

Certificate in Hyperbaric Medicine (United Kingdom)

Medical Gas Therapy

Acetylene – A combustible gas occasionally encountered in industrial settings; not used therapeutically but relevant for safety training in hyperbaric facilities. Related terms: flammable gases, safety protocols The presence of acetylene in a chamber can cause fire hazards; therefore, strict cleaning and monitoring procedures are required.

Air – The natural mixture of gases ($\approx 78\%$ nitrogen, 21% oxygen) that serves as the baseline breathing medium. Related terms: ambient air, fractional inspired oxygen (FiO_2) In hyperbaric medicine, air may be used as a control gas during research protocols to compare outcomes against enriched oxygen environments.

Alveolar Gas Equation – A formula that calculates the partial pressure of oxygen in the alveoli (PAO_2) based on inspired oxygen, barometric pressure, and water vapor pressure. Related terms: PAO_2 , PaO_2 , FiO_2 Understanding this equation helps clinicians predict oxygenation improvements during hyperbaric treatment and adjust prescriptions accordingly.

Atmospheric Pressure – The pressure exerted by the weight of the atmosphere at sea level, approximately 101.3 kPa (1 ATA). Related terms: absolute pressure, gauge pressure Hyperbaric chambers are calibrated in multiples of atmospheric pressure; for example, 2 ATA equals twice the sea-level pressure.

Barotrauma – Tissue injury caused by rapid changes in pressure, commonly affecting the ears, sinuses, or lungs. Related terms: middle-ear squeeze, pulmonary barotrauma Proper equalisation techniques and patient screening are essential to minimise barotrauma risk during compression and decompression phases.

Barometric Chamber – A sealed enclosure capable of altering internal pressure for therapeutic purposes; often synonymous with hyperbaric chamber. Related terms: monoplace chamber, multiplace chamber Chambers can be classified by size and design, influencing patient capacity, gas delivery systems, and safety features.

Boyle's Law – The principle that, at constant temperature, the volume of a gas is inversely proportional to its pressure. Related terms: gas laws, Charles's law This law explains why gas-filled cavities (e.g., middle ear) expand or contract during pressure changes, guiding equalisation strategies.

Carbon Dioxide (CO_2) – A colourless gas produced by cellular metabolism; used in some research protocols to assess ventilatory drive. Related terms: hypercapnia, CO_2 retention Elevated CO_2 levels can stimulate breathing, but excessive accumulation may lead to respiratory acidosis, requiring careful monitoring.

Carbon Monoxide (CO) – A toxic gas formed by incomplete combustion; exposure can cause cellular hypoxia. Related terms: CO poisoning, carboxyhemoglobin Hyperbaric oxygen therapy is a definitive treatment for CO poisoning, accelerating the dissociation of CO from haemoglobin.

Closed-Circuit Rebreather – A respiratory system that recirculates exhaled gas after removal of CO₂, conserving oxygen. Related terms: open-circuit system, CO₂ scrubber In multiplace chambers, closed-circuit systems allow precise control of FiO₂ and reduce waste gas, enhancing cost-effectiveness.

Compression Phase – The period during which chamber pressure is increased from ambient to the prescribed therapeutic level. Related terms: ramp rate, compression schedule A controlled compression rate (typically 1 ATA per minute) reduces discomfort and mitigates barotrauma risk.

Decompression Phase – The gradual reduction of chamber pressure back to ambient levels after the therapeutic exposure. Related terms: decompression schedule, stop Proper decompression is critical to avoid decompression sickness, especially in patients with underlying pulmonary pathology.

Decompression Sickness (DCS) – A condition caused by inert gas bubbles forming in tissues and circulation during rapid pressure reduction. Related terms: “the bends”, arterial gas embolism Although rare in therapeutic hyperbaric settings, vigilance is required for patients with recent scuba exposure or air-containing wounds.

Diffusion Gradient – The difference in partial pressure of a gas between two compartments, driving net movement. Related terms: Fick’s law, oxygen diffusion Hyperbaric oxygen therapy increases the diffusion gradient for oxygen, facilitating delivery to hypoxic tissues.

Double-Wall Chamber – A hyperbaric enclosure consisting of an inner pressure-resistant liner and an outer structural shell. Related terms: single-wall chamber, composite chamber Double-wall designs enhance safety by providing a secondary barrier against leaks and structural failure.

Duration of Exposure – The total time a patient spends at the therapeutic pressure, usually expressed in minutes. Related terms: treatment run time, total session time Standard protocols range from 60 to 120 minutes, with adjustments based on indication and patient tolerance.

Effective Oxygen Delivery (EOD) – The quantity of oxygen that reaches viable tissue, factoring in pressure, FiO₂, and circulatory status. Related terms: tissue oxygen tension, oxygen utilisation EOD is a key metric for evaluating treatment efficacy in conditions such as chronic wounds or ischemic injuries.

Enriched Air Nitrox (EAN) – A breathing gas mixture containing a higher percentage of oxygen (typically 32–36%) and reduced nitrogen. Related terms: trimix, diving gases EAN is occasionally employed in hyperbaric therapy to achieve moderate oxygen enrichment while limiting fire risk.

Equilibration – The process by which gas concentrations become uniform throughout body compartments. Related terms: steady state, gas exchange During hyperbaric exposure, equilibration of oxygen occurs within minutes, allowing rapid therapeutic effects.

Exhalation Valve – A device that permits controlled release of exhaled gas from a breathing circuit, maintaining pressure balance. Related terms: pressure regulator, venturi Proper valve function prevents over-pressurisation and contributes to patient comfort.

Fractional Inspired Oxygen (FiO₂) – The proportion of oxygen in the gas mixture inhaled by the patient,

expressed as a decimal or percentage. Related terms: oxygen concentration, oxygen fraction FiO_2 can be adjusted from 0.21 (ambient air) up to 1.0 (100% oxygen) depending on therapeutic goals.

Gas-Filled Cavity – Any anatomical space containing gas, such as the middle ear, sinuses, or gastrointestinal tract. Related terms: pneumatic cavity, barometric compliance These cavities must be equalised before and during hyperbaric exposure to avoid pressure-related injury.

Hyperbaric Oxygen Therapy (HBOT) – The clinical use of 100% oxygen at pressures greater than 1 ATA to enhance tissue oxygenation and promote healing. Related terms: monoplace HBOT, multiplace HBOT Indications include decompression illness, carbon-monoxide poisoning, chronic refractory wounds, and certain infections.

Hypercapnia – Elevated arterial CO_2 levels, often resulting from hypoventilation. Related terms: respiratory acidosis, CO_2 retention In hyperbaric settings, hypercapnia can be induced intentionally to stimulate ventilation, but must be monitored to avoid adverse effects.

Hypobaric Therapy – The deliberate reduction of ambient pressure to treat certain conditions, such as altitude-related illnesses. Related terms: altitude training, hypobaric chamber While not a primary focus of the Certificate in Hyperbaric Medicine, understanding hypobaric principles aids comprehensive training.

Inert Gas – A gas that does not readily react chemically under physiological conditions, most commonly nitrogen. Related terms: nitrogen narcosis, inert gas loading In hyperbaric therapy, inert gases are reduced to minimise bubble formation and optimise oxygen delivery.

Isobaric Oxygen – Administration of oxygen at ambient pressure without increasing ambient pressure. Related terms: normobaric oxygen therapy, high-flow nasal cannula Isobaric oxygen may be used as an adjunct or alternative when hyperbaric treatment is contraindicated.

Jugular Venous Oxygen Saturation (SjvO_2) – A measurement of oxygen saturation in the jugular vein, reflecting cerebral oxygen extraction. Related terms: cerebral oximetry, brain tissue oxygenation SjvO_2 monitoring can provide insight into the adequacy of cerebral oxygenation during HBOT.

Laser-Assisted Wound Healing – A technique that uses low-level laser therapy to stimulate cellular repair; often combined with HBOT for synergistic effect. Related terms: photobiomodulation, adjunct therapy Clinical studies suggest enhanced granulation tissue formation when both modalities are applied sequentially.

Leak Test – A safety procedure to verify the integrity of a hyperbaric chamber before patient entry. Related terms: pressure testing, chamber certification Regular leak testing prevents uncontrolled depressurisation and ensures compliance with regulatory standards.

Monoplace Chamber – A single-patient hyperbaric chamber typically constructed of acrylic or steel, delivering 100% oxygen throughout the enclosure. Related terms: multiplace chamber, single-occupancy chamber Monoplace chambers are widely used for routine HBOT due to their simplicity and lower operating costs.

Multiplace Chamber – A larger chamber capable of treating multiple patients simultaneously, often using a pressurised air environment with individual oxygen masks or hoods. Related terms: group HBOT, chamber capacity Multiplace chambers allow for complex treatment protocols, including those requiring concurrent medical monitoring.

Normobaric Oxygen Therapy (NBOT) – Delivery of oxygen at ambient pressure, frequently via nasal cannula or face mask. Related terms: high-flow oxygen, oxygen concentrator NBOT is less invasive but provides lower tissue oxygen tensions compared with HBOT, limiting its therapeutic range.

O₂ Toxicity – Cellular injury caused by excessive exposure to high partial pressures of oxygen, manifesting as pulmonary or central nervous system (CNS) toxicity. Related terms: pulmonary oxygen toxicity, CNS oxygen toxicity Treatment protocols limit exposure time and pressure to mitigate toxicity while achieving therapeutic benefit.

Oxygen Concentrator – A device that extracts and concentrates oxygen from ambient air, delivering a high-FiO₂ gas for therapeutic use. Related terms: medical grade oxygen, oxygen generator Concentrators are commonly used in NBOT settings and as backup sources for HBOT facilities.

Oxygen Cockpit – The internal environment of a hyperbaric chamber where oxygen is delivered and monitored. Related terms: chamber atmosphere, oxygen monitoring Maintaining appropriate oxygen levels in the cockpit is critical to prevent fire hazards and ensure patient safety.

Oxygen Partial Pressure (pO₂) – The pressure exerted by oxygen within a gas mixture, measured in mmHg or kPa. Related terms: alveolar pO₂, arterial pO₂ In HBOT, pO₂ can exceed 2,000 mmHg, dramatically increasing dissolved oxygen in plasma.

Oxygen Toxicity Threshold – The maximum safe exposure duration at a given pO₂ before toxic effects become likely. Related terms: UPTD (units per tissue dose), OTU (oxygen toxicity units) Clinicians calculate cumulative exposure using OTU tables to stay within safe limits.

Oxygen Therapy – The administration of oxygen to patients to correct hypoxaemia or enhance tissue oxygenation. Related terms: supplemental oxygen, therapeutic oxygen HBOT represents a high-pressure form of oxygen therapy, distinguished from conventional low-pressure methods.

Oxygen Uptake Ratio (OUR) – The proportion of delivered oxygen that is actually utilised by the body. Related terms: oxygen consumption, VO₂ OUR helps assess the efficiency of hyperbaric treatments and may guide adjustments in pressure or duration.

Partial Pressure – The pressure contributed by an individual gas within a mixture, proportional to its concentration. Related terms: Dalton's law, total pressure Understanding partial pressures is fundamental for calculating FiO₂ and predicting physiological responses.

Patient Monitoring – Continuous observation of vital signs, oxygen saturation, and symptomatology during hyperbaric sessions. Related terms: telemetry, bedside monitoring Effective monitoring enables early detection of adverse events such as barotrauma or oxygen toxicity.

Pressure Regulator – A device that controls the flow and pressure of gas entering the chamber or breathing circuit. Related terms: flow controller, pressure relief valve Accurate regulation ensures the prescribed therapeutic pressure is maintained throughout the session.

Pressure-Controlled Ventilation (PCV) – A mechanical ventilation mode where the inspiratory pressure is set, allowing tidal volume to vary with lung compliance. Related terms: volume-controlled ventilation, mechanical ventilation PCV may be employed for patients requiring assisted breathing during hyperbaric treatment.

Pressure-Relief Valve – A safety component that automatically releases excess pressure to prevent over-pressurisation of the chamber. Related terms: safety valve, burst disc Regular testing of the valve is mandatory for compliance with UK hyperbaric safety standards.

Pulmonary Barotrauma (PBT) – Lung injury caused by over-expansion of alveoli during rapid pressure changes, potentially leading to pneumothorax. Related terms: air embolism, lung over-inflation Screening for pre-existing lung disease and using appropriate compression rates reduces PBT incidence.

Radiation-Induced Tissue Damage – Cellular injury resulting from ionising radiation, often manifesting as soft-tissue necrosis or osteoradionecrosis. Related terms: osteoradionecrosis, radiotherapy side effects HBOT promotes angiogenesis and fibroblast activity, improving healing in irradiated tissues.

Rebreather System – A closed-circuit apparatus that recirculates exhaled gas after CO₂ removal, conserving oxygen. Related terms: scrubber, open-circuit system In multiplace chambers, rebreathers allow precise FiO₂ control and reduce oxygen consumption.

Regulatory Compliance – Adherence to national and international standards governing hyperbaric facilities, such as the UK Health and Safety Executive (HSE) guidelines. Related terms: certification, quality assurance Compliance ensures legal operation, patient safety, and eligibility for NHS reimbursement.

Respiratory Acidosis – A decrease in blood pH due to elevated CO₂ levels, often resulting from hypoventilation. Related terms: hypercapnia, ventilation-perfusion mismatch During HBOT, careful monitoring of CO₂ is required to avoid exacerbating acidosis, especially in patients with compromised lung function.

Return-to-Service (RTS) Protocol – A structured plan for resuming normal duties after hyperbaric treatment, considering residual effects and fitness for work. Related terms: post-treatment assessment, clearance RTS protocols are essential for divers, pilots, and occupational groups exposed to pressure changes.

Safety Officer – The designated individual responsible for overseeing chamber operation, emergency procedures, and compliance with safety standards. Related terms: chamber supervisor, emergency coordinator The safety officer must hold appropriate training and certification, as mandated by UK regulations.

Sealed-Valve System – A breathing apparatus where the valve closes on exhalation, preventing gas flow back into the circuit. Related terms: demand valve, non-rebreather Sealed-valve systems reduce oxygen

wastage and are commonly used in monoplace chambers.

Seizure Risk – The potential for convulsive events during HBOT, particularly at high pO_2 levels or in patients with a history of epilepsy. Related terms: CNS oxygen toxicity, prophylactic antiepileptic Protocols limit exposure to pressures above 3 ATA and include pre-treatment neurological assessment.

Shallow Water Blackout – A loss of consciousness caused by rapid reduction of ambient pressure while swimming near the surface, related to CO_2 accumulation and O_2 depletion. Related terms: hypoxic blackout, dive safety Education on this phenomenon is part of the broader hyperbaric safety curriculum.

Side-Stream Monitoring – Sampling of gas from the breathing circuit to analyse composition, oxygen concentration, and CO_2 levels in real time. Related terms: gas analyser, capnography Side-stream monitors provide immediate feedback, enabling rapid adjustments to maintain therapeutic targets.

Skin Graft Incorporation – The process by which a transplanted skin layer becomes vascularised and integrated with host tissue. Related terms: graft take, neovascularisation Adjunctive HBOT enhances graft survival by increasing oxygen delivery and stimulating angiogenesis.

Standard Operating Procedure (SOP) – A documented set of step-by-step instructions for routine and emergency operations within a hyperbaric facility. Related terms: protocol, workflow SOPs ensure consistency, safety, and compliance across all staff members.

Steam Sterilisation – A method of decontaminating equipment using saturated steam under pressure, commonly applied to reusable components of breathing circuits. Related terms: autoclave, aseptic processing Proper sterilisation prevents nosocomial infections, especially when treating immunocompromised patients.

Stenosis – Narrowing of a lumen, such as a blood vessel or airway, which can impede gas exchange. Related terms: vascular stenosis, airway obstruction HBOT may be employed to promote healing of post-surgical stenoses by delivering high oxygen concentrations to the affected tissue.

Supplemental Oxygen – Additional oxygen provided beyond ambient levels, delivered via nasal cannula, mask, or hyperbaric chamber. Related terms: oxygen therapy, high-flow oxygen In HBOT, supplemental oxygen is 100% and administered at elevated pressures to achieve therapeutic plasma-dissolved oxygen levels.

Surface Tension – The cohesive force at the interface between liquid and gas, influencing alveolar stability. Related terms: surfactant, alveolar collapse Hyperbaric pressure reduces surface tension effects, aiding in the recruitment of collapsed alveoli during treatment.

Sustained Release – A pharmacological concept where a drug is released gradually over time; sometimes combined with HBOT to enhance tissue penetration. Related terms: drug delivery system, controlled release Research explores synergistic effects of sustained-release antibiotics and hyperbaric oxygen in chronic infections.

Sympathetic Nervous System – Part of the autonomic nervous system that mediates the “fight-or-flight”

response, influencing vascular tone. Related terms: parasympathetic system, autonomic regulation
Hyperbaric exposure can modulate sympathetic activity, affecting blood pressure and heart rate during treatment.

Systemic Inflammatory Response Syndrome (SIRS) – A widespread inflammatory reaction that can be triggered by infection, trauma, or hyperoxia. Related terms: sepsis, cytokine storm
Monitoring inflammatory markers during HBOT helps differentiate therapeutic benefits from potential hyperoxic stress.

Thermal Conductivity – The ability of a material to transfer heat; relevant for chamber construction materials to ensure patient comfort. Related terms: insulation, heat loss
Acrylic chambers have lower thermal conductivity than steel, reducing heat loss at higher pressures.

Thermal Stress – Physiological strain caused by temperature extremes; hyperbaric chambers may become warm due to gas compression. Related terms: heat dissipation, patient comfort
Ventilation systems and cooling jackets are employed to mitigate thermal stress during long sessions.

Time-Weighted Average (TWA) – A statistical measure of exposure to a gas over a specified period, used for occupational safety. Related terms: exposure limit, TLV
In hyperbaric facilities, TWA calculations ensure staff are not over-exposed to elevated oxygen levels.

Totally-Occluded Airway – A complete blockage of the airway, a contraindication for hyperbaric treatment until resolved. Related terms: airway obstruction, emergency airway
Prior to HBOT, airway patency must be confirmed to prevent barotrauma from trapped gas.

Transcutaneous Oxygen Monitoring (TcPO₂) – Non-invasive measurement of oxygen tension through the skin, useful for assessing peripheral perfusion. Related terms: skin oximetry, peripheral oxygenation
TcPO₂ values rise significantly during HBOT, providing objective data on treatment efficacy for chronic wounds.

Travel-Related Decompression Illness – Decompression symptoms arising after rapid altitude changes during commercial air travel. Related terms: altitude-related DCS, post-flight syndrome
Patients who have recently undergone HBOT may require clearance before flying to avoid exacerbating residual inert gas bubbles.

Trapped Gas – Air or other gases confined within body cavities, such as sinus cavities or gastrointestinal tract. Related terms: pneumatic cavity, barometric equilibration
Prior to compression, clinicians must ensure adequate venting of trapped gas to avoid pressure-related injury.

Turn-Down Ratio – The proportion by which the pressure is reduced during decompression relative to the compression pressure. Related terms: decompression schedule, pressure gradient
A typical turn-down ratio of 1:1.5 to 1:2 balances treatment efficacy with safety.

Two-Stage Compression – A compression protocol that involves an initial rapid increase to an intermediate pressure, followed by a slower ascent to the therapeutic pressure. Related terms: ramp compression, staged compression
This approach can improve patient tolerance while maintaining therapeutic benefits.

Uptake Kinetics – The rate at which oxygen is absorbed into blood plasma and tissues during hyperbaric

exposure. Related terms: diffusion rate, oxygen transport Faster uptake kinetics are observed at higher pressures, explaining the rapid clinical improvement seen in certain acute conditions.

Ventilation-Perfusion (V/Q) Mismatch – An imbalance between air flow and blood flow in the lungs, which can limit oxygenation. Related terms: shunt, dead space ventilation HBOT can partially overcome V/Q mismatch by increasing dissolved oxygen independent of hemoglobin transport.

Venturi Mask – A device that delivers a precise FiO_2 by mixing oxygen with ambient air through a venturi effect. Related terms: oxygen mask, flow regulator In monoplace chambers, venturi masks are rarely used because the entire chamber is filled with oxygen, but they are relevant for pre-treatment assessment.

Vibration Therapy – The application of mechanical oscillations to stimulate tissue repair; occasionally combined with HBOT for synergistic effect. Related terms: mechanotherapy, adjunctive therapy Early studies suggest enhanced granulation when vibration is applied after hyperbaric sessions.

Wound Healing Phases – The sequential stages of tissue repair: haemostasis, inflammation, proliferation, and remodeling. Related terms: granulation tissue, epithelialisation HBOT primarily augments the proliferative phase by delivering high oxygen levels that support fibroblast activity and collagen synthesis.

Wound Oxygen Tension – The partial pressure of oxygen within wound tissue, a critical determinant of healing rate. Related terms: tissue pO_2 , oxygen diffusion Measurements taken before and after HBOT provide quantitative evidence of therapeutic impact.

Yield Strength – The stress at which a material begins to deform plastically; important for chamber structural integrity. Related terms: material fatigue, safety factor Engineering specifications for hyperbaric chambers require yield strengths well above operational pressures to ensure long-term durability.

Z-Score – A statistical measure indicating how many standard deviations an observation is from the mean; used in research to assess treatment effect size. Related terms: statistical significance, confidence interval In hyperbaric studies, Z-scores help determine whether observed improvements exceed random variation.