

1. What does the so-called 'Similar Exposure Group; SEG' mean? (5%) By what methodologies can SEGs be defined? (5%)
2. What is the TLV in  $\text{mg}/\text{m}^3$  of a solution containing 50% heptane (TLV=400ppm or  $1640 \text{ mg}/\text{m}^3$ ), 30% methyl chloroform (TLV=350 ppm or  $1910 \text{ mg}/\text{m}^3$ ), and 20% perchloroethylene (TLV=25 ppm or  $170 \text{ mg}/\text{m}^3$ )? (4%) Please convert the TLV for the mixture into ppm (parts per million). (6%) [Assuming the components in the mixture have similar toxicological effects; assuming all of the liquid mixture eventually evaporates]
3. What does 'Isokinetic Sampling' mean? (5%)
4. How many  $1.0 \mu\text{m}$  diameter particles are required per cubic centimeter of aerosol for the mass concentration to be  $10 \text{ mg}/\text{m}^3$ ? (5%) [Assume a particle density of  $1 \text{ g}/\text{cm}^3$ ]
5. A passive organic vapor monitor and a solid sorbent tube method were used side-by-side to determine the concentration of benzene vapor.
  - (1) For passive organic vapor monitor, the diffusive path length of the monitor is 1.1 cm, the diffusive area is  $1.33 \text{ cm}^2$ , and the diffusion coefficient of benzene vapor at  $25^\circ\text{C}$ , 760 mmHg is  $0.0907 \text{ cm}^2/\text{sec}$ . If the sampling was performed at  $25^\circ\text{C}$ , 760 mmHg for 5 hours, and the average concentration of benzene vapor was found to be 0.2 ppm. How many moles of benzene were collected in the monitor? (8%) [molecular weight of benzene: 78.11 g/mole; density of liquid benzene: 0.88 g/ml]
  - (2) For solid sorbent tube, the sampling rate was 75 mL/min (the sampling time was also 5 hours). Both front and back sections of the sorbent tube were desorbed with 1.5 mL of inert solvent, respectively. The desorption efficiency is known to be 90%. After 2  $\mu\text{L}$  was injected into a chromatograph, the interpolated mass on an external standards curve was 0.2  $\mu\text{g}$  for the front section. For the back section, 2  $\mu\text{L}$  was also injected and the interpolated mass was found to be 0.007  $\mu\text{g}$ . What was the concentration of benzene vapor in ppm determined by the solid sorbent tube method? (8%)
  - (3) Is the concentration determined from the solid sorbent tube the same as the concentration obtained from the passive organic vapor monitor? Why? (4%)
6. What are the important parameters should be considered in the evaluation of direct reading instrument? (10%)
7. What does equal loudness contour (等響度曲線) mean? What is its role in the noise level measurement? (6%)
8. A worker stands in front of a machine and there are three sound sources around him. These sound levels measured at the spot he stands were 90 dB, 90 dB and 80 dB, respectively. Therefore, what is the combined sound level of these three sound sources measured at this spot? (9%) [Please list the equation(s) used in your calculation(s).]
9. Please briefly describe WBGT. What factors should be considered when it is applied for environmental exposure measurement. (10%)
10. For radiation exposure measurement, please briefly define radioactivity (活度), radiation exposure (暴露), absorbed dose (吸收劑量), and equivalent dose (等效劑量), and indicate the respective measurement units, respectively. What are the relationships among absorbed dose, equivalent dose and effective dose (有效劑量). (10%)
11. ' $\text{CFU}/\text{m}^3$ ' is commonly used for bioaerosol sample concentration unit. What does it mean? (5%)