

International Hazard Datasheets on Occupation



Physical chemist


Who is a physical chemist?






A physical chemist is a worker who conducts research into relationships between chemical and physical properties of substances to increase knowledge of physical aspects of chemical phenomena or to develop or improve materials, products and industrial processes.





What is dangerous about this job?

- Exposure to ionizing radiation when doing work with radioactive materials and/or with defective laboratory equipment with an internal radioactive source.
- Exposure to non-ionizing radiation: infrared radiation, visible light, ultraviolet light, laser radiation, microwave and radio-frequency radiation; and radiation from very-low and extremely-low frequency electromagnetic fields; exposure may occur when working with defective laboratory equipment and/or because of incorrect work habits.
- Exposure to carcinogenic, mutagenic and teratogenic substances.
- Exposure to substances that can damage the nervous system.

Hazards related to this job

Specific preventive measures can be seen by clicking on the respective  in the third column of the table.

Accident hazards 	<ul style="list-style-type: none">• Falls, slips and trips on wet and slippery floors.	
	<ul style="list-style-type: none">• Being hurt by falling objects from storage shelves.	
	<ul style="list-style-type: none">• Injuries caused by striking against laboratory equipment and laboratory furniture due to overcrowded laboratory rooms.	
	<ul style="list-style-type: none">• Burns caused by contact with hot surfaces (hot plates, ovens, etc.)	
	<ul style="list-style-type: none">• Chemical burns due to accidental exposure (spilling, splashing, leaking, etc.) to corrosive liquids and gases.	
	<ul style="list-style-type: none">• Electrocutation or electric shock due to defective electrical systems, short-circuits, incorrect use by electro-mechanical equipment and contact with "live" wires.	
	<ul style="list-style-type: none">• Explosions of over-pressurized vessels and/or vacuum equipment.	
	<ul style="list-style-type: none">• Damage to eyes, resulting from exposure to laser radiation, splashes of chemicals and corrosive gases.	

Physical hazards 	<ul style="list-style-type: none"> Exposure to ionizing radiation when doing work with radioactive materials and/or with defective laboratory equipment which has an internal radioactive source. 	5
	<ul style="list-style-type: none"> Exposure to non-ionizing radiation: infrared radiation, visible light, ultraviolet light, laser radiation, microwave and radio-frequency radiation; and radiation from very-low and extremely-low frequency electromagnetic fields; exposure may occur when working with defective laboratory equipment and/or because of incorrect work habits. 	5
Chemical hazards 	<ul style="list-style-type: none"> Exposure to a wide variety of chemicals: corrosive, irritating, suffocating, allergic, radioactive, etc. 	3 5
	<ul style="list-style-type: none"> Exposure to carcinogenic, mutagenic, and teratogenic substances. 	3 6
	<ul style="list-style-type: none"> Exposure to substances that can cause damage to the nervous system. 	3
	<ul style="list-style-type: none"> Exposure to chemicals which may cause different allergic reactions: respiratory tract irritation, asthma, eye irritation and skin rash. 	3
Biological hazards 	<ul style="list-style-type: none"> Vision problems (Eye Discomfort Syndrome) when working with computers, caused by excessive visual load, prolonged concentration on the screen, inappropriate viewing angle, poor illumination, glare, image flicker, poor combination of colours, etc. 	6
	<ul style="list-style-type: none"> Exposure to Legionella, bacteria which may be transmitted through ventilation systems 	
Ergonomic, psychosocial and organizational factors 	<ul style="list-style-type: none"> Vision problems (Eye Discomfort Syndrome) when working with computers, caused by excessive visual load, prolonged concentration on the screen, inappropriate viewing angle, poor illumination, glare, image flicker, poor combination of colours, etc. 	7 9
	<ul style="list-style-type: none"> Musculoskeletal problems due to repetitive strain injury (RSI), or overuse occupational syndrome (OOS) of upper extremities as a result of continuous repetitive exertions stemming from prolonged work with keyboard, mouse and other similar accessories while working with a computer. 	8 9

Preventive measures

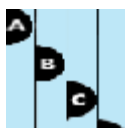
- 1 Wear safety shoes with non-skid soles; where needed floor should be made rugged.
- 2 Use heat insulating gloves.
- 3 Apply chemical safety rules when handling or working with hazardous chemicals; read MSDS and consult a safety supervisor for specific chemicals.
- 4 Install an appropriate guard over and around vacuum glass vessels which can collapse.

- 5 Verify that work is done according to IAEA radiation-safety guidelines for working with ionizing radiation.
 - 6 Apply chemical and/or biological safety rules when working with biological and/or carcinogenic, mutagenic and teratogenic substances; if necessary, read IARC documents; in special cases it is recommended to consult with safety supervisor.
 - 7 Install suitable general illumination that fits the character and tasks of the work; consult with an illumination expert; prevent glare by appropriate positioning of the screen or, alternatively, use a glare-preventing filter.
 - 8 Prepare the computer workstation according to ergonomic requirements and with appropriate consideration of worker's height and personal characteristics. Make use of the control and adjustment gadgets installed in the equipment of the workstation: for regulating the height and angle of the screen; the height of the seat; the back of the chair; etc.
 - 9 Make frequent pauses for "rest and exercises" of the eyes, hands and other organs; change frequently the work posture (e.g. from inclined sitting to upright standing and vice versa).
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Specialized information

Synonyms Research chemist; theoretical chemist; thermodynamics chemist.

Definitions and/or description



Conducts research into relationships between chemical and physical properties of substances to increase knowledge of physical aspects of chemical phenomena or to develop or improve materials, products or industrial processes: specializes in the application of physical laws and methods to the study of chemical behavior as in electrochemistry, thermo-chemistry, radiation chemistry, surface chemistry, corrosion science and crystallography, where such techniques as spectroscopy, X-ray diffraction, thermo-magnetic analysis and electron microscopy are employed. Induces changes in composition of substances by introduction of heat, light, energy, and chemical catalysts. Conducts research into composition, structure, properties, relationships, and reactions of matter. Physical chemists are often concerned with developing new types of instruments for measuring different types of data. Spend a lot of time with computer modeling of chemical systems in various ways. Confers with scientists and engineers regarding research, and prepares technical papers and reports. May specialize in particular field of physical chemistry and be designated accordingly (5).

Related and specific occupations

Analytical chemist; chemist; chemistry engineer; food chemist; instrumentation chemist; etc.

Tasks

Acquiring; adding; adjusting; advising; analyzing; arranging; boiling; calibrating; classifying; collecting; combusting; comparing; concentrating; connecting; consulting; controlling; copying; cutting; demonstrating; developing; diluting; discussing; dissolving; distributing; drying; evaporating; examination; exercising; exhibiting; extracting; filling; filtering; fixing; following-up; handling; heating; identifying; injecting; inserting; inspecting; instructing; investigating; invitation; keeping up-to-date; learning; lowering; maintaining; managing; marking; mixing; modeling; monitoring; operating; opening; planning; preparing; processing; pumping; ; measuring; researching; repairing; reporting; sampling; searching; showing; separating; sorting; supervising; supplying; surveying; taking; testing; training; twinning; typing; updating; washing; weighing; writing.

Primary equipment used

Blending and mixing appliances; calculators; computers; electronic microscope; glass and plastic vessels; filters; ICP; measuring tools; pumps; scales and weights; spectrometer.

**Workplaces
where the
occupation
is common**

Chemical industry; institutes of standards; quality assurance laboratories; research laboratories; universities and colleges

Notes



It is important to note that physical chemistry is a field of science that relates chemical structure to the physical properties of substances. The term physical chemistry is usually applied to the study of properties such as vapour pressure, surface tension, viscosity, refractive index and density, as well as to the study of the so-called classical aspects of the behaviour of chemical systems, such as thermal properties, equilibrium, rates of reactions, mechanisms of reactions, and ionization phenomena. In its more theoretical aspects, physical chemistry attempts to explain spectral properties of substances in terms of fundamental quantum theory; the interaction of energy with matter; the nature of chemical bonding; the relationships correlating the number and energy states of electrons in atoms and molecules with the observable properties shown by these systems; and the electrical, thermal, and mechanical effects of individual electrons and protons on solids and liquids. In light of the above it is clear that the physical chemist is more of a theoretical chemist than practical chemist.

References



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 3. Kirk-Othmer, Encyclopedia of Chemical Technology, 4th Ed., 1992.
 4. U.S. Department of Labor: Dictionary of Occupational Titles – DOT, 2 Vol., 1991.
 5. "Chemistry, Physical". Microsoft® Encarta® Online Encyclopedia 2002.
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