To speak	works speaks	work speak
2. Verb is made singular from the base form by adding ‘-es’ at the end of the verb that has <u>a sibilant sound -</u> <i>( a type of consonant that produces high amplitude and pitch with hissing or buzzing sound.)</i> <b>s, ss, ch, x, tch, sh, and zz</b>	To focus To confess To teach To mix To catch To wash to buzz	focuses confesses teaches mixes catches washes buzzes	focus confess teach mix catch wash buzz

# What we already know

## ❖ Singular and Plural Rules- Verbs

Rules ( Present Simple Tense)	Infinitive (to do/ base form)	Singular Verb	Plural Verb
3. If a verb ends with ‘y’ and a consonant comes before ‘y’ then ‘y’ is replaced with ‘ies’ at the end of the verb in singular form (‘ly’, ‘dy’, ‘py’ or ‘ry’).	To fly To study To spy To carry	flies studies spies carries	fly study spy carry
4. If a verb ends with ‘y’ and a vowel comes before ‘y’ then the base form of the verb is made singular by simply adding ‘s’ at the end of the verb(‘ay’, ‘uy’, ‘ey’, or ‘oy’).	To pay To buy To obey	pays buys obeys	pay buy obey

# What we already know

## ❖ Singular and Plural Rules- Verbs

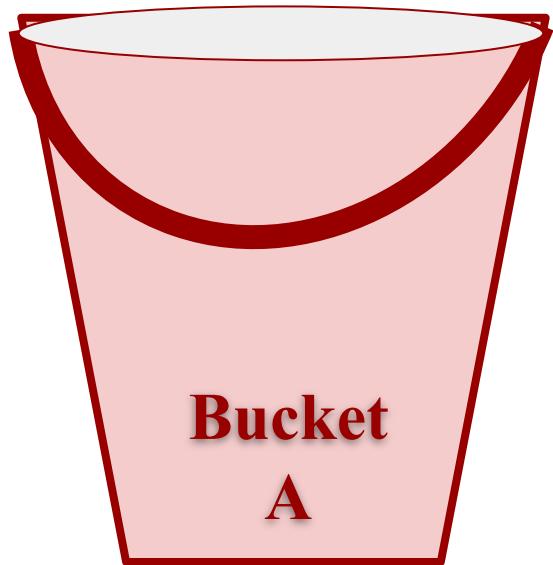
Rules ( Present & Past Simple Tense)	Infinitive (to be/ base form)	Singular Verb (he,she,it)	Plural Verb (I, you, we, they)
5. If a verb has third person singular or plural personal pronouns as a subject then	be	is/am/was	are/ were
	do	does/ did	do/ did
	go	goes/ went	go/went
	have	has/ had	have/ had

# Let's Practice it...

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# Let's Practice it...

eg. is, .....



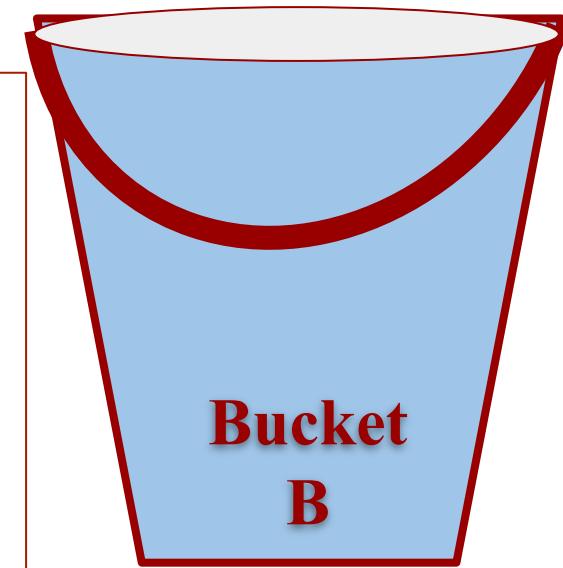
Singular Verbs

*Put me where  
I belong to*

**VERB**

is, jumps, drink, do,  
talk, ride, write,  
speaks,  
waters, match, buys, are,  
listens, goes, fries, enjoy,

eg. are, .....



Plural Verbs

01:00

# Let's Check the Answers...

eg. is, .....



Singular Verbs

*Put me where  
I belong to*

VERB

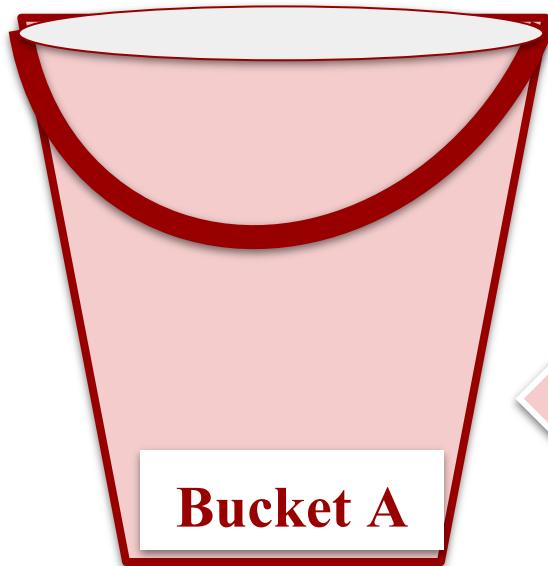
eg. are, .....



Plural Verbs

# Let's Check the Answers...

eg. is, .....



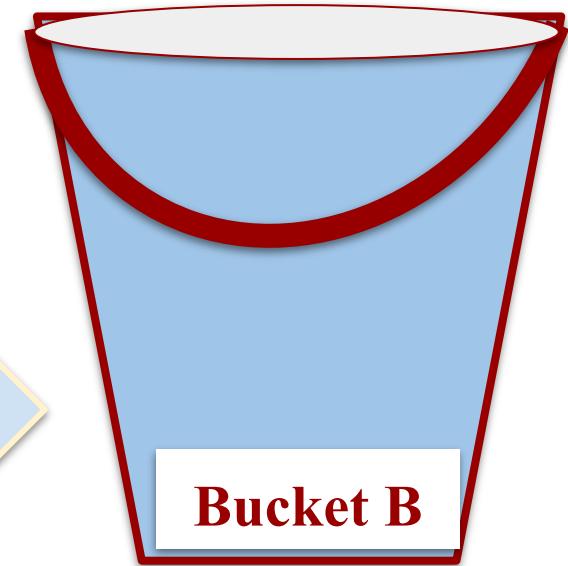
Singular Verbs

is,  
goes,  
buys,  
fries,  
jumps,  
waters,  
speaks,  
listens

*Put me where  
I belong to*

VERB

eg. are, .....



Plural Verbs

do,  
are,  
talk,  
ride,  
drink,  
write,  
match,  
enjoy

# Let's Practice it..!

**Q. Identify the plural and singular nouns/ pronouns and fill in the blanks with appropriate verb forms.**

**01:00**

1. The child \_\_\_\_\_ (*be verb*) sleeping now.
2. The flats that my father bought \_\_\_\_\_ (*be verb*) now under renovation.
3. My friends \_\_\_\_\_ (*live/ lives/ living*) in different cities.
4. They \_\_\_\_\_ (*plays/ play/playing*) cricket every evening.
5. She \_\_\_\_\_ (*love/ loves/ loving*) to sing songs.
6. Lata Mangeshkar's songs \_\_\_\_\_ (*be verb*) enjoyed by people of all ages.

# Let's Check Your Answers!

**Q. Identify the plural and singular nouns/ pronouns and fill in the blanks with appropriate verb forms.**

1. The child is (*be verb*) sleeping now.
2. The flats that my father bought are (*be verb*) now under renovation.
3. My friends live (*live/ lives/ living*) in different cities.
4. They play (*plays/ play/ playing*) cricket every evening.
5. She loves (*love/ loves/ loving*) to sing songs.
6. Lata Mangeshkar's songs are (*be verb*) enjoyed by people of all ages.

## 2. Introduction

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# Definition

## What is Subject- Verb Agreement (SVA)?

- **Subject–Verb Agreement** is a grammatical rule that the verb in a sentence must match its subject (*Noun/ Pronoun/ Gerund/ Noun Phrase*) in number (*Singular/ Plural*) and person (*1st/2nd/3rd Person*).
- Not only does a verb change its form to tell time, but it also can change its form to indicate how many subjects it has.
- For engineers, subject–verb agreement is not just a grammar rule—it's a tool for precision, credibility, and professionalism in both academics and industry

# 17 Basic Rules of SVA

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# Rules of Subject -Verb Agreement

Rules	Example
1. The verb and subject must agree in number (singular or plural)	<ul style="list-style-type: none"> <li>➤ The <b>student</b> <u>speaks</u> English. (<i>Singular</i>)</li> <li>➤ <b>Students</b> <u>speak</u> English. ( <i>Plural</i>)</li> </ul>
2. The number of subjects (singular or plural) will not change due to words/phrases in between the subject and verb.	<ul style="list-style-type: none"> <li>➤ The <b>flats</b> that my father bought <u>are</u> now under renovation. (since the subject is ‘<b>flats</b>’ the verb should be ‘<u>are</u>’).</li> </ul>
3. Subjects joined by ‘with’, ‘along with’, ‘together with’, ‘as well as’, ‘besides’, ‘in addition to’, do not affect the verb. The verb agrees with the main subject.	<ul style="list-style-type: none"> <li>➤ <b>Suraj</b>, along with his brother, <u>is</u> going to college.</li> <li>➤ The <b>teacher</b>, together with the students, <u>helped</u> the earthquake victims.</li> </ul>

# Rules of Subject -Verb Agreement

Rules	Example
4. Two subjects joined by ‘and’ usually take a plural verb.	<ul style="list-style-type: none"> <li>➤ <b>Radha and Rani</b> <u>are</u> good friends.</li> </ul>
5. If two subjects are joined by ‘and’ and form one idea, take singular verbs.	<ul style="list-style-type: none"> <li>➤ <b>Time and tides</b> <u>waits</u> for none.</li> <li>➤ <b>Slow and steady</b> <u>wins</u> the race.</li> <li>➤ <b>Bread and butter</b> <u>is</u> wholesome food.</li> </ul>
6. When subjects are joined by ‘either ... or’/‘neither... nor’, the verb agrees with the subject closer to the verb.	<ul style="list-style-type: none"> <li>➤ <i>Either/Neither the boys or/nor the girls</i> <u>have</u> done this work.</li> <li>➤ <i>Either/Neither Ravi or/nor Raj</i> <u>has</u> done this work.</li> <li>➤ <i>Either/ Neither the coach or/nor players</i> <u>are</u> ready.</li> <li>➤ <i>Either/ Neither the players or/nor coach</i> <u>is</u> ready.</li> </ul>

# Rules of Subject -Verb Agreement

Rules	Example
7. When the subject is ‘either of/ neither of/one of’ + plural noun, verb is singular.	<ul style="list-style-type: none"> <li>➤ Either of the <b>options</b> <u>is</u> fine.</li> <li>➤ Neither of the <b>plans</b> <u>is</u> good.</li> </ul>
8. When subjects are of ‘different persons’ the verb agrees with the subject closer to the verb.	<ul style="list-style-type: none"> <li>➤ <i>Either he or I am doing</i> this work.</li> <li>➤ <i>Neither you nor he has done</i> this work.</li> <li>➤ <i>Either they or I shall do</i> this work.</li> </ul>
9. Collective nouns as a single unit take singular verb, whereas collective nouns as individual take plural verb.	<ul style="list-style-type: none"> <li>➤ Our <b>family</b> <u>is</u> not rich. (<i>family as a unit</i>)</li> <li>➤ Our <b>family</b> <u>are</u> staying in different cities. (<i>family as individual members</i>)</li> </ul>
10. Nouns like ‘news, economics, maths, civics, physics,etc. are plural in form but singular in meaning. Hence, singular verb are used.	<ul style="list-style-type: none"> <li>➤ <b>Maths</b> <u>is</u> very difficult for some people.</li> <li>➤ The <b>news</b> <u>is</u> very interesting.</li> </ul>

# Rules of Subject -Verb Agreement

Rules	Example
11.Nouns like scissors, trousers, binoculars, etc. are plural in form and take plural verb.	➤ The <b>binoculars</b> <u>are</u> expensive.
12.Uncountable nouns take singular verb while countable nouns take plural verb.	➤ Water <u>is</u> essential. ➤ Books <u>are</u> on the table.
12.'Each of' takes singular verb. Words with 'Each' or 'Every' take singular verb. Two subjects with 'Each' or 'Every' before them take singular verb.	➤ Each of <b>students</b> <u>is</u> brilliant. ➤ Each <b>student</b> <u>was</u> present. ➤ Every <b>man and woman</b> <u>is</u> invited.
14.Titles of books, movies, or works take singular verb.	➤ “ <b>The Avengers</b> ” <u>is</u> an action movie.

# Rules of Subject -Verb Agreement

Rules	Example
<p>15. When ‘amount, distance, weight, height, or time’ is expressed as a single unit of measurement, it is treated as singular subject. Hence, singular verb is used.</p>	<ul style="list-style-type: none"> <li>➤ <i>Amount</i> :- <b>The ten core rupees</b> <u>was</u> sanctioned to build an old age home.</li> <li>➤ <i>Distance</i>:- <b>Twenty km</b> <u>was</u> covered in 30 mins.</li> <li>➤ <i>Weight</i>:- <b>30 kg of rice</b> <u>is</u> enough for a month.</li> <li>➤ <i>Time</i>:- <b>3 weeks</b> <u>is</u> a long vacation.</li> </ul>
<p>16. When subject is <b>indefinite pronouns</b> like ‘everyone, anyone, someone, everything, anything, something, nobody, everybody, anybody’, singular verb is used.</p>	<ul style="list-style-type: none"> <li>➤ <b>Everyone</b> <u>is</u> happy.</li> <li>➤ <b>Nobody</b> <u>knows</u> the truth.</li> <li>➤ Is there <b>anyone</b> in the room?</li> <li>➤ Is there <b>something</b> that I can do for you?</li> </ul>
<p>17. When ‘all, most of the, half of the’ + people/countable nouns, verb is plural. Whereas ‘all, most of the, half of the’ + uncountable noun, verb is singular.</p>	<ul style="list-style-type: none"> <li>➤ <b>Most of the students</b> <u>are</u> absent today.</li> <li>➤ <b>Half of the water</b> <u>is</u> wasted.</li> </ul>

# Advance Case of SVA

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# Rules of SVA- Advance Case

Rules	Example
1. When the subject is infinitive phrase, verb is singular.	➤ <b>To err</b> <u>is</u> human.
2. When subject is gerund ('ing' word), verb is singular.	➤ <b>Reading</b> <u>is</u> a good habit. ➤ <b>Walking</b> with my dog in the morning <u>is</u> my favorite pastime.
3. When two gerunds act together as subject, verb can be singular.	➤ <b>Reading and writing</b> <u>is</u> important.
4. When two gerunds denote separate actions, verb is plural.	➤ <b>Speaking and writing</b> <u>are</u> productive skills.
5. When the subject is clause, verb is singular.	➤ <b>How you overcome the challenges</b> <u>is</u> inspiring.

# Rules of SVA- Advance Case

Rules	Example
6. When there are words between the subject and verb, the verb agrees with the true subject.	<ul style="list-style-type: none"> <li>➤ The <b>bunch of keys</b> <u>is</u> on the table.</li> <li>➤ The <b>nature of the villagers</b> <u>is</u> friendly.</li> </ul>
7. The subject of the verb is plural if it talks about possibility in the past.	<ul style="list-style-type: none"> <li>➤ If <b>I</b> <u>were</u> you, <b>I</b> would attend the class.</li> <li>➤ If <b>he</b> <u>were</u> a scientist, <b>he</b> would invent a flying car.</li> </ul>
8. When the sentence starts with There/ Here + be, the verb agrees with noun after it.	<ul style="list-style-type: none"> <li>➤ There <u>is</u> a high rise <b>building</b> near my house.</li> <li>➤ There <u>are</u> many <b>books</b> in my cupboard.</li> </ul>
9. When the subject is a relative pronoun, the verb agrees with the antecedent.	<ul style="list-style-type: none"> <li>➤ Arjun is the <b>teacher</b> who <u>teaches</u> me English.</li> <li>➤ I'm not a <b>woman</b> who <u>owns</u> a Louis Vuitton bag.</li> </ul>
10. In Interrogative or inversion sentences the verb comes before subject.	<ul style="list-style-type: none"> <li>➤ No sooner <u>did</u> <b>I</b> <u>entered</u> my room than my <b>phone</b> <u>rang</u>.</li> </ul>

# Common Agreement Errors

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# Common Agreement Errors -SVA

## 1. Misalignment with inverted sentences

- Inversion means placing the verb before the subject.
- It is used to add formal tone or to emphasis or give special effect.
- It is normally used in formal statement or in writing.

### Examples:

**Incorrect:** Not only Supriya speaks English fluently but also writes well.

**Correct:** Not only does Supriya speak English fluently, but she also writes well.

**Incorrect:** Not only smoking is injurious to health but also smells bad.

**Correct:** Not only is smoking injurious to health, but it also smells bad.

**Note:** Common words that use inversion : *not only, nor, never, not, little did, hardly...when, no sooner... than, only after, etc.*

# Common Agreement Errors -SVA

## 2. Misalignment with inverted interrogative sentences

➤ When forming interrogative sentences, especially **Wh- questions** (*who, what, when, why, where & how*), auxiliary verbs are placed before the subject.

**Example:**

**Incorrect:** Where Supriya is going?

**Correct:** Where is Supriya going?

**Incorrect:** You coming with me?

**Correct:** Are you coming with me?

**Incorrect:** Where you coming from?

**Correct:** Where are you coming from?

**Incorrect:** How he speaks English?

**Correct:** How does he speak English?

**Incorrect:** Why you came late?

**Correct:** Why did you come late?

# Common Agreement Errors -SVA

## 3. Mistakes after Quantifiers

- Quantifiers like some of, a lot of, none of , most of, etc. can be used both with countable and uncountable nouns.
- The verb must agree with the subject being talked about and not the quantifier itself.

*Example:*

**Incorrect:** Some of the money were spent on traveling.

**Correct:** **Some of the money was** spent on traveling. (*money is uncountable*)

**Incorrect:** None of his friends is employed.

**Correct:** None of his **friends are** employed.

**Incorrect:** One of the girl is sick. ('One' is the subject which is singular &

**Correct:** One of the girls is sick. 'of the girls' is a prepositional phrase )

# Common Agreement Errors -SVA

## 4. Mistakes with compound subjects

- When two subjects (nouns/ pronouns) are joined by ‘and’, then compound subject is formed.
- The verb must be plural as the subjects are treated plural.

*Example:*

**Incorrect:** The teacher and the student has missed the college bus.

**Correct:** The teacher and the student have missed the college bus.

**Incorrect:** My friend and teacher were present at the function yesterday.

**Correct:** My friend and teacher was present at the function yesterday.  
*(friend & teacher are being referred to as a single person)*

# How to Overcome SVA Errors?

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# How to Overcome SVA

## Errors?

01

- Memorising the SVA rule is not enough.

02

- Consistent structured practice from authentic and trusted sources

03

- Learn with clarity, repetition and use in real world situation.

04

- Try using free online interactive grammar quiz or tools/resources.

05

- Watch TV shows/ movies with interactive subtitles to learn SVA.

# Why does SVA matter?

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# Why does it Matter?

**01**

➤ Ensures Clarity

**02**

➤ Exhibits Professionalism

**03**

➤ Strengthens Technical Writing

**04**

➤ Improves and enhances communication skills

**05**

➤ Boost Academic as well as Career success

# Why Engineers need SVA?

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# Why Engineers need SVA?

**01**

- As a student it helps to write error free assignments, lab reports & projects.

**02**

- As a professional it helps to create reports, proposal, technical documents, manuals, etc.

**03**

- It helps to communicate confidently in emails, meetings & presentations.

**04**

- Improves and enhances communication skills

**05**

- Boost academic as well as career growth by strengthening for pursuing higher studies.

# Let us practice!

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# **Activity 1: Spot the errors**

**Q1. Spot the errors and rectify them according to SVA Rules.**

- i) Each of the rooms are well decorated.
- ii) Not only Tina lost her cell phone but also her purse.
- iii) Here is your books.
- iv) Neither of the books are mine.
- v) The bouquet of flowers on your table are beautiful.

**02:00**

# Check Your Answers!

**Q1. Spot the errors and rectify them according to SVA Rules.**

i) **Each of the rooms are well decorated.**

*Ans: Each of the rooms are is well decorated. (Rule 12)*

ii) **Not only Tina lost her cell phone but also her purse.**

*Ans: Not only did Tina lose her cell phone, but she also lost her purse. (Common Agreement Error- 1)*

iii) **Here are your books.**

*Ans: Here are is your **books**. (Rule 8 - Advance Case)*

# Check Your Answers!

**Q1. Spot the errors and rectify them according to SVA Rules.**

**iv) Neither of the books are mine.**

*Ans: Neither of the books ~~are~~ is mine. (Rule 6)*

**v) The bouquet of flowers on your table are beautiful.**

*Ans: The **bouquet** of flowers on the table ~~are~~ is beautiful.  
(Rule 9)*

# Activity 2 -

**Q2. Choose the appropriate answer from the options as per SVA Rules and complete the report.**

**01:00**

## Passage:

The report, which details the user feedback, i) *is/are* ready for submission. Its findings ii) *suggests/suggest* that the user interface iii) *requires/require* major updates. However, the development team and the design department iv) *is/are* working to implement these changes. v) *Each of/Most of* the suggested improvement is prioritized based on user.

# Check Your Answers!

**Q2. Choose the appropriate answer from the options as per Subject Verb Agreement Rules and complete the report.**

**Passage:**

The report, which details the user feedback, i) *is* ready for submission. Its findings ii) *suggest* that the user interface iii) *requires* major updates. However, the development team and the design department iv) *are* working to implement these changes. v) *Each of* the suggested improvement is prioritized based on user.

# Activity 3 -

Read carefully the extracted paragraph from Calculus Based Physics Lab Report. Identify the subject-verb errors and rewrite the paragraph correctly.

05:00

Forces is interactions between object in nature. Two class of force is contact and field forces (Serway). Contact forces is interactions that involve physical contact between two object. An examples of this is one's fingers typing keys. Field forces are interactions that does not involve physical contact. An example of this are the gravitational force. Newton developed laws to describe motion causes by forces. Newton's second laws is number one on the table below. This equation state that the acceleration of an object are directly proportional to the force acting on them and inversely proportional to their mass.

# Activity 3 - Check your Answers

Read carefully the extracted paragraph from *Calculus Based Physics Lab Report*. Identify the subject-verb errors and make appropriate changes where necessary.

Forces **are** interactions between **objects** in nature. Two **classes** of forces **are** contact and field forces (Serway). Contact forces **are** interactions that involve physical contact between two **objects**. An **example** of this is one's fingers typing keys. Field forces are interactions that **do** not involve physical contact. An example of this **is** the gravitational force. Newton developed laws to describe motion **caused** by forces. Newton's second **law** is number one on the table below. This equation **states** that the acceleration of an object **is** directly proportional to the force acting on **it** and inversely proportional to **its** mass.

# Sample Lab Report

**Lab 4: Newton's 2<sup>nd</sup> Law**

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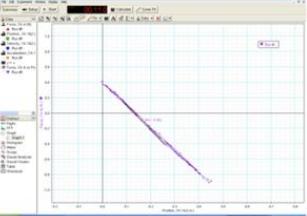
**INTRODUCTION**

Forces are interactions between objects in nature. Two classes of forces are contact and field forces (Serway). Contact forces are interactions that involve physical contact between two objects. An example of this is one's fingers typing keys. Field forces are interactions that do not involve physical contact. An example of this is the gravitational force. Newton developed laws to describe motion caused by forces. Newton's second law is number one on the table below. This equation states that the acceleration of an object is directly proportional to the force acting on it and inversely proportional to its mass. This force is the net force, or the vector sum of all the objects acting on the object (Serway). An application of Newton's law is Hooke's law. Hooke's Law is number two on the table below. "K" represents the spring constant of the spring. "X" represents the displacement from equilibrium. The force is directly proportional to the displacement from equilibrium. The negative sign indicates that the force is always directed towards equilibrium. This force is a restoring force. The two hypotheses that are being tested are:  
**H<sub>0</sub>:** Mass of an object is equal to the net force divided by its acceleration  
**H<sub>a</sub>:** The spring constant is equal to the net force divided by displacement from equilibrium.

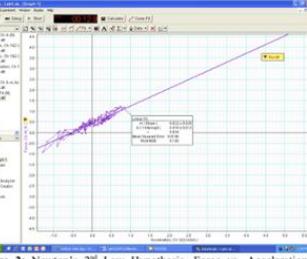
Newton's 2 <sup>nd</sup> Law (1)	Hooke's Law (2)
$F = ma$	$F = -kx$

**PROCEDURES**

To test the Hooke's Law hypothesis, a cart with a force sensor is placed on a track. The track is angled at 9 degrees from the table. The force sensor is attached to a spring. A string is attached to the end of the cart and to a pulley. The pulley string is pulled on to extend and compress the spring. The motion sensor collects displacement values and the force sensor collects the force of the spring. A force vs. displacement graph is produced to show the linear relationship. The slope of this graph is



**Figure 1:** Hooke's Law Hypothesis. Force vs. Displacement graph. Slope of this graph is -3.19 and is equal to the spring constant.



**Figure 2:** Newton's 2<sup>nd</sup> Law Hypothesis. Force vs. Acceleration graph. Slope of this graph is 0.822 ± 0.028 and is equal to the total mass of cart and force sensor.

**REFERENCES**

Serway and Jewett, **Physics**, Thomson 2004  
DeGoede, Lab 4: Newton's 2<sup>nd</sup> Law, 2002

**Figure1:** Gresh, D., & Sturz, R. (n.d.). *Lab 4: Newton's 2nd Law* [Screenshot]. Department of Physics and Engineering, Elizabethtown College. Retrieved November 18, 2025.

# Assignment

Select any one topic and draft an error free short technical report.

- a) Role of AI in Predictive Maintenance
- b) Cybersecurity Threats in IoT Devices

## ***Instructions:***

- While writing the report, ensure you demonstrate **error-free subject–verb agreement**
- Highlight or underline at least 10 sentences where you have applied subject–verb agreement rules intentionally.
- Attach a short reflection (5–6 lines) on how subject–verb agreement improves technical writing quality.

# Learning Outcomes

*By the end of this session, students will be able to:*

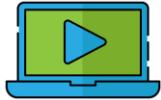
1. Identify and correct subject–verb agreement errors in engineering writing
2. Apply grammar rules to real technical contexts
3. Improve clarity and professionalism in lab reports and project documentation

# Links of Resources



## Video Links -

1. <https://youtu.be/LfJPA8GwTdk?t=133>
2. <https://youtu.be/4NkXM1j3seA?t=357>
3. <https://youtu.be/ZOKNQjUzVdM?t=371>



## Website Links -

1. [Countable - Unc... | Free Interactive Worksheets | 2043817](#)
2. <https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/quantifiers>
3. [Countable and Uncountable Nouns Exercises| English Grammar](#)
4. <https://professorscottsenglish.com/english-grammar/common-grammar-mistakes/subject-verb-agreement-errors/12-subject-verb-agreement-errors-that-english-learners-make-and-how-to-fix-them/>
5. <https://harpercollege.pressbooks.pub/academic-writing-skills/chapter/unit-10subject-verb-agreement/>



# **Key Message For Students**

*“Engineering is about accuracy and clarity.  
Good grammar—like subject–verb agreement—  
makes your ideas as strong and precise as your designs.”*

*- A Grammar Teacher*

# Thank You!