MEDLAB BASICS · STUDY SHEET

Laboratory Safety and Biosafety

Bloodborne pathogens and exposures, biosafety levels and safety cabinets, chemical labels and SDS, fire, electrical and radiation safety, waste, shipping specimens, and the sentinel laboratory

19 sources + more detail
medlabbasics.com/sheets/lab-safety.html
checked Nov 2026

1 Bloodborne pathogens: the kinds of control

CONTROL	WHAT IT IS (OSHA)	LABORATORY EXAMPLES
Engineering	Isolates or removes the hazard from the workplace	Sharps containers, self-sheathing needles, safety-engineered sharps, BSCs, splash shields, centrifuge safety cups
Work practice	Changes the way a task is done	No two-handed recapping, no mouth pipetting, handwashing after gloves come off, no eating or drinking in the work area
Personal protective equipment	Barrier worn by the worker, provided at no cost	Gloves, fluid-resistant gowns or lab coats, face shields, masks with goggles
Administrative	Written programs and training	Exposure control plan, chemical hygiene plan, SOPs, annual training

- Exposure control plan: written, reviewed and updated at least annually and when tasks change; front-line workers help choose safer devices.
- Hepatitis B vaccine: offered at no cost within 10 working days of assignment. A worker who declines signs a declination and can still get the vaccine later.
- Training: at assignment and at least annually. Training records kept 3 years; medical records for the length of employment plus 30 years.
- Treat all blood and other potentially infectious materials (OPIM) as infectious. OPIM include CSF, synovial, pleural, pericardial, peritoneal and amniotic fluid, semen, vaginal secretions and any fluid visibly bloody.

EXAM TIP Exams ask which control type a measure is. A sharps container or safety needle is engineering; a rule about how to do the task is work practice; gloves and face shields are PPE.

2 After a needlestick or splash

1. Needlestick or cut: wash the site at once and thoroughly with soap and water.
2. Splash to the nose, mouth or skin: flush with water. Eyes and mucous membranes: irrigate at the eyewash with water or saline for 15 minutes (OSHA laboratory guidance).
3. Report to the supervisor at once.
4. The employer makes a confidential medical evaluation available immediately and at no cost: route and circumstances documented, source patient identified and tested for HBV and HIV after consent, worker's blood collected after consent.
5. Post-exposure prophylaxis, when indicated, follows U.S. Public Health Service recommendations and starts as soon as possible; counseling and evaluation of any later illness follow.
6. The worker receives the health care professional's written opinion within 15 days of the evaluation.

SAFETY If the worker agrees to a baseline blood draw but not yet to HIV testing, the sample is kept for at least 90 days. If the worker consents within those 90 days, it is tested as soon as feasible.

3 Biosafety levels (BMBL)

LEVEL	AGENTS	KEY PRACTICES AND BARRIERS	EXAMPLES
BSL-1	Well characterized, not known to cause disease in healthy adults	Standard practices; open bench; door, handwashing sink, cleanable bench	Bacillus subtilis, Naegleria gruberi
BSL-2	Cause human disease of varying severity; spread by needlestick, mucosa, ingestion	Limited access; BSC for any procedure that can make aerosols or splashes; autoclave available; self-closing doors	HBV, HIV, Salmonella, Toxoplasma; most clinical specimens
BSL-3	Serious or lethal disease by inhalation	All work with viable agents in a BSC; controlled access through two self-closing doors; inward (negative) airflow; respiratory protection as needed	M. tuberculosis cultures, Coxiella burnetii; Brucella, F. tularensis and identified Coccidioides cultures
BSL-4	Dangerous, exotic, aerosol-transmitted, no vaccine or therapy	Class III BSC or positive-pressure suit; airlock entry; separate building or isolated zone	Marburg virus, Crimean-Congo hemorrhagic fever virus

4 Biological safety cabinets

CABINET	PROTECTS	AIRFLOW	VOLATILE CHEMICALS
Class I	Worker and environment, not the product	Unfiltered room air in at 75 lfm or more; HEPA-filtered exhaust	Small amounts if exhausted outdoors
Class II A1 / A2	Worker, product and environment	Inflow 75 (A1) or 100 (A2) lfm; HEPA downflow; about 70% recirculated, 30% exhausted	No flammables; small amounts only when exhausted outdoors (canopy connection)
Class II B1 / B2	Worker, product and environment	Inflow 100 lfm; hard-ducted; B1 exhausts about 70%, B2 exhausts 100% (total exhaust)	Small amounts (work at the rear in B1)
Class II C1	Worker, product and environment	Inflow 100 lfm; about 70% exhausted, 30% recirculated; room-recirculated or canopy-connected	Small amounts in the exhausted zone, only when canopy-connected with an alarm
Class III	Maximum protection for worker and environment	Gas-tight glove box under negative pressure; HEPA supply; exhaust through two HEPA filters	Small amounts (exhaust hard-connected to the outside)

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4 Biological safety cabinets CONTINUED

SAFETY A laminar flow clean bench is not a BSC. It blows filtered air toward the worker and protects only the product: never use it for specimens or cultures.

- Certify BSCs at least annually and whenever moved. No open flames in a BSC; use an electric loop sterilizer or disposable loops.
- UV lamps are never the only disinfection method, and they are off when the room is occupied.
- Use a BSC for pipetting, centrifuging, grinding, blending, shaking, mixing, sonicating and opening containers of infectious material. Wait 10 minutes after the rotor stops before opening a centrifuge used for infectious material.

5 Chemical labels and the safety data sheet

SDS SECTION	LOOK HERE FOR
1 Identification · 2 Hazard(s) identification · 3 Composition	Product, supplier, hazard class and category, signal word, pictograms, ingredients
4 First-aid measures	What to do for eye, skin, inhalation and ingestion exposure
5 Fire-fighting measures	Extinguishing media, combustion hazards
6 Accidental release measures	Spill containment and cleanup
7 Handling and storage · 8 Exposure controls/PPE	Incompatibles and storage; exposure limits, ventilation, gloves, respirators
9-11 Properties, stability and reactivity, toxicology	Flash point, reactivity, health effects
12-15 Ecological, disposal, transport, regulatory	Headings kept for GHS order; content not mandatory under OSHA
16 Other information	Date of preparation or last revision

- A shipped container label carries six things: product identifier, signal word ('Danger' for severe, 'Warning' for less severe), hazard statements, pictograms, precautionary statements, and the responsible party's name, address and phone.
- SDSs must be readily accessible to workers on every shift; electronic access is acceptable if nothing blocks immediate access.

EXAM TIP The numbers run in opposite directions. NFPA 704 diamond: 0 least to 4 most hazardous (blue health, red flammability, yellow instability, white special: OX, W, SA). HazCom categories: 1 most severe to 4 least severe.

6 Fire

STEP	RACE (RESPONSE)	PASS (EXTINGUISHER)
1	Rescue anyone in danger	Pull the pin
2	Activate the alarm	Aim low at the base of the fire
3	Confine the fire by closing doors	Squeeze the handle, extinguisher upright
4	Evacuate, or Extinguish if small	Sweep side to side at the base

CLASS	FUEL	LABORATORY EXAMPLE
A	Ordinary combustibles	Paper, cloth, wood, many plastics
B	Flammable liquids and gases, grease	Solvents (xylene, alcohols), flammable gases
C	Energized electrical equipment	Analyzer, wiring, computer
D	Combustible metals	Magnesium, sodium, potassium
K	Cooking oils and fats	Kitchens, not usually the lab

SAFETY A multipurpose dry chemical extinguisher covers A, B and C. Evacuate at once if in any doubt, if the extinguisher empties, or if the fire grows beyond its starting stage.

7 Shipping specimens and cultures

CATEGORY	WHAT IT IS	UN NUMBER AND NAME	PACKAGING
Category A	Can cause permanent disability or life-threatening or fatal disease in healthy people or animals on exposure	UN2814 (affecting humans), UN2900 (animals only), UN3549 (solid medical waste)	Triple packaging tested to the Category A standard (UN specification mark), itemized contents list
Category B	Infectious, but not in a form that meets Category A	UN3373 'Biological substance, Category B'	Triple packaging; UN3373 diamond mark; 1.2 m drop test
Exempt specimen	Routine testing not related to infectious disease, low probability of pathogens (for example cholesterol, glucose, drug tests)	None	US ground (49 CFR): excepted from Division 6.2 rules. WHO and air rules: basic triple packaging marked 'Exempt human specimen'
Regulated medical waste	Waste from patient care or testing	UN3291	Leakproof; sharps in puncture-resistant containers

EXAM TIP Triple packaging is a leakproof primary receptacle, a leakproof secondary packaging with enough absorbent for all the liquid, and a rigid outer packaging. Dry ice goes outside the secondary packaging, in a box that vents CO_2.

8 Sentinel laboratories (LRN)

Sentinel laboratories in the Laboratory Response Network provide routine diagnostic services, rule out and refer: when an isolate cannot be ruled out as a threat agent (such as Bacillus anthracis, Brucella, Francisella tularensis or Yersinia pestis), further work moves into the BSC and the isolate goes to an LRN reference laboratory, such as the state public health laboratory. National laboratories such as CDC do the specialized characterization.

SAFETY Do not use commercial identification systems (manual or automated, including MALDI-TOF) on a suspected threat agent, and never sniff plates. BMBL warns that their databases may not include these agents, MALDI-TOF can make aerosols, and sniffing Brucella cultures has caused laboratory infections.

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