

ESYS10 Mid-term examination
Tuesday, February 8, 2005
11:00 AM – 12:20 PM

Answers to review questions and problem sets allowed. Please pass in your review question answers with your exam paper. No books, no other notes.

I. Fill in the blank (10 points each)

1. A process with a negative feedback is stable OR unstable to changes in one of the parts of the process. (Circle the correct one.)
2. The lowest layer of the atmosphere is called the _____
3. Wind that is exactly along contours of constant pressure instead of blowing from high to low pressure is called _____ wind.
4. "Homo sapiens" is an example of a _____ within the taxonomic tree.
5. For a blackbody, the wavelengths and total amount of radiated energy depend on the _____ of the blackbody.

II. Short answer (20 points each)

1. Sea ice and snow form when the temperature is low.
 - (a) What effect do snow and ice have on the earth's temperature? Why? (6 points)

 - (b) Draw a feedback loop for snow/ice and temperature. (8 points)

 - © Is the feedback loop positive or negative? Is it stabilizing or destabilizing? (6 points)
2. Describe how the Coriolis effect causes the wind to veer to the right in the northern hemisphere when there is high pressure in the north and low pressure near the equator. Please include a sketch of how this works.
3. All electromagnetic (E-M) radiation moves through space at the same speed.
 - (a) What is this speed called? (It is usually denoted by the symbol "c".) (3 points)

 - (b) Because all E-M waves move at the same speed, we know how the frequency and wavelength of the electromagnetic radiation are related to each other. If the wavelength of the EM radiation is short, is its frequency large or small? Explain why. (Use one of the equations at the end of this question.) (7 points)

© Compare the EM radiation emitted by a very hot blackbody (such as the sun) with the EM radiation emitted by a much cooler blackbody (such as the earth). Which equation in the list at the end gives you the relation between the frequency of the EM radiation and the energy of a photon? _____ (3 points)

(d) Is the wavelength of the peak EM radiation of the hot body longer or shorter than the wavelength of the peak EM radiation from the cold body? Explain how you know this. (7 points)

Some random and possibly useful expressions.

$$A = \pi r^2$$

$$E = h\nu$$

$$A = 4\pi r^2$$

$$T(K) = T(C) + 273.15$$

$$\text{Volume} = 4/3 \pi r^3$$

$$F = \sigma T^4$$

$$\lambda\nu = c$$

III. Essay (30 points). The California Air Resources Board and Los Angeles city have been working for several years on a plan to reduce air pollution from the ports of Los Angeles-Long Beach. The following article in 2002 gives the background, and an article in last week's LA Times (2005) describes recent developments. Questions for the essay follow at the end.

Finally Tackling L.A.'s Worst Air Polluter; Harbor: Twin ports add more to smog than any other site, but have been little regulated. Officials seek to protect health but not hurt the economy.; [Home Edition]

GARY POLAKOVIC. Los Angeles Times. Los Angeles, Calif.: Feb 10, 2002. pg. B.1 (Copyright (c) 2002 Los Angeles Times)

A container ship as long as three football fields glides into the still waters of the Port of Los Angeles, where it disgorges sneakers, electronic components and a plume of black exhaust.

With each docking and departure, one ship pumps an average of four tons of pollutants into the skies. On a typical day, 16 container ships arrive at the port complex that stretches from San Pedro to Long Beach, releasing more smog-forming gases than 1 million cars, or more than twice as much as all of the power plants in the Los Angeles Basin.

No other facility produces more air pollution than the port complex, and air quality officials have known it for a long time. Though strict regulations have been imposed on polluters across California, the L.A. ports have gone largely

unregulated for a variety of reasons, from lack of jurisdiction over foreign-flagged ships to fears of losing trade to other cities.

Now, officials are struggling to craft new rules that will protect people's health without jeopardizing the economic benefits of being the nation's busiest waterfront. There's a lot on the line.

The Los Angeles-Long Beach port complex is a gateway to one quarter of a trillion dollars in Pacific Rim and Latin American trade. As trade continues to grow, ship emissions are expected to double in the next 20 years in Southern California.

And the big cargo ships are not the only serious source of pollution. Tugboats, harbor craft and fishing fleets add 11 tons daily, according to the South Coast Air Quality Management District.

Onshore, hundreds of trucks laden with computers from Japan, toys from China and furniture from Malaysia rumble over the Vincent Thomas Bridge toward distant cities. Smaller "yard tractors" scurry like beetles stacking containers on the docks under a pall of haze that stretches to the Long Beach skyline and beyond.

Though nearby communities such as Wilmington and San Pedro get the worst of it, onshore breezes blow the pollution inland, where it forms ozone, an acutely toxic gas, and haze that blankets suburban valleys. Smog causes bronchitis, lung irritation and chest pains. Microscopic specks of unburned fuel are linked to cancer, asthma and heart attacks.

Farther north, Santa Barbara County's chief smog fighter, Douglas Allard, has identified 102 smoky ships as "frequent fliers." They are vessels that routinely visit California waters, traveling the shipping lanes between the Channel Islands and the mainland, although there are no plans to clean them up.

In 15 years vessel smokestacks will account for two-thirds of the county's smog-forming gases, too much to maintain healthy, blue skies, Allard said.

Out in the open ocean, scientists say ship smog spreads farther than previously thought. Soot from smokestacks adds to haze and traps heat from the sun, which scientists say contributes to global warming.

"For most people, this is an invisible industry. You know when you get stuck behind a truck that smells dirty, but people are not even aware that 65% of all consumer goods are transported by ships," said James J. Corbett, professor of marine policy at the University of Delaware.

"When it comes to controlling emissions from ships," he said, "we're just at the beginning stages, about where we were in 1965 with cars. The industry is beginning to make the transition toward cleaning up, but it's the least regulated source of all."

L.A. Port Meeting Canceled

No new date is set for a task force seeking to improve air quality. Activists are concerned.
By Deborah Schoch, Times Staff Writer

Port of Los Angeles officials abruptly canceled a meeting Tuesday of a high-profile task force charged with designing a first-in-the-nation plan to rein in air pollution at a seaport.

The decision created a stir, as some community activists said the plan may be falling victim to intense pressure from shippers, railroads and other industry groups.

Port officials said the experts who were drafting the plan requested more time, although two of the experts said they were unaware of such a request. No new date was scheduled, and it was unclear Tuesday whether the task force would present a pollution cleanup plan to Mayor James K. Hahn on schedule by the end of February.

Hahn, who is seeking reelection on March 8, pledged more than three years ago to hold pollution at 2001 levels and promised a plan by the end of 2004. That deadline was later extended.

Some industry representatives, who sharply criticized aspects of the proposal at private meetings last week, said Tuesday that they were pleased that the group would have more time to study their concerns.

"The task force should take the time to do it right," said Michele Grubbs, a task force member and a vice president of the Pacific Merchant Shipping Assn.

The all-day public meetings Monday and Tuesday were intended to showcase sweeping proposals to cut pollution at the port, which together with the Long Beach port has grown into the region's largest air polluter.

The plan is expected to include such proposals as increased use of low-sulfur fuel by ships and railroads and a push to replace older trucks with cleaner-burning models.

On Tuesday, port Commissioners Camilla Townsend and Thomas H. Warren e-mailed task force members, stating that the technical experts working on the plan had requested more time. But two experts said the group did not request the cancellation.

"All I can say is that I'm a member of the technical working group, and we did not ask for

additional time," said air pollution expert Ed Avol, professor of preventive medicine at the Keck School of Medicine at USC.

Another expert, Peter Greenwald, the air district's senior policy advisor, concurred. "We want to see the process move as quickly as possible," he said.

But Christopher Patton, the project manager for the group and an environmental expert with the city, said he told Warren on Monday "that if I had my druthers, I would like more time."

Task force member Noel Park, a community activist, said he was dismayed by industry criticisms of the proposals.

"You just know there's intense lobbying going on," he said. "I have visions of the lobbyists circling City Hall like the airplanes circling King Kong."

Write an essay commenting on this article. Consider the following issues: Why are Californians concerned about emissions? Why is there a focus on cleaning up air pollution at the port, compared with other sources of air pollution? Who are some of the stakeholders in this discussion and what are the issues that concern them? Do you think that port pollution will eventually be regulated? What are some consequences (positive or negative) of regulation?