Background experience. In each of the following cases identify the conditions under which this might occur.

A. Roy is walking along, tears his sleeve and within minutes Roy is dead.

B. Every morning Joan gets on the elevator and rides to the ground floor and goes to work. Joan lives on the 12th floor. Every evening, when she comes home from work, she takes the elevator to the 7th floor and walks up the stairs to her apartment.

C. An open window, a gust of wind, glass on the floor, water on the floor, Mary's dead.

In each of the following cases consider issues that are important to consider.

TA. Mabel is designing a recycle blower that recycles some of the hot effluent gas from the reactor back to the reactor feed stream.

TB. You have just been transferred to the Liverpool, England office and are asked to design a plant to produce 10,000 tons per annum of polypropylene.

TC. The gaseous feed to the reactor is acetic acid vapour. The vapour is produced by evaporation from a vessel heated by steam. The flow to the reactor is controlled by measuring the vapour flow via an orifice and sending the signal to the steam flow to the evaporator.

B. What inferences could be drawn from the following facts? In each case enumerate as many alternatives as possible.

1. An expensive television set, delivered to the house next door only a few weeks ago, has just been taken away again by the firm which delivered it.

2. You parked your car overnight by the curb and next morning the right front tire was flat.

3. You said that you would telephone your wife around four o'clock. You do and there is no answer.

4. The answer, as given in the textbook, to problem No. 16 is 17.32 pounds. Your answer is 0.532 pounds mass.

5. Your answer, to problem No. 17, involving the amount of gas product \( x \) present at equilibrium for a gas phase reaction comes out negative.

6. You are given a problem on an exam and you feel that you cannot solve the problem unless you are given a molecular weight of benzene.

7. The thermocouple on all fifteen trays of the ethylbenzene distillation column read 157°C.

C. Check the following statements and explain what has been assumed to be true. Is the assumption valid or have we applied a formula to a situation where it cannot be applied?
1 A Upon application of the Clausius-Clapeyron equation, one finds that the vapor pressure of ether is calculated to be 773 mm Hg.

2 C To separate an ethanol-water feed that is 40 wt % water ($110^\circ$F) into a 5 wt % ethanol bottoms, 90 wt % ethanol at a reflux ratio 1.5 times the minimum requires fourteen ideal trays plus a reboiler.

3 A Democracy would work in South America if it were given a chance.

4 C Purpose: The distribution of anodic and cathodic centers of corrosion were studied. The various test specimens were placed in agars containing phenolphthalein, salt and potassium ferricyanide.

5 A The gas is mixed with the liquid by introducing the gas into the bottom of the vessel through a sparger. A sparger is merely a pipe with a large number of small holes drilled in it. The gas travels into the pipe, emerges through the holes and is swept into the liquid by the combined buoyancy and local turbulence.

D. Explain how stereotypes and emotions are appealed to in the following:

1 A Smoke Fillapuff the Strong man's cigarette.

2 A Miss Sexqueen uses Softy Lotion. Try it today.

3 A Obviously it follows that the reactor was put in upside down.

4 A Everybody knows that heat flows upwards in this system.

5 A It stands to reason that $a$ is larger than $b$.

6 A No one can deny that the cost of nitric acid is too high.

E. List four analogies that have been used to explain scientific concepts and point out the limitations of these.

F. Explain how the writer has taken a few facts and expanded them into an unwarranted generalization.

1 A Conscription is essentially democratic, since it applies to all alike, irrespective of class or profession.

2 A I can never succeed.

3 A No girl will ever have me.

4 A Spare the rod and spoil the child.

5 A Let sleeping dogs lie.

6 A Nurses are the best dates.

7 A All men are boors.
G. Explain how the writer has taken a few facts and jumped to or implied an unwarranted conclusion in the following sentences.

1. A month ago I put snow tires on my 1956 Plymouth and since that time I haven't been stuck once. Buy Snow Tires today.

2. Harry started to smoke a year ago and now he finds that he has lung cancer.

3. According to the best industrial reference, "Perry's", the Hooker cell will produce about 25% more NaOH per kilowatt hour than the De Nora cell.

H. Criticize the following statements. Then correct them.

1. The results are contradictory and are illustrated in Figure 1.

2. This estimate has been plotted in Figure 3 and shows the likelihood that the meters will all fail at the same time.

3. This measured value is 20 gallons; this is too large.

I. What are the theoretical model, frame of reference, assumptions and region of application for the following equations and laws. (Give page reference to the texts used).

1. Ideal gas law. \( pV = nRT \)
   There are three methods of derivation, explain each.

2. van der Waals equation
   \[ (p + \frac{\alpha}{V^2})(V - b) = RT \]

3. Law of conservation of mass.
   Matter cannot be created or destroyed, i.e., mass in less mass out must equal the accumulation.

4. Mole % = vol % = partial pressure %.

5. Vapor pressure above a liquid depends only upon the temperature.

6. Raoult's law states that the equilibrium vapor pressure that is exerted by a component in a solution is proportional to the mole fraction of the component.

7. Adiabatic saturation line identical to the wet-bulb line.

8. Henry's law states that the equilibrium value of the mole fraction of gas dissolved in a liquid is directly proportional to the partial pressure of that gas above the liquid surface.

J. Recognize your attitudes and stereotypes.

1. Make a list of persons, professions, institutions, our views of which tend to be colored through conventional "labels" that have become attached to them.
Examine your own views upon the following subjects and try to
decide how far they are based on mere habit, are inherited, or
are influenced by self-interest, and how far are they honestly
held as a result of reasoned conviction.

University education; homework; the speed limit; examinations;
value of reading newspaper; listening to radio; watching television;
value of spectator sports; value of modern means of rapid transportation.

K. Explain where the following analogies break down.

1. Bohr compared molecular structure with the solar system of the
   universe to explain chemical behaviour.

2. An ideal gas behaves like billiard balls bouncing around in a box.

3. The human eye is similar to a camera.

4. Heat and mass transfer are analogous.

5. Momentum, heat and mass transfer are analogous.

6. The difference between learning how to communicate and learning
   creative writing is like the difference between learning to skate,
   to play ice hockey and to compete in a figure skating competition
   (as given in section 1.1).

7. "My love is like a red, red rose".

Jumping to conclusions. Carefully think through the following problems.

1. van der Waals' equation is given as

   \( (p + \frac{n}{v^2}) (V - b) = RT \)

   Expand this into a general form for "n" moles of gas.

2. The first two statements in each of the following groups of
   sentences are the premises and the third is the deduction from these
   premises. (Accept the premises as true statements of fact). Are
   the deductions correct?

   a. All fishes are cold-blooded.
   The whale is not cold-blooded.
   Hence the whale is not a fish.

   b. A dwelling house is one used solely for residential purposes.
   This house is not used solely for residential purposes. It
   cannot, therefore, be reckoned as a dwelling place.
Examine your own views upon the following subjects and try to decide how far they are based on mere habit, are inherited, or are influenced by self-interest, and how far are they honestly held as a result of reasoned conviction.

University education; homework; the speed limit; examinations; value of reading newspapers; listening to radio; watching television; value of spectator sports; value of modern means of rapid transportation.

K. Explain where the following analogies break down.

1. Bohr compared molecular structure with the solar system of the universe to explain chemical behavior.
2. An ideal gas behaves like billiard balls bouncing around in a box.
3. The human eye is similar to a camera.
4. Heat and mass transfer are analogous.
5. Momentum, heat and mass transfer are analogous.
6. The difference between learning how to communicate and learning creative writing is like the difference between learning to skate, to play ice hockey and to compete in a figure skating competition (as given in section I.1).

7. "My love is like a red, red rose."

Jumping to conclusions. Carefully think through the following problems.

1. van der Waal's equation is given as

\[ (p + \frac{a}{V^2}) (V - b) = RT \]

Expand this into a general form for "n" moles of gas.

2. The first two statements in each of the following groups of sentences are the premises and the third is the deduction from these premises. (Accept the premises as true statements of fact). Are the deductions correct?

a. All fishes are cold-blooded. The whale is not cold-blooded. Hence the whale is not a fish.

b. A dwelling house is one used solely for residential purposes. This house is not used solely for residential purposes. It cannot, therefore, be reckoned as a dwelling place.
3B. Check the reasoning in the following:

\[ n^2 = n \left( 1 + 1 + 1 + 1 + 1 \ldots + 1 \right) \]

\[ n^2 = \underbrace{n + n + n + n \ldots + n} \]

\[ \frac{dn^2}{dn} = \frac{d}{dn} \left( \underbrace{n + n + n \ldots + n} \right) \]

\[ 2n = \underbrace{1 + 1 + 1 + \ldots + 1} \]

\[ 2n = n \]

\[ 2 = 1 \]

M. Use concrete rather than abstract words.

1B. In the following lists check the word that is on a different level of abstraction, if any.

- entropy
- velocity
- heat transfer coefficient
- catalyst activity
- energy
- 15 cm.
- June 9th
- F. T. Brown
- oxygen

- turbulent flow
- inside a closed pipe
- molecules bounce
- against a wall
- causing pressure

W. A. Jones
"Modern Technical Writing" by Sherman
Semantion
My observation
hydrogen
humidification tower
Esso's heat exchanger No. 3520

2B. Which of the following terms are absolute and which relative?

- entropy, velocity, temperature
- fundamental, high, perfect, final.
Identify the basis of an argument.

A. Obviously, since abortion is murdering a helpless baby, abortion is wrong.

B. Clearly, the trip to town is more tiring than it should be.

C. The famous Charles A. F. Burns, PhD, reminds us that *all is not sweetness and light* when it comes to disarmament.

TA. It stands to reason that the cause of the temperature fluctuation in the reactor is the faulty control system.

TB. The Chemical Engineer’s Handbook, p 6-43 says that radiation should not contribute to the heat loss for a case analogous to the one we are analyzing. Therefore we can neglect the radiation.
Exercise 30-Q Analyze the following passage and classify it into facts, event facts, opinion and opinionated fact. Here is an accurate account of what happened

The telephone rang! Harry grabbed the phone. "Trouble out on the ethylbenzene unit," said Bill. Harry said that he would be right out as Harry slammed down the phone. As Harry approached the unit, Bill came out of the control room to meet him and said, "I'm sure that the heat transfer coefficient is insufficient in the reboiler to the product column; I'll show you what I mean."

Harry glanced at the rotameter and saw that the flow to the column was the usual amount of 180 L/s; the pressure gauge read 1.4 MPa and the bottoms temperature was 140°C. Rounding the column, he saw the liquid level in the bottoms level gauge rising at the rate of about 3 cm/min. The liquid level disappeared out the top of the level gauge. About two minutes later the level reappeared in the level gauge, dropped rapidly and disappeared out the bottom of the sight gauge.

"See," said the operator, "we lost all of the bottoms out of the column just like that!" "It's gone off to the storage tank," offered John. "No, it's gone through the reboiler and straight up the column. You can see by the instabilities in the pressure gauges that occur just after the level disappears out the bottom of the level gauge," said Bill.

Based on the Account given in Exercise 30-Q, which of the following statements are true (T), false (F) or can't tell:

1. Bill said that there was trouble out on the ethylbenzene unit
   Facts: T F ?
   Event facts: T F ?

2. Harry said, "I'll be out immediately."
   Facts: T F ?
   Event facts: T F ?

3. The heat transfer is insufficient.
   Facts: T F ?
   Event facts: T F ?

4. The trouble is in the reboiler.
   Facts: T F ?
   Event facts: T F ?

5. The flow to the column was 180 L/s (3000 gpm).
   Facts: T F ?
   Event facts: T F ?

6. The pressure was 1.4 MPa (150 psig).
   Facts: T F ?
   Event facts: T F ?

7. The bottom temperature was 140°C.
   Facts: T F ?
   Event facts: T F ?

8. The level in the bottom of the column was building up and then suddenly dropping.
   Facts: T F ?
   Event facts: T F ?

9. John said, "The bottoms have gone off to the storage tank."
   Facts: T F ?
   Event facts: T F ?

10. When the level in the bottoms of the column drops, the pressure gauges show instabilities.
    Facts: T F ?
    Event facts: T F ?
Case 30-R  Tony LoPresti (based on a case developed by Denise Bryant-Lukosius, Nursing, McMaster University)

You are the primary care nurse in the outpatient clinic. Tony LoPresti, 22 year old male, comes into the clinic accompanied by his mother, Roseanne LoPresti.

For the past six months," Roseanne explains, "Tony has had a fever and night sweats." She said that he has lost about 5 kg. Tony added that he also has anorexia, a slight cough and some back pain.

Roseanne said," Your back pain always seems worse when you booze it up. You really shouldn't drink so much, Tony."

You check the medical file and note a moderately elevated white blood count of $18.2 \times 10^9 / L$ with a neutrophilia and a mild anemia with a hemoglobin of 110.

The file continues:

A lump was found in the left groin. It was mildly tender, mobile and about 2½ cm in diameter. The lump was excised and the biopsy show that the architecture of the node is completely replaced by bands of residual nodules of inflammatory cells in which plasma cells and lymphocytes predominate but which is polymorphous and contains numerous histiocytes, eosinocytes and occasional neutrophils. Among these are large atypical, mono and binucleate cells some of which are Reed-Sternberg cells. The appearance of the node is consistent with nodular sclerosing Hodgkin's Disease.

A bone marrow biopsy of the left posterior iliac crest showed marrow fibrosis.

You think that Tony has Hodgkin's Disease.

Based on the Account given in Exercise 30-R , which of the following statements are true (T), false (F) or can't tell:

<table>
<thead>
<tr>
<th>Facts</th>
<th>Event facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tony said, &quot;For the past six months I have had a slight, dry cough.&quot;</td>
<td>T F ?</td>
</tr>
<tr>
<td>2. Tony has a mild anemia.</td>
<td>T F ?</td>
</tr>
<tr>
<td>3. Tony has a problem with alcohol.</td>
<td>T F ?</td>
</tr>
<tr>
<td>4. Tony has Hodgkin's Disease.</td>
<td>T F ?</td>
</tr>
<tr>
<td>5. The cells in Tony's lymph node were large, atypical, mono and binucleate cells.</td>
<td>T F ?</td>
</tr>
<tr>
<td>6. Some of the cells were Reed-Sternberg cells.</td>
<td>T F ?</td>
</tr>
<tr>
<td>7. A C.T. scan of the chest and the abdomen showed multiple rounded masses within the mediastinum. The liver and spleen are slightly enlarged.</td>
<td>T F ?</td>
</tr>
<tr>
<td>8. The white blood count was elevated at $18.2 \times 10^9 / L$.</td>
<td>T F ?</td>
</tr>
<tr>
<td>9. Tony lost some weight over the past six months.</td>
<td>T F ?</td>
</tr>
</tbody>
</table>
Cloudy thinking activities:

A. Husband: “I’ll be home late if I stop to pick up the cleaning”
Wife (later) “You’re late; but you haven’t the cleaning!”
Trigger event

Charles claims that the only way two phase flow can occur is slug flow, annular flow, mist flow and bubble flow.

Eyed needles have been found on Paleolithic sites from 40,000 years ago. It is believed that Paleolithic people used them to sew animal skins into protective garments. Thus, tailoring is a very old practice. [LeBlanc 3]

Ever-growing suburban populations suck the life out of cities. Suburbs make good public transportation almost impossible. Riders are concentrated along a few main roads, rather than they are scattered over many smaller ones. Thus, it becomes expensive to carry them. This results in infrequent service or higher fares, either of which makes public transit less appealing. People in suburbs there get around mainly by car, resulting in the need for wide roads, which are expensive for cities to build and maintain. [LeBlanc 5]

For the various scenarios, use your creativity to do this task.

You are at a meeting. The agenda indicated that we are to decide if we should spend $230,000 to improve the lighting in the parking lot. Arguments have been presented both for and against approval. The arguments for have emphasized safety and security of employees who work after dark; the aesthetic image of the company when people drive by in the evening; sufficient illumination that the video cameras monitoring the area will be able to pick up sufficient details to identify culprits doing industrial espionage and break-ins. The arguments against have focused on other, less expensive alternatives to provide safety and security for employees; other options to improve the exterior visual image of the company; the lack of a need to do the latter and the merits of other projects seeking funding at this time.

The design of the new phthalic anhydride plant has been completed. You are asked to check of the details to ensure that the projected capital and operating costs are reasonable; sufficient details have been considered and delved into, the calculations are based on the correct fundamentals and seem reasonable, that is, the sizing control and operating specifications “make sense,” all areas have been considered.