A Laboratory Manual For

FERTILIZER TECHNOLOGY

(22615)

Semester – VI

(CH)

Maharshtra State

Board Of Technical Educationv, Mumbai

(Autonomous)(ISO 9001-2015)(ISO/IFC 27001-2013)

Bharati Vidyapeeth's Institute of Technology Navi Mumbai

Certificate

This is to certify that, Mr/ Ms. …….
Roll No. …… of sixth Semester of Diploma in Chemical engineering of Bharati Vidyapeeth Institute of Technology , Navi Mumbai (Inst.code:0027) has satisfactorily completed the term work in the subject FERTILIZER TECHNOLOGY(22615) for the academic year 20…. to 20…. as prescribed in the MSBTE curriculum.

Place: ……... **Enrollment No. : ……**

Date:……. **Exam. Seat No. : …….**

Sign:

Name:

Subject Teacher **Head of the Department** **Principal**

Seal of Institution

Semester: SIXTH **Marks: Max : 25 Min :10**

Sr. No.	Title	Date of performance	Date of submission	Marks	Sign of teacher
1	Determine the moisture from sludge fertilizer.				
2	Determine the moisture from compost fertilizer.				
3	Determine the moisture from organic fertilizer.				
4	Determine the particle diameter of Calcium Ammonium Nitrate with a dry type sieving analysis.				
5	Determine the nitrogen content in given Ammonium chloride fertilizer by titration method.				
6	Use the dry sieve to determine the particle diameter of Ammonium chloride.				
7	Use the dry sieve to determine the particle diameter of triple phosphate.				
8	Determine the nitrogen content in given nitrophosphate fertilizer by titration method.				
9	Determine the particle diameter of di-ammonium phosphate with a dry type sieving analysis.				
10	Determine the particle diameter of NPK with a dry type sieving analysis.				
11	Determine the nitrogen content in given NPK fertilizer by titration method.				
12	Determine the nitrogen content in given vermin-compost fertilizer by titration method.				
Total marks out of 120					
Marks out of 25					

Name and Signature of student Name and Signature of faculty

EXPERIMENT 1

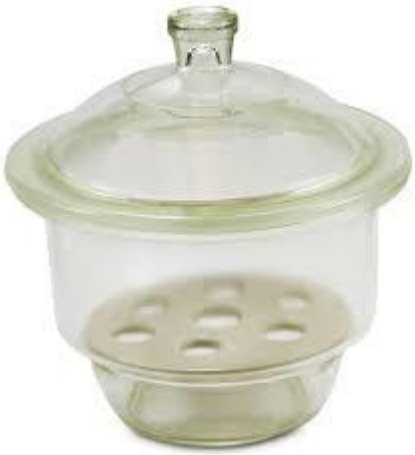
Aim: Determine the moisture from sludge fertilizer.

Apparatus : Air oven, Desiccator, Digital weighing balance, Crucible , Sludge fertilizer sample etc.

Procedure :

1. Heat the empty crucible and cover in oven maintained at a temperature of 104-110 ^{0}C.
2. After one hour , remove the crucible from the oven and cool in a desiccator for 15-20 minutes.
3. Using tongs , record the weight of empty crucible , W1, on weighing balance.
4. Using a spatula , transfer app. 1gm of the sludge fertilizer sample to the crucible and mass to the nearest 0.001 gm and record weight as W2.
5. Secure the crucible in desiccator and transfer into a preheated oven at 104-110^{0}C.
6. Heat for one hour without the lid on the crucible.
7. Place the cover the crucible and transfer into the desiccator for 15-20 minutes to cool.
8. Weigh the crucible to the nearest 0.001 gm and record the weight in grams as W3.





Result: Moisture content of given fertilizer sample is _____

Questions:

1) What is sludge fertilizer?

2) What are the components of sludge fertilizer?

3) What is sludge made of?

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

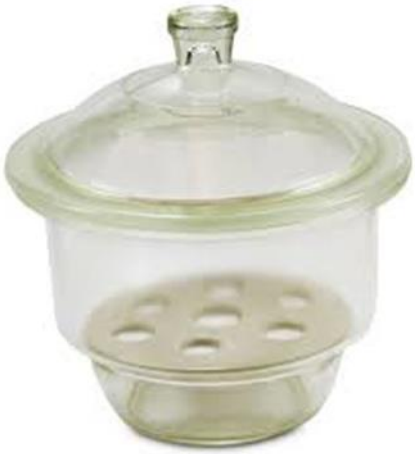
EXPERIMENT 2

Aim: Determine the moisture from compost fertilizer.

Apparatus : Air oven, Desiccator, Digital weighing balance, Crucible , Compost fertilizer sample etc.

Procedure :

1. Heat the empty crucible and cover in oven maintained at a temperature of 104-110 ^{0}C.
2. After one hour , remove the crucible from the oven and cool in a desiccator for 15-20 minutes.
3. Using tongs , record the weight of empty crucible , W1, on weighing balance.
4. Using a spatula , transfer app. 1gm of the compost fertilizer sample to the crucible and mass to the nearest 0.001 gm and record weight as W2.
5. Secure the crucible in desiccator and transfer into a preheated oven at 104-110^{0}C.
6. Heat for one hour without the lid on the crucible.
7. Place the cover the crucible and transfer into the desiccator for 15-20 minutes to cool.
8. Weigh the crucible to the nearest 0.001 gm and record the weight in grams as W3.



Result: Moisture content of given fertilizer sample is _____

Questions:

1) What is compost fertilizer?

2) What is the composition of compost fertilizer?

3) What is compost , why is beneficial to soil?

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

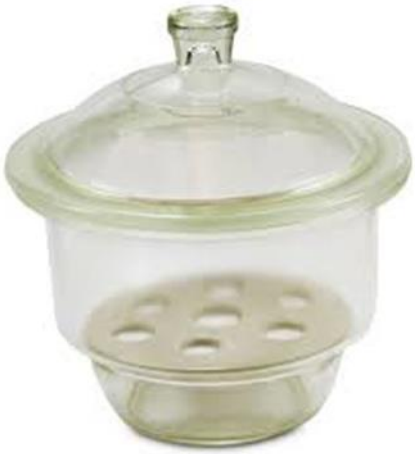
EXPERIMENT 3

Aim: Determine the moisture from organic fertilizer.

Apparatus : Air oven, Desiccator, Digital weighing balance, Crucible , Organic fertilizer sample etc.

Procedure :

1. Heat the empty crucible and cover in oven maintained at a temperature of 104-110 ^{0}C.
2. After one hour , remove the crucible from the oven and cool in a desiccator for 15-20 minutes.
3. Using tongs , record the weight of empty crucible , W1, on weighing balance.
4. Using a spatula , transfer app. 1gm of the organic fertilizer sample to the crucible and mass to the nearest 0.001 gm and record weight as W2.
5. Secure the crucible in desiccator and transfer into a preheated oven at 104-110^{0}C.
6. Heat for one hour without the lid on the crucible.
7. Place the cover the crucible and transfer into the desiccator for 15-20 minutes to cool.
8. Weigh the crucible to the nearest 0.001 gm and record the weight in grams as W3.



Result: Moisture content of given fertilizer sample is _____

Questions:

1) What is organic fertilizer?

2) What is the composition of organic fertilizer?

3) Examples of best organic fertilizers?

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

EXPERIMENT 4

Aim: Determine the particle diameter of calcium ammonium nitrate with a dry type sieving analysis.

Apparatus: Weighing balance , set of screens , sieve shaker , sample etc.

Procedure:

1. Collect the sample for which screening is to be done.
2. Remove the unwanted materials inside screen and clean it properly.
3. Arrange the entire screen in the descending mesh number (big size at top).
4. Correctly weigh out given quantity of solid sample , put in the top screen.
5. Cover the top screen and keep set on a sieve shaker.
6. Carry out the operation , collect the material and weigh sample from each screen.
7. After completion , collect the material and weigh sample each screen.
8. Calculate weight fraction and weight percentage of each screen.

Observations and Calculations :

Sr. No.	Mesh No.	Micron Size	Weight of Material retained On the screen	Weight Fraction	Weight percentage
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Sample calculation for mesh no. :

Mesh number :

Size in micron :

Weight of material :

Total of weight :

Weight fraction = (weight of material/total weight)

=

=

Weight percentage = (weight of material/total weight) x 100

=

=

Result :

Questions:

1) Enlist the equipment used in industry for size reduction.

2) What is the effect of using more number of screens?

3) Define mesh.

4) What is mean by oversize and undersize particle.

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

EXPERIMENT 5

Aim: Determine the nitrogen content in given ammonium chloride fertilizer by titration method.

Apparatus: Burette , Pipette , Conical flask , Beaker , Weighing balance Volumetric flask etc.

Procedure:

9. Wash the glassware with water.
10. Weigh accurately 0.2 gms of ammonium chloride fertilizer sample.
11. Dissolve it in a 100 ml of 0.1N NaOH solution in a conical flask.
12. Keep funnel on the flask to avoid evaporation losses.
13. Heat the reaction mixture so that ammonium chloride hydrolyses with evolution of ammonia.
14. Confirm total removal of ammonia by change in the colour of yellow turmeric paper.
15. Carry out blank titration between 0.1N HCl solution and 0.1N NaOH solution.
16. Cool the reaction mixture initially prepared and titrate it against 0.1N HCl solution. Known as blank titration.
17. Perform the titration until a constant burette reading is obtained.

Observations and Calculations :

For blank titration –

1. In burette – 0.1N HCl solution.
2. In conical flask – 10ml of 0.1N NaOH solution.
3. Indicator – phenolphthalein.
4. End point –pink to colourless.

For back titration –

1. In burette – 0.1N HCl solution.
2. In conical flask – 100ml of prepared reaction mixture.
3. Indicator – phenolphthalein.
4. End point –colourless to pink.

Observation Table : For blank titration -

Readings	Pilot Reading	Burette Readings in ml			Constant Burette Reading
		I	II	III	
Initial					……X ml
Final					
Difference					

For back titration -

Readings	Pilot Reading	Burette Readings in ml			Constant Burette Reading
		I	II	III	
Initial					……X ml
Final					
Difference					

Sample Calculations –

1. Weight of fuel = constant burette reading for blank titration = Xml.
   This is the volume of 0.1N HCL solution consumed for 10ml of 0.1N NaOH solution.
   Therefore , for 100ml of 0.1N NaOH solution ,

   = X x 10ml = X1mlof 0.1N HCl solution.

2. Amount of 0.1N NaOH solution consumed ,

   A = (X1 – X) ml.

Now, 1ml of 0.1N NaOH solution ,

= 0.0017 gm of ammonia (for ammonium chloride).

Therefore , A ml of 0,.1N NaOH solution ,

= (0.0017 X A) gm of ammonia in 0.2 gm ammonium chloride.

= B

Therefore , ammonia content in given fertilizer sample ,

= (amount of ammonia / amount of fertilizer sample) X 100

= (B / 0.2) X 100 %

Result: Nitrogen content in given fertilizer sample is----------

Questions:

1) What is nitrogenous fertilizer?

2) What is the percentage of nitrogen in ammonium fertilizer?

3) What are the uses of ammonium fertilizer?

4) What is mixed fertilizer?

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

EXPERIMENT 6

Aim: Use the dry type sieve to determine the particle diameter of Ammonium chloride.
Apparatus: Weighing balance , set of screens , sieve shaker , sample etc.

Procedure:

1. Collect the sample for which screening is to be done.
2. Remove the unwanted materials inside screen and clean it properly.
3. Arrange the entire screen in the descending mesh number (big size at top).
4. Correctly weigh out given quantity of solid sample , put in the top screen.
5. Cover the top screen and keep set on a sieve shaker.
6. Carry out the operation , collect the material and weigh sample from each screen.
7. After completion , collect the material and weigh sample each screen.
8. Calculate weight fraction and weight percentage of each screen.

Observations and Calculations :

Sr. No.	Mesh No.	Micron Size	Weight of Material retained On the screen	Weight Fraction	Weight percentage
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Sample calculation for mesh no. :

Mesh number :

Size in micron :

Weight of material :

Total of weight :

Weight fraction = (weight of material/total weight)

=

=

Weight percentage = (weight of material/total weight) x 100

=

=

Result :

Questions:

1) Enlist the equipment used in industry for size reduction.

2) What is the effect of using more number of screens?

3) Define mesh.

4) What is mean by oversize and undersize particle.

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

EXPERIMENT 7

Aim: Use the dry type sieve to determine the particle diameter of Triple super phosphate.
Apparatus: Weighing balance , set of screens , sieve shaker , sample etc.

Procedure:

1. Collect the sample for which screening is to be done.
2. Remove the unwanted materials inside screen and clean it properly.
3. Arrange the entire screen in the descending mesh number (big size at top).
4. Correctly weigh out given quantity of solid sample , put in the top screen.
5. Cover the top screen and keep set on a sieve shaker.
6. Carry out the operation , collect the material and weigh sample from each screen.
7. After completion , collect the material and weigh sample each screen.
8. Calculate weight fraction and weight percentage of each screen.

Observations and Calculations :

Sr. No.	Mesh No.	Micron Size	Weight of Material retained On the screen	Weight Fraction	Weight percentage
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Sample calculation for mesh no. :

Mesh number :

Size in micron :

Weight of material :

Total of weight :

Weight fraction = (weight of material/total weight)

=

=

Weight percentage = (weight of material/total weight) x 100

=

=

Result :

Questions:

1) Enlist the equipment used in industry for size reduction.

2) What is the effect of using more number of screens?

3) Define mesh.

4) What is mean by oversize and undersize particle.

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

EXPERIMENT 8

Aim: Determine the nitrogen content in given nitro-phosphate fertilizer by titration method.

Apparatus: Burette , Pipette , Conical flask , Beaker , Weighing balance Volumetric flask etc.

Procedure:

1. Wash the glassware with water.
2. Weigh accurately 0.2 gms of nitro-phosphate fertilizer sample.
3. Dissolve it in a 100 ml of 0.1N NaOH solution in a conical flask.
4. Keep funnel on the flask to avoid evaporation losses.
5. Heat the reaction mixture so that fertilizer hydrolyses with evolution of ammonia.
6. Confirm total removal of ammonia by change in the colour of yellow turmeric paper.
7. Carry out blank titration between 0.1N HCl solution and 0.1N NaOH solution.
8. Cool the reaction mixture initially prepared and titrate it against 0.1N HCl solution. Known as blank titration.
9. Perform the titration until a constant burette reading is obtained.

Observations and Calculations :

For blank titration –

1. In burette – 0.1N HCl solution.
2. In conical flask – 10ml of 0.1N NaOH solution.
3. Indicator – phenolphthalein.
4. End point –pink to colourless.

For back titration –

1. In burette – 0.1N HCl solution.
2. In conical flask – 100ml of prepared reaction mixture.
3. Indicator – phenolphthalein.
4. End point –colourless to pink.

Observation Table : For blank titration -

Readings	Pilot Reading	Burette Readings in ml			Constant Burette Reading
		I	II	III	
Initial					……X ml
Final					
Difference					

For back titration -

Readings	Pilot Reading	Burette Readings in ml			Constant Burette Reading
		I	II	III	
Initial					……X ml
Final					
Difference					

Sample Calculations –

1. Weight of fuel = constant burette reading for blank titration = Xml.
   This is the volume of 0.1N HCL solution consumed for 10ml of 0.1N NaOH solution.
   Therefore , for 100ml of 0.1N NaOH solution ,

   = X x 10ml = X1mlof 0.1N HCl solution.

2. Amount of 0.1N NaOH solution consumed ,

   A = (X1 – X) ml.

Now, 1ml of 0.1N NaOH solution ,

= 0.0051 gm of ammonia (for phosphate fertilizer).

Therefore , A ml of 0,.1N NaOH solution ,

= (0.0051 X A) gm of ammonia in 0.2 gm ammonium chloride.

= B

Therefore , ammonia content in given fertilizer sample ,

= (amount of ammonia / amount of fertilizer sample) X 100

= (B / 0.2) X 100 %

Result: Nitrogen content in given fertilizer sample is----------

Questions:

1) What is nitrogenous fertilizer?

2) What is the percentage of nitrogen in ammonium fertilizer?

3) What are the uses of ammonium fertilizer?

4) What is mixed fertilizer?

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

EXPERIMENT 9

Aim: Determine the particle diameter of Di-ammonium phosphate with a dry type sieving analysis.
Apparatus: Weighing balance , set of screens , sieve shaker , sample etc.

Procedure:

1. Collect the sample for which screening is to be done.
2. Remove the unwanted materials inside screen and clean it properly.
3. Arrange the entire screen in the descending mesh number (big size at top).
4. Correctly weigh out given quantity of solid sample , put in the top screen.
5. Cover the top screen and keep set on a sieve shaker.
6. Carry out the operation , collect the material and weigh sample from each screen.
7. After completion , collect the material and weigh sample each screen.
8. Calculate weight fraction and weight percentage of each screen.

Observations and Calculations :

Sr. No.	Mesh No.	Micron Size	Weight of Material retained On the screen	Weight Fraction	Weight percentage
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Sample calculation for mesh no. :

Mesh number :

Size in micron :

Weight of material :

Total of weight :

Weight fraction = (weight of material/total weight)

=

=

Weight percentage = (weight of material/total weight) x 100

=

=

Result :

Questions:

1) Enlist the equipment used in industry for size reduction.

2) What is the effect of using more number of screens?

3) Define mesh.

4) What is mean by oversize and undersize particle.

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

EXPERIMENT 10

Aim: Determine the particle diameter of NPK with a dry type sieving analysis.
Apparatus: Weighing balance , set of screens , sieve shaker , sample etc.

Procedure:

1. Collect the sample for which screening is to be done.
2. Remove the unwanted materials inside screen and clean it properly.
3. Arrange the entire screen in the descending mesh number (big size at top).
4. Correctly weigh out given quantity of solid sample , put in the top screen.
5. Cover the top screen and keep set on a sieve shaker.
6. Carry out the operation , collect the material and weigh sample from each screen.
7. After completion , collect the material and weigh sample each screen.
8. Calculate weight fraction and weight percentage of each screen.

Observations and Calculations :

Sr. No.	Mesh No.	Micron Size	Weight of Material retained On the screen	Weight Fraction	Weight percentage
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Sample calculation for mesh no. :

Mesh number :

Size in micron :

Weight of material :

Total of weight :

Weight fraction = (weight of material/total weight)

=

=

Weight percentage = (weight of material/total weight) x 100

=

=

Result :

Questions:

1) Enlist the equipment used in industry for size reduction.

2) What is the effect of using more number of screens?

3) Define mesh.

4) What is mean by oversize and undersize particle.

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

EXPERIMENT 11

Aim: Determine the nitrogen content in given NPK fertilizer by titration method.

Apparatus: Burette , Pipette , Conical flask , Beaker , Weighing balance Volumetric flask etc.

Procedure:

1. Wash the glassware with water.
2. Weigh accurately 0.2 gms of NPK fertilizer sample.
3. Dissolve it in a 100 ml of 0.1N NaOH solution in a conical flask.
4. Keep funnel on the flask to avoid evaporation losses.
5. Heat the reaction mixture so that fertilizer hydrolyses with evolution of ammonia.
6. Confirm total removal of ammonia by change in the colour of yellow turmeric paper.
7. Carry out blank titration between 0.1N HCl solution and 0.1N NaOH solution.
8. Cool the reaction mixture initially prepared and titrate it against 0.1N HCl solution. Known as blank titration.
9. Perform the titration until a constant burette reading is obtained.

Observations and Calculations :

For blank titration –

1. In burette – 0.1N HCl solution.
2. In conical flask – 10ml of 0.1N NaOH solution.
3. Indicator – phenolphthalein.
4. End point –pink to colourless.

For back titration –

1. In burette – 0.1N HCl solution.
2. In conical flask – 100ml of prepared reaction mixture.
3. Indicator – phenolphthalein.
4. End point –colourless to pink.

Observation Table : For blank titration -

Readings	Pilot Reading	Burette Readings in ml			Constant Burette Reading
		I	II	III	
Initial					……X ml
Final					
Difference					

For back titration -

Readings	Pilot Reading	Burette Readings in ml			Constant Burette Reading
		I	II	III	
Initial					……X ml
Final					
Difference					

Sample Calculations –

1. Weight of fuel = constant burette reading for blank titration = Xml.
   This is the volume of 0.1N HCL solution consumed for 10ml of 0.1N NaOH solution.
   Therefore , for 100ml of 0.1N NaOH solution ,

   = X x 10ml = X1mlof 0.1N HCl solution.

2. Amount of 0.1N NaOH solution consumed ,

   A = (X1 – X) ml.

Now, 1ml of 0.1N NaOH solution ,

= 0.0017 gm of ammonia (for phosphate fertilizer).

Therefore , A ml of 0,.1N NaOH solution ,

= (0.0017 X A) gm of ammonia in 0.2 gm ammonium chloride.

= B

Therefore , ammonia content in given fertilizer sample ,

= (amount of ammonia / amount of fertilizer sample) X 100

= (B / 0.2) X 100 %

Result: Nitrogen content in given NPK fertilizer sample is----------

Questions:

1) What is nitrogenous fertilizer?

2) What is the percentage of nitrogen in ammonium fertilizer?

3) What are the uses of ammonium fertilizer?

4) What is mixed fertilizer?

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN

EXPERIMENT 12

Aim: Determine the nitrogen content in given vermin-compost fertilizer by titration method.

Apparatus: Burette , Pipette , Conical flask , Beaker , Weighing balance Volumetric flask etc.

Procedure:

1. Wash the glassware with water.
2. Weigh accurately 0.2 gms of vermin-compost fertilizer sample.
3. Dissolve it in a 100 ml of 0.1N NaOH solution in a conical flask.
4. Keep funnel on the flask to avoid evaporation losses.
5. Heat the reaction mixture so that fertilizer hydrolyses with evolution of ammonia.
6. Confirm total removal of ammonia by change in the colour of yellow turmeric paper.
7. Carry out blank titration between 0.1N HCl solution and 0.1N NaOH solution.
8. Cool the reaction mixture initially prepared and titrate it against 0.1N HCl solution. Known as blank titration.
9. Perform the titration until a constant burette reading is obtained.

Observations and Calculations :

For blank titration –

1. In burette – 0.1N HCl solution.
2. In conical flask – 10ml of 0.1N NaOH solution.
3. Indicator – phenolphthalein.
4. End point –pink to colourless.

For back titration –

1. In burette – 0.1N HCl solution.
2. In conical flask – 100ml of prepared reaction mixture.
3. Indicator – phenolphthalein.
4. End point –colourless to pink.

Observation Table : For blank titration -

Readings	Pilot Reading	Burette Readings in ml			Constant Burette Reading
		I	II	III	
Initial					……X ml
Final					
Difference					

For back titration -

Readings	Pilot Reading	Burette Readings in ml			Constant Burette Reading
		I	II	III	
Initial					……X ml
Final					
Difference					

Sample Calculations –

1. Weight of fuel = constant burette reading for blank titration = Xml.
   This is the volume of 0.1N HCL solution consumed for 10ml of 0.1N NaOH solution.
   Therefore , for 100ml of 0.1N NaOH solution ,

   = X x 10ml = X1mlof 0.1N HCl solution.

2. Amount of 0.1N NaOH solution consumed ,

   A = (X1 – X) ml.

Now, 1ml of 0.1N NaOH solution ,

= 0.0017 gm of ammonia (for phosphate fertilizer).

Therefore , A ml of 0,.1N NaOH solution ,

= (0.0017 X A) gm of ammonia in 0.2 gm ammonium chloride.

= B

Therefore , ammonia content in given fertilizer sample ,

= (amount of ammonia / amount of fertilizer sample) X 100

= (B / 0.2) X 100 %

Result: Nitrogen content in given NPK fertilizer sample is----------

Questions:

1) What is vermin-compost fertilizer?

2) What is the percentage of nitrogen in compost fertilizer?

3) What are the uses of vermin-compost fertilizer?

4) How vermin-compost fertilizer prepared?

Answers:

C(4)	P(4)	A(2)	TOTAL	SIGN