Altitude Diver
Specialty Course
Instructor Outline
Points for the instructor to consider that give additional qualifying information about conducting the course. Not intended to be read to students.

Required information. Read to students as printed.

Important information. Read to students.
Objectives always precede individual Academic Topics and open-water dives.

By the end of this session, you will be able to:
- Objective
- Objective
- Objective
Please read this first.

Qualifying To Teach PADI Specialty Diver Courses

To apply for a Specialty Instructor rating, an individual must be certified as a PADI Underwater Instructor or higher. There are two ways to qualify to teach PADI Specialty Diver courses: 1) Attend a Specialty Instructor Training Course conducted by PADI Course Directors, or 2) apply directly to PADI.

Specialty Instructor Training Course attendance is highly recommended and encouraged. These courses provide hands-on training, technique demonstrations, course marketing information, current PADI Standards information and, when applicable, instructor-level open-water training.

Application made directly to PADI requires either: 1) use of a PADI standardized Specialty Course Instructor Outline (this document), or 2) the submission of a self-generated specialty course outline for review. To speed outline approval, reduce liability exposure and ensure educational validity of your specialty courses, it is highly recommended that PADI standardized Specialty Course Instructor Outlines be used for courses they have been developed for. The Specialty Course Instructor Application is to be used whether attending a Specialty Instructor Training Course or applying directly to PADI.

Important Note: Prior to promoting or teaching a PADI Specialty Diver course, written confirmation of instructor certification in that specialty must first be received from PADI.

For more information on certification as a PADI Specialty Instructor, please refer to the “General Standards and Procedures” section of the PADI Instructor Manual. If you still have questions after reading this section, call your PADI Office.
COURSE STANDARDS AND OVERVIEW

This course is designed to be an introduction to altitude diving and to help the student diver develop the skills, knowledge and techniques necessary for altitude diving.

Prerequisites
To qualify for the Altitude Diver course, an individual must:

1. Be certified as a PADI Open Water Diver, PADI Junior Open Water Diver or have a qualifying certification from another training organization.
2. Be 10 years of age or older.

The Altitude Dive from the PADI Adventures in Diving Diver may be counted toward this specialty at the discretion of the instructor conducting the specialty course.

Instructor Supervision
Altitude Diver courses may be conducted by a Teaching status PADI Underwater Instructor (or PADI Instructor with a higher rating) who has been certified as a PADI Altitude Diving Instructor.

The maximum student diver diver-to-instructor ratio for open water altitude training dives is eight students per instructor (8:1).

Considerations for Open Water Training
For the purpose of training, altitude is defined as ranging from 300 to 3,000 metres/1000 to 10,000 feet above sea level.

The Altitude Diver course is to include two open water training dives. The two dives may be conducted in one day, but one dive per day is recommended. After the training dives, student diver divers are required to log their dives in their personal log books.

All open water training dives must be conducted using the special altitude rules and procedures for the Recreational Dive Planner. If students arrive at an altitude dive site that is higher than their point of origination they must either:

1. Wait 6 hours prior to making their first open water altitude dive, OR
2. Count two pressure groups for each 300 metres/1000 feet of altitude to determine their beginning pressure group (round up fractions of 300 metres/1000 feet).

When diving above 2400 metres/8000 feet, students must wait 6 hours prior to making an open water dive.

If an altitude training dive made during this specialty is between a theoretical depth of 18-30 metres/60-100 feet, the Advanced Open Water Diver rating is recommended as a prerequisite. Likewise, if an altitude training dive made during this specialty is between a theoretical depth of 30-40 metres/100-130 feet, the Deep Diver rating is recommended as a prerequisite.
COURSE OVERVIEW

This course covers the knowledge, skills and techniques for altitude diving. The minimum number of recommended hours is 24, with time being equally divided between knowledge development and practical water-training sessions. To conduct an Altitude Diver course, the following is to be included:

1. Planning, organization, procedures, techniques, problems and hazards of altitude diving.
2. Special Recreational Dive Planner procedures that must be followed when diving at altitudes above 300 metres/1000 feet.
4. Special equipment, descent lines and buoyancy control considerations.
5. Limited visibility diving and underwater navigation techniques.
6. Overview of the physical aspects of the fresh water, altitude aquatic environment.
7. Cause, signs, symptoms, and prevention of hypoxia and hypothermia while altitude diving.

CERTIFICATION PROCEDURES

The certifying instructor obtains an Altitude Diver certification by submitting a completed signed PIC to the appropriate PADI Office. The instructor who conducts the student’s final open water training session is to be the certifying instructor. The instructor certifying the student must ensure that all certification requirements have been met.

KEY STANDARDS

Prerequisite Certification: PADI Open Water Diver, Junior Open Water Diver or qualifying certification

Minimum Age: 10
Recommended Course Hours: 24
Minimum Open Water Training: 2 dives
Student-to-Instructor Ratio: 8:1*
Minimum Instructor Rating: Altitude Specialty Instructor

*For dives that include 10-11 year olds, direct supervision is required at a maximum ratio of 4:1. No more than two of the four divers may be age 10 or 11.

Training dives may be conducted at night for divers who have completed the Night Adventure Dive or the first dive of the PADI Night Diver specialty course, or have qualifying night diving experience.
Introductory Information
Altitude Diver Specialty Course
Instructor Outline

Heading IV, in the outline “Academic Topics,” provides information that should be presented to students prior to boarding the diving vessel used during the course. At the discretion of the instructor, the topics in this section may be “modularized” (divided into several academic presentation sessions).

Heading V, in the outline “General Open-Water Considerations,” provides specific information about conducting the open-water dives in the course. Although open-water teaching and organizational techniques are left to the instructor, read this information carefully prior to taking students in open water.

The altitude dive from the PADI Adventures in Diving Program may be counted toward Dive One of this specialty, at the discretion of the instructor. Similarly, Dive One of this specialty may be counted toward the Altitude Dive in the PADI Adventures in Diving Program.
I. Course Overview

The purpose of the Altitude Diver specialty course is to familiarize divers with the skills, knowledge, planning, organization, procedures, techniques, problems, hazards and enjoyment of diving at altitudes between 300 metres/1000 feet and 3000 metres/10,000 feet using the Recreational Dive Planner. Training should emphasize fun and safety.

The goals of Altitude Diver training are:

A. To develop the student’s theoretical knowledge of altitude diving.

B. To enable the student to safely plan, organize and execute no-decompression dives at altitudes up to 3000 metres/10,000 feet.

C. To improve the student’s diving abilities and skills while supervised.

II. Altitude Diver Course Requirements

A. Prerequisite certification: PADI Open Water Diver, PADI Junior Open Water Diver or have a qualifying certification from another training organization. The instructor is to ensure that the individual can perform the skills required of a PADI Open Water Diver. If any training will be conducted deeper than 18 metres/60 feet of theoretical depth, prerequisite certification as PADI Advanced Open Water Diver or equivalent is recommended. If any training will be conducted deeper than 30 metres/100 feet of theoretical depth, the PADI Deep Diver rating is highly recommended.

B. Minimum age requirement: 10 years old.

C. The Elective Altitude Dive from the PADI Adventures in Diving program may be counted toward the certification requirements for this specialty at the discretion of the instructor conducting the specialty course.

D. Confined-water training may be added at the discretion of the instructor conducting this specialty course. As a preassessment before the course begins, a confined-water session may include a scuba skills review. The PADI Skill Evaluation or Scuba Review is an excellent way to accomplish this review.

E. Student-to-instructor ratio is 8:1, to certified assistant: 4:1.

Note

For dives that include 10-11 year olds, direct supervision is required at a maximum ratio of 4:1. No more than two of the four divers may be age 10 or 11.
F. Dive data

1. **Two scuba dives**
2. Dives are to be conducted at an altitude between 300 metres/1000 feet and 3000 metres/10,000 feet above sea level.
3. It is recommended that training be conducted at a depth of 30 metres/100 feet or shallower, with depths shallower than 18 metres/60 feet preferred. At no time will training be conducted at a theoretical depth deeper than 40 metres/130 feet.

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<td>For 12-14 year olds, Adventure Dive maximum depth is 18 metres/60 feet or 21 metres/70 feet if they have taken the Adventure Deep Dive. For 10-11 year olds, the maximum depth is 12 metres/40 feet.</td>
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### III. Student and Instructor Equipment Requirements

#### A. Student equipment

1. All personal, standard equipment appropriate for the environment including:
   a. Mask, snorkel and fins
   b. Exposure suit appropriate for local diving environment and depth, including hood, boots and gloves or mitts, if needed.
   c. Quick-release weight belt or weight system
   d. Regulator system with submersible pressure gauge.
   e. Alternate air source suitable for sharing air with other divers
   f. BCD with low-pressure inflator
   g. Complete instrumentation, including a means to monitor depth, time and direction. Computers may be used to accomplish this, provided such computers are designed for use at altitude. It is highly recommended that computer divers carry additional time and depth instruments to back up their computers.
   h. Recreational Dive Planner, Table or The Wheel. The Wheel is highly recommended because theoretical depths must be rounded to the next deeper depth on the RDP; The Wheel’s five-foot increment minimizes rounding in this instance.

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<th>Note to Instructor</th>
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<td>If The Wheel is used, be sure your students have mastered The Wheel prior to taking the course. (Use of Diving with The Wheel video recommended.)</td>
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i. Slate with pencil  
j. Diving tool or knife capable of cutting line  
k. Whistle or other surface signaling device  
l. Log book (Adventure Log recommended)

B. Instructor equipment.
1. All personal, standard equipment as required by students.  
2. Safety equipment  
   a. Boat or surface float, as appropriate for local environment,  
      with descent line or other arrangement suitable for making  
      safety stops.  
   b. First aid supplies and equipment. Highly recommended:  
      Pocket Mask and oxygen
3. Bourdon tube and capillary depth gauges for comparisons on  
   Dive 1.  
4. PADI materials that may be used to teach this course.  
   a. General materials and teaching aids:  
      • Giant Recreational Dive Planner (RDP) — Table or  
         The Wheel  
      • For each student, hand out copies of Theoretical Depth  
         at Altitude chart and Procedures for Using RDP at  
         Altitude (see appendix)  
      • Student Record File  
      • Dive Roster  
   b. Reference materials  
      • PADI Adventures in Diving Manual  
      • PADI Divemaster Manual (revised)  
   c. Recognition materials  
      • PIC envelopes  
      • Specialty Diver certificates  
      • Altitude Diver chevrons

IV. Academic Topics

The following is an actual presentation outline. Directions to, or com-  
ments for, the instructor are enclosed in [brackets].

A. Introductions, course overview and welcome to the course  
1. Staff introductions  
   a. [Introduce yourself and your assistants]  
2. Student introductions.  
   a. [Have students introduce themselves and explain why  
      they’re interested in altitude diving. Break the ice and  
      encourage a relaxed atmosphere.]  
3. Course goals:  
   a. To develop your theoretical knowledge of altitude diving  
   b. To enable you to organize, plan and conduct safe dives at  
      altitudes up to 3000 metres/10,000 feet.
c. To improve your diving ability and skills while in a supervised environment.

4. Course overview
   a. Classroom presentations. [Note to instructor: Academic information may be presented through classroom presentations and predive briefings. If class presentations will be used, give the times, dates and locations.] There will be [number] classroom presentations during this course.
   b. Open water training dives. There will be two open water training dives during this course. [Note to instructor: Give times, dates and locations of dives.]
   c. Performance assessment. [Note to instructor: You are to ensure that all performance requirements have been met. Skills will be assessed during open water training and directly observed. Academic assessment may be accomplished through discussions with students and oral quizzes. Tell the class how their performance will be evaluated.]

5. Certification
   a. Upon successful completion of the course, you will be awarded the PADI Altitude Diver Certification.
   b. This certification means you will be qualified to:
      • Plan, organize, make and log open water dives made to a maximum altitude of 3000 metres/10,000 feet using the RDP, in conditions generally comparable to or better than the conditions you were trained in.
      • Apply for the rating of Master Scuba Diver if you are a PADI Advanced Open Water (or have a qualifying certification from another organization) and PADI Rescue Diver (or have a qualifying certification from another organization) with certification in four other PADI Specialty ratings (in addition to Altitude Diver).

6. Class requirements
   a. Course costs [Note to instructor: Explain all course costs]
   b. Equipment needs [Note to instructor: Discuss and list all the equipment the students will need.]
   c. Materials used during the course
   d. Attendance requirements

7. Administration.
   a. Collect course fees, enrollment, Standard Safe Diving Practices Statement of Understanding, PADI Medical Statement, Liability Release and Assumption of Risk. [Note to instructor: The PADI Student Record File contains all of these forms. If you already have a completed file on a student, remember that new copies of the forms must be filled out. You may wish to use another Student Record File or loose copies to insert in the existing file.]
B. Altitude diving and decompression theory.

**Learning Objectives.**

*By the end of this session, you will be able to:*

- **Define an altitude dive.**
- **Describe the importance of the “pressure ratio” that dive tables and computers use to help divers avoid decompression sickness.**
- **Explain how diving at altitude affects this pressure ratio.**
- **Calculate the approximate atmospheric pressure for various altitudes up to 3000 metres/10,000 feet.**
- **Explain how far any decompression theory can be relied on to keep the risk of decompression sickness within an acceptable minimum, and why.**
- **Describe how the lack of empirical data (documented hyperbaric test dives) on altitude diving affects altitude diving, flying after diving and driving to altitude recommendations.**
- **Compare and contrast the theoretical and practical differences between altitude diving, flying after diving, and driving to altitude after diving.**
- **List the current recommendations for flying or driving to altitude after diving.**

1. For purposes of using the RDP, an *altitude dive* is any dive made at an altitude higher than 300 metres/1000 feet above sea level. The procedures for using the RDP at altitude (discussed later) may be used to a maximum altitude of 3000 metres/10,000 feet.

2. As the diver ascends in altitude, there is less air pressure. Pressure declines roughly 3.1 percent per 300 metres/1000 feet up to 3000 metres/10,000 feet. [Note to instructor: Because air compresses itself in the atmosphere, this number is not exact. However, this rough approximation is suitable for demonstrating pressure changes within the RDP altitude diving range. Use this figure to compute a couple of examples for lessening pressure in bar or psi, whichever is used by local divers, but explain that this simplification is for demonstration purposes only and should not be considered exact.]
   a. At sea level, the diver is surrounded by one atmosphere of pressure.
   b. At 3000 metres/10,000 feet, the pressure is .714 atmospheres.
   c. This is the same pressure change as 3 metres/10 feet of seawater, which we know makes a big difference in our no-decompression limits. As we’ll see, this must be accounted for when using the RDP or any other dive table or dive computer.
3. All dive tables and computers attempt to avoid decompression sickness by keeping nitrogen dissolved into a diver’s body during a dive within acceptable limits.
   a. The dissolved nitrogen exerts a pressure called tissue pressure.
   b. Tables and computers are concerned with the pressure ratio between the tissue pressure and the surface pressure at sea level.
   c. The ratio must not exceed the acceptable limits set by the table or dive computer.
   d. At altitude the surface pressure is less than at sea level, which makes the pressure ratio greater when surfacing compared to making the same dive at sea level.
   e. Unless the actual depth is converted to a theoretical depth for table use and special procedures are followed (these will be discussed in detail later), at altitude the pressure ratio can exceed the maximum limit intended by the table or dive computer, increasing the possibility of decompression sickness.

4. All decompression models — table or computer, are empirical, that is, they rely on the experience of observed test data.
   a. Tables and computers are mathematical models that extrapolate empirical data, but at the extremes, it is known that mathematics alone cannot be relied on (e.g., repetitive deep diving, sawtooth profiles with deep dive following shallow, etc.).
   b. Therefore, tables and computers can only be relied on to produce acceptably minimal risk of decompression sickness within what has been successfully tested.
   c. There is relatively little test data for altitude diving, flying after diving or driving to altitude after diving.
   d. In the absence of test data, procedures and recommendations for altitude diving, flying after diving and driving to altitude after diving must be highly conservative — often more conservative than the math alone dictates.
   e. Whether at sea level or at altitude, the diver must realize that because people differ in their physiology, no dive table or computer can guarantee that decompression sickness will never occur, even when diving within the table or computer limit.

5. Flying (or driving to altitude) after diving comparison with altitude diving.
   a. Although flying (or driving to altitude) after diving and altitude diving both involve pressures above sea level, from a decompression model point of view, they are very different.
• Flying (or driving to altitude) after diving involves the diver diving, then surfacing and ascending to a lesser pressure.
• In altitude diving, the diver ascends to altitude first, dives and returns to the same altitude pressure.
• When flying (or driving to altitude) after high altitude diving, follow the same procedures you would use after diving at sea level. Never mix altitudes by diving at one altitude and then making a repetitive dive at a higher altitude. [Note to instructor: Review current flying after diving recommendations.]

C. Altitude diving and physiology

**Learning Objectives.**

*By the end of this session, you will be able to:*

- Identify two possible detrimental physiological conditions from altitude diving, aside from decompression sickness, explain their causes and how to avoid them.
- Explain the proper first aid for the two possible physiological conditions should they occur.

Besides decompression sickness, there are two physiological conditions of special concern in altitude diving: hypoxia and hypothermia.

1. Hypoxia

   a. The air at altitude has less pressure and density, so each breath has fewer oxygen molecules in it (though the percentage of nitrogen is the same as at sea level). This lower partial pressure makes it harder for your body to meet its oxygen demands.
   
   b. When there’s insufficient oxygen partial pressure to meet body demands, the condition of hypoxia results.
   
   c. Hypoxia at altitude results from heavy exercise, including hauling equipment, donning equipment and walking to and entering the dive site. Signs/symptoms include fatigue, shortness of breath, light-headedness, faintness and exhaustion.
   
   d. To avoid hypoxia, limit exercise. Don’t let yourself get out of breath. Rest frequently.
   
   e. Hypoxia can come on suddenly at the end of a dive.

   - During the dive, you are under pressure so your body has no problem meeting its oxygen demands.
   
   - When returning to the surface, you are back into thin air suddenly. If you have been exerting yourself near the dive’s end, or do so in exiting the water, you may find it difficult to catch your breath.
f. Should symptoms of hypoxia occur, stop all activity, rest and catch your breath. Resume activity at a slower pace only after full recovery of normal respiration.
g. After several weeks at altitude, the body becomes adapted to the thinner air and hypoxia is less likely.

2. Hypothermia
   a. Hypothermia occurs when the diver has been exposed to the cold (water or air) long enough that the body core temperature begins to drop.
   b. Even with wet suits or dry suits, given a long enough dive or series of dives, hypothermia can be a problem.
   c. Hypothermia can occur at sea level, but it’s a particular concern for altitude divers because freshwater lakes at altitude tend to be colder, with distinct thermoclines.
   d. Signs/symptoms of hypothermia include shivering, numbness and blueness. As the body’s core temperature drops, coordination is affected, weakness, confusion, unconsciousness and eventually death follow.
   e. Hypothermia is prevented by wearing exposure suits appropriate to local conditions and planned depths, by allowing yourself to rewarm between dives and by ending a dive if you begin shivering. Shivering is a warning that should never be ignored!
   f. A diver suspected of having slight-to-mild hypothermia should be removed from the cold, dressed in warm clothes and allowed to rewarm. More severe cases may require CPR, shock management and emergency medical treatment.

D. Altitude diving equipment considerations

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<td>By the end of this session, you will be able to:</td>
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<td>• List two reasons why altitude diving may affect buoyancy.</td>
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<td>• List two dive accessories especially appropriate for altitude diving and explain the use of each.</td>
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<td>• Describe how altitude affects the readings of bourdon tube, capillary and electronic depth gauges, and how the diver should compensate for these effects.</td>
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<tr>
<td>• Identify and explain the two considerations for using a dive computer at altitude.</td>
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1. Buoyancy at altitude
   a. Virtually all altitude diving is freshwater diving. Compared to salt water, freshwater has less buoyancy.
   b. Wet suits and neoprene dry suits have more buoyancy at altitude
• Wet suits are closed cell, meaning the gas trapped in the material can’t escape.
• In the lower atmospheric pressure at altitude, this gas expands, making the suit thicker and more buoyant at the surface.
• This effect has no bearing on non-neoprene dry suits, which have no trapped gas in the material.

c. The best way to account for the different buoyancy at altitude is to perform a buoyancy check before the dive. [Note to instructor: You may want to review proper buoyancy check.]

2. Accessories especially appropriate for diving at altitude:
   a. Descent/ascent line
      • Not required, but highly recommended when descents and ascents cannot be made along a gradually sloping bottom or up a wall.
      • Ascents are very slow at altitude; lines make it easier to maintain the slow ascent rate.
      • Can be valuable for measuring depth
   b. Slate
      • Altitude dive planning converts actual depths to theoretical depths (to be discussed) to account for pressure differences. For contingency table calculations, conversions must be carried on the slate.
      • Safety stop/emergency decompression stop depth varies with altitude. Appropriate stop depth should be carried on the slate.

3. Depth gauges at altitude
   a. Bourdon tube gauges
      • At altitude, bourdon tube gauges read shallower than actual depth.
      • To correct to actual depth, use this rule of thumb: Add .3 metres/1 foot to the depth the gauge shows, plus .3 metres/1 foot for each 300 metres/1000 feet of altitude. The correction factor should be noted on your slate. [Note to instructor: Although more precise correction tables have been developed for correcting depth gauges, you may find this rule more convenient and easier to remember. The rule may yield a corrected depth slightly (less than .3 metres/1 foot) deeper than do such tables.]
      • Some bourdon tube gauges have an adjustment dial for resetting the gauge for accurate readings at altitude.
      • The actual depth is converted to a theoretical depth for use on the RDP, which will be discussed in the next section.
b. Capillary depth gauges
   • Capillary depth gauges read deeper than the actual depth because they are based on compressing the air in the capillary tube. Since the surface pressure is less than at sea level, it’s easier to compress the air in the tube.
   • This makes the capillary depth automatically adjust for altitude. The capillary depth gauge reads deeper than actual, but it reads in the theoretical depth to be used on the RDP. No conversion is necessary.
   • Unfortunately, capillary depth gauges are harder to read for depths below 9 metres/30 feet, so bourdon tube gauges or electronic gauges may be necessary.

c. Electronic depth gauges differ in their performance at altitude. Some automatically compensate for altitude; some must be adjusted. Consult the owner’s manual/manufacturer of the specific gauge.

d. If in doubt, compare your depth gauge with a gauge known to be accurate, or with a measured line. Note: Most depth gauges are calibrated for salt water. This is not a concern because the RDP is calibrated for salt water too, and no adjustment is necessary. When comparing in fresh water, however, a salt water calibrated depth gauge will read 3 percent shallower than a measured line.

4. Dive computers and altitude
   a. Using a dive computer at altitude requires two considerations:
      • The computer must be designed for use at altitude.
      • The computer manufacturer’s instructions for use at altitude must be followed.
   b. If a computer cannot be used to calculate equivalent decompression limits, it may still be usable as a time and depth gauge, consult the manufacturer’s literature.
   c. If you plan to do a lot of diving at altitude, you may wish to consider that in purchasing a dive computer.
E. Using the Recreational Dive Planner at altitude

**Learning Objectives.**

*By the end of this session, you will be able to:*

- Identify the altitude range for which the RDP may be used.
- List the two components of a proper ascent procedure for altitude diving.
- Demonstrate the procedures for determining the proper repetitive group on the RDP when arriving at altitude from sea level.
- Demonstrate how to determine the theoretical depth for a corresponding actual depth at altitude using the Theoretical Depth at Altitude chart (imperial or metric).
- State The Wheel’s advantage over the Table for altitude dive planning.
- Define acclimated diver as it applies to using the RDP.
- State the maximum number of dives that may be made in one day at altitude.
- Demonstrate the procedure for determining the proper repetitive group on the RDP for an acclimated diver arriving at an altitude higher than his acclimation altitude.
- Correctly calculate no-decompression limits for single and repetitive dives at altitude for acclimated and unacclimated divers diving in less than six hours and more than six hours after arriving at a dive site.
- State the maximum depth for a dive at altitude.

1. RDP altitude range: The special procedures for using the RDP must be used when diving at or above 300 metres/1000 feet. The maximum altitude is 3000 metres/10,000 feet.
2. Ascent procedures.
   a. Ascend from all altitude dives at a rate not to exceed 9 metres/30 feet per minute.
   b. A three-minute safety stop at the depth prescribed on the Theoretical Depth at Altitude Chart is required on all dives.
3. Repetitive diving: Make no more than two dives per day when diving at altitude.
4. Arriving at altitude
   a. When arriving at an altitude dive site higher than where your travel originated from, you have surfaced from a greater pressure to a lower pressure. This means the nitrogen pressure in your body is greater than the surrounding pressure, just like after surfacing from a dive. This residual nitrogen must be accounted for in planning an altitude dive just as you would in planning a repetitive dive.
   b. You may allow a six-hour surface interval after arriving at altitude and make your first dive a new dive.
c. If you wish to dive in less than six hours, upon arrival at the altitude dive site, count two pressure group for each 300 metres/1000 feet of altitude to determine your beginning pressure group. You may allow a surface interval to reduce this pressure group. Round up fractions of 300 metres/1000 feet.

d. When diving above 2400 metres/8000 feet, wait six hours.

**Sample problem**

A diver plans to dive 90 minutes after arriving at 1500 metres/5000 feet. What would his Pressure Group be for planning the dive?

Answer: B. Count 10 pressure groups upon his arrival (two for each 300 metres/1000 feet) to get Pressure Group J. After 90-minute surface interval (Side Two of The Wheel, Table 2 on Table), Pressure Group J moves to Pressure Group B.

5. Determining theoretical depths

a. As mentioned earlier, the actual depth must be converted to a theoretical depth for use on the RDP.

b. Use the Theoretical Depth at Altitude Chart to make these conversions.

**Note to Instructor**

Copies of these charts are in the Appendix of this outline. Make copies of the chart for each student and distribute them at this time.

- Use the exact or next greater number,
- Round altitudes up to the next 300 metres/1000 feet.
- Round depths to the next greater depth. This can mean a depth is rounded when entering the Theoretical Depth at Altitude Chart, and then again when applying the theoretical depth to the RDP.

- The Wheel, with its five foot depth increments, helps reduce unnecessary rounding in altitude diving. Its use for altitude diving is highly recommended.

- Remember that capillary depth gauges will automatically read the theoretical depth, and no conversion is necessary.

- The maximum depth for any dive is a theoretical depth of 40 metres/130 feet.

**Sample problem**

A diver at 1000 metres/3300 feet plans to dive to an actual depth of 14.3 metres/47 feet. What depth will he use for dive planning on the RDP? Answer: 18 metres/60 feet. 1000 metres/3300 feet rounds to 1200 metres/4000 feet on the Theoretical Depth at Altitude Chart. 14.3 metres/47 feet rounds to 16 metres/50 feet. Find 16 metres/50 feet in the Actual Depth column of the Theoretical Depth at Altitude Chart and follow to the right until under
the 1200 metre/4000 feet column. The theoretical depth is 18 metres/58 feet. 58 feet (imperial) rounds to 60 feet on the RDP (18 metres is found on the metric RDP). Note: The required safety stop for this dive would be made at 4.5 metres/13 feet according to the Theoretical Depth at Altitude Chart.

   a. After more than six hours at altitude, a diver’s body nitrogen equilibrates (for practical purposes) with the surrounding altitude. Because of this lower body nitrogen level, more restrictive rules may be used when a diver already acclimated to altitude ascends to a higher altitude to dive.
   b. For the purposes of using the RDP, an acclimated diver is a diver who has spent six or more hours at an altitude between 1200 metres/4000 feet and 3000 metres/10,000 feet. Divers acclimated to less than 1200 metres/4000 feet follow procedures as if acclimated to sea level.
   c. For acclimated divers determining a pressure group upon arrival at an altitude higher than acclimation altitude: Count four pressure groups for each 300 metres/1000 feet difference. Round up to nearest 300 metres/1000 for dive altitude and round down to nearest 300 metres/1000 for acclimation altitude.

Sample problem

A diver is acclimated to 1400 metres/4600 feet. What pressure group is he in upon arrival at a dive site at 1757 metres/5763 feet? Answer: H. 1400 metres/4600 feet rounds down to 1200 metres/4000 feet; 1757 metres/5763 feet rounds up to 1800 metres/6000 feet. This is a difference of 600 metres/2000 feet. Four pressure groups for each 300 metres/1000 feet is Eight pressure groups, which is H.

d. Acclimated divers may use the pressure group upon arrival provision for altitudes up to 3000 metres/10,000 feet.

e. Acclimated divers follow all other rules for altitude diving.

7. Sample problems and exercises
Note to Instructor

Conduct several sample dive plans for various altitudes similar to those likely to be encountered by the class. Be sure to cover:

1. Determining NDL for first and repetitive dive at altitude for a diver arriving from sea level and waiting six hours.
2. Determining NDL for first and repetitive dive at altitude for a diver arriving from sea level and diving in less than six hours.
3. Determining NDL for first and repetitive dive for an acclimated diver diving at an altitude higher than his acclimation altitude.

Have your students demonstrate that they can correctly plan these types of dives with the RDP.

V. General Open Water Considerations

A. Involve students in dive-planning activities. Dive planning is the heart of altitude diving, and should, in fact, be the emphasis of your open water training activities.

B. Always conduct a thorough briefing. The better the briefing, the smoother the dive.

C. Assign buddy teams according to ability (weak with strong) and establish check-in, check-out procedures.

D. Assign logistical duties to staff and review emergency procedures.

E. A certified assistant or instructor should accompany all buddy teams during in-water activities. It is highly recommended that you have personnel on shore/boat to supervise divers entering and leaving the water.

F. No dive should exceed the no decompression limit of the RDP.

G. During the briefing, tell your students at what tank pressure they should begin their ascent to their safety stop. Remember that altitude ascents are not to exceed 9 metres/30 feet per minute in assigning this pressure.

H. It is highly recommended that no altitude diving exceed a theoretical depth of 30 metres/100 feet. At no time should any dive exceed a theoretical depth of 40 metres/130 feet. If dives are to exceed 18 metres/60 feet of theoretical depth, the Advanced Open Water Diver rating will be required.

I. Consider using a descent/ascent line with accurate depth marking, especially for the first dive. Doing so will permit students to compare and contrast actual depths with their depth gauges.
VI. Open Water Training Dives

A. Open Water Training Dive One

Performance Requirements.
By the end of this dive, you will be able to:

- Calculate a no-decompression profile for the theoretical depth and altitude at which the dive will take place, using the Recreational Dive Planner.
- Execute a descent using a reference as a tactile or visual guide (line or sloping bottom).
- Compare a depth gauge to the instructor’s and/or other student diver’s depth gauges.
- Use a depth gauge and timing device (or dive computer) to measure an ascent rate that is not faster than 9 metres/30 feet per minute.
- Perform an ascent using a reference as a tactile or visual guide (line or sloping bottom).
- Perform at least a three-minute safety stop at a theoretical depth of 5 metres/15 feet before surfacing.

1. Briefing
   a. Evaluate conditions
   b. Facilities at dive site
   c. Entry technique to be used — location
   d. Exit technique to be used — location
   e. Bottom composition, expected features and points of interest
   f. Depth range
   g. Planned air supply limit
   h. Review communication
   i. What to do if separated from class/buddy
   j. What to do if an emergency arises
   k. Buddy assignments

2. Plan dive
   a. Assign depth; have students determine theoretical depth and no-decompression limit (you should check these).
   b. Record no-decompression limit, maximum actual depth and maximum theoretical depth on slates.
   c. Review depth gauges and instrumentation; each student should know how to account for behavior of his instrument while diving.
   d. Be sure that there’s a mix of nonadjustable bourdon tube, adjustable bourdon tube, electronic and capillary gauges among various buddy teams for comparison during dive.
   e. Assign maximum planned dive time.
3. Predive
   a. Prepare personal equipment.
   b. Don equipment.
   c. Predive safety check.
   d. Proper entry.
   e. Weight adjustment for neutral buoyancy.
   f. Maintain buddy contact.

4. Open Water Training Dive One
   a. Descend in buddy teams.
   b. Compare different depth gauges and observe difference.
   c. Reference slate/use depth gauge to stay within planned depth limit.
   d. Tour for pleasure, staying within planned dive limits.
   e. Ascent not exceeding 9 metres/30 feet per minute with three-minute safety stop at theoretical depth of 5 metres/15 feet as specified by Theoretical Depth at Altitude Chart.

5. Postdive
   a. Proper exit
   b. Remove and stow equipment.

6. Debrief
   a. Assess performance, make suggestions, give positive reinforcement.
   b. Students calculate their ending pressure groups — review for correct calculation.
   c. Log dive. (Instructor signs log.)

B. Open Water Training Dive Two

Performance Requirements.
By the end of this dive, you will be able to:
- Calculate and plan a no decompression profile for the theoretical depth and altitude at which the dive will take place, using the Recreational Dive Planner.
- Apply the skills and knowledge developed in the academic session and first open water training dive.

1. Briefing (if this dive is made in the same location as the first dive, repetition of identical information is not necessary)
   a. Evaluate conditions
   b. Facilities at dive site
   c. Entry technique to be used — location
   d. Exit technique to be used — location
   e. Bottom composition, expected features and points of interest
f. Depth range  
g. Planned air supply limit  
h. Review communication  
i. What to do if separated from class/buddy  
j. What to do if an emergency arises  
k. Buddy assignments  

2. Plan dive  
a. Have the students plan this dive in buddy teams for your assessment and approval.  
b. Ensure that students record no decompression limit, maximum actual depth and maximum theoretical depth on slates.  

3. Predive  
a. Prepare personal equipment.  
b. Don equipment.  
c. Predive safety check.  
d. Proper entry.  
e. Weight adjustment for neutral buoyancy.  
f. Maintain buddy contact.  

4. Open Water Training Dive Two  
a. Descend in buddy teams.  
b. Dive made as planned by students.  
c. Reference slate; use depth gauge to stay within planned depth limit.  
d. Ascent not exceeding 9 metres/30 feet per minute with three-minute safety stop at theoretical depth of 5 metres/15 feet as specified by Theoretical Depth at Altitude Chart.  

5. Postdive  
a. Proper exit  
b. Remove and stow equipment.  

6. Debrief  
a. Assess performance, make suggestions, give positive reinforcement.  
b. Students calculate their ending pressure groups — Review for correct calculation.  
c. Log dive. (Instructor signs log.)  
d. Complete certification paperwork.
Altitude Dive
Knowledge Review Answer Key

To the student: Answer the following questions and bring this completed Knowledge Review with you to your next training session.

1. Define “altitude dive” and briefly explain why special dive table considerations are needed when altitude diving.

   *Any dive made at 300 metres/1000 feet or greater above sea level. Special dive table considerations are needed to account for the difference in atmospheric pressure.*

2. Identify the main difference between flying after diving (or driving to altitude after diving) and diving at altitude.

   *The exposure to lower atmospheric pressure follows the dive when flying or driving to altitude after diving. In altitude diving, the exposure to lower atmospheric pressure precedes the dive.*

3. List the recommendations for flying after altitude diving, or driving to a higher altitude after altitude diving.

   *The recommendations are exactly and same whether diving at sea level or diving at altitude.*

4. List two possible detrimental physiological conditions from altitude diving, aside from decompression sickness, and explain how to avoid them.

   1. Hypoxia
   2. Hypothermia

5. Describe how altitude affects bourdon tube, capillary and electronic depth gauges, and how to compensate for the effects.

   a. Bourdon tube:

      *Reads shallower than actual depth – use adjustment knob if available.*

   b. Capillary:

      *Reads deeper than actual depth. Reads theoretical depth – no adjustment necessary*

   c. Electronic:

      *Varies. Some adjust automatically – consult manufacturers instructions.*
6. Identify the following when using the RDP at altitude.
   
a. Rate of ascent: 9 metres/30 feet or slower
b. Safety stop time/depth: 3 minute stop at theoretical depth
c. Maximum depth: Theoretical depth of 40 metres/130 feet
d. Maximum altitude: 3000 metres/10,000 feet

7. Identify the maximum number of altitude dives that may be made in one day when using the RDP.
   
Two

8. You plan to dive to an actual depth of 18 metres/60 feet one hour after arriving to an altitude of 1090 metres/3578 feet. If you were to dive to the no decompression limit, what would your no decompression limit be for a repetitive dive to the same depth after a 45 minute surface interval?
   
   16 min metric   18 min imperial

9. You plan to dive to an actual depth of 24 metres/80 feet after spending seven hours at the dive site altitude of 1226 metres/4023 feet. What is your no decompression limit for this dive? If your bottom time is 15 minutes, what would your no decompression limit be for a repetitive dive to an actual depth of 18 metres/60 feet after a one hour, five minute surface interval?
   
   Part 1: 20 minutes
   Part 2: Metric – Table = 25 min, Wheel = 26 min
   Imperial – Table = 20 min, Wheel = 24 min

Student Statement: I have had explained to me and I understand the questions I missed.

Name ___________________________________________________________________________ Date __________

Adventure Dive: Altitude

Skills Overview

• Knowledge Review
  • Briefing
  • Suiting Up
  • Predive Safety Check (BWRAF)
  • Entry
  • Descent
  • Depth Gauge Comparisons at Depth
  • Guided Tour (time/air pressure permitting)
  • Ascent — Safety Stop
  • Exit
  • Debrief
  • Log Dive — PADI Instructor Completes Advanced Open Water Training Record Sheet
PADI Adventure Dive Training Record

Adventure Dive:
ALTITUDE DIVE

Skills Overview

- Knowledge Review
- Briefing
- Suiting Up
- Predive Safety Check (BWRAF)
- Entry
- Descent
- Depth Gauge Comparisons at Depth
- Guided Tour (time/air pressure permitting)
- Ascent – Safety Stop
- Exit
- Debrief
- Log Dive – Complete Training Record

Instructor Statement

"I verify that this student has satisfactorily completed the Knowledge Review and Performance Requirements (as described in PADI’s Adventures in Diving Program Instructor Guide) for this PADI Adventure Dive. I am a renewed, Teaching status PADI Instructor for the current year."

Instructor Name ____________________________
First ___________________ Middle Initial ______ Last ________________

Instructor Signature ________________________________________________

PADI No. ________________ Dive Completion Date ____________ Day/Month/Year

Instructor Contact Information (Please Print)

Instructor Mailing Address ____________________________________________
City ___________________ State/Province ____________________________
Country __________________ Zip/Postal Code __________________________
Phone/FAX/email ____________________________

Student Diver Statement

"I verify that I have completed all of the Performance Requirements for this Adventure Dive. I realize that there is more to learn about altitude diving and that completion of a PADI Altitude Diver course is highly recommended. I also agree to abide by PADI Standard Safe Diving Practices."

Diver Signature ____________________________ Date ____________ Day/Month/Year
# Theoretical Depth at Altitude

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## SAFETY/EMERGENCY DECOMPRESSION STOP DEPTH

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## Theoretical Depth at Altitude

### IMPERIAL

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### SAFETY/EMERGENCY DECOMPRESSION STOP DEPTH

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PADI Specialty Training Record
Altitude Diver

I verify that this student has satisfactorily completed all academic and/or any confined water training sessions as outlined in the PADI Specialty Course Instructor Outline for Altitude Diver. I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name ________________________________  PADI# ______
Instructor Signature ________________________________  Completion Date ________

Open Water Dives

Dive One
I verify that this student has satisfactorily completed Dive One as outlined in the PADI standardized outline for Altitude Diver including:

• Descend with buddy
• Compare different depth gauges
• Reference slate/depth gauge to remain within planned depth
• Tour for pleasure
• Ascent not to exceed 9 metres/30 feet per minute with 3 minute safety stop at theoretical depth of 5 metres/15 feet

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name ________________________________  PADI# ______
Instructor Signature ________________________________  Completion Date ________

Dive Two
I verify that this student has satisfactorily completed Dive Two as outlined in the PADI standardized outline for Altitude Diver including:

• Descend with buddy
• Dive made as planned by student
• Reference slate/depth gauge to remain within planned depth
• Ascent not to exceed 9 metres/30 feet per minute with 3 minute safety stop at theoretical depth of 5 metres/15 feet

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name ________________________________  PADI# ______
Instructor Signature ________________________________  Completion Date ________

I verify that I have completed all performance requirements for this Altitude Diver Specialty. I am adequately prepared to dive in areas and under conditions similar to those in which I was trained. I agree to abide by PADI Standard Safe Diving Practices.

Student Name ____________________________________________________________________________
Student Signature ____________________________________________________________________________  Date ________