INSPIRATION QUESTIONNAIRE

Something for a rainy day

Which is the most appropriate answer, assuming there is one?
Submitted innocently, in the hope it may be of interest, a revision tool and will not cause any agro.
Please make your own corrections. There will be mistakes!
There are a few more sections to go and extra questions.

1.
The Inspiration is CE approved for use with the following diluent gases
(a) air to 40m and heliox to 110m
(b) air to 52m and heliox to 99m
(c) air to 50m and heliox to 100m
(d) air to 50m and trimix to 100m

2.
Rule number one for rebreather use is
(a) check O2 and diluent bottles are always turned on
(b) watch for a ppO2 spike on descent and a ppO2 drop on ascent
(c) never hold your breath when diving
(d) know your ppO2 at all times

SECTION 1

IMPORTANT INFORMATION

1.
Which of the following diluent gases would not be acceptable as they would produce a lethal diluent flush? (more than one answer)
(a) pure nitrogen for shallow dives
(b) pure helium for deep dives
(c) EAN 36 for a 30m dive
(d) Trimix 13/55 for a 90m dive

2.
To maintain trim and buoyancy underwater it is recommended that you
(a) dive heavy and make adjustments with the wing
(b) take 2 to 3kg more than on OC dives
(c) place up to 3kg from your weight belt in the weight pocket and use your drysuit for buoyancy control
(d) use ankle weights to keep your feet down and vent gas from the loop before you swim over objects

3.
Which of these procedures can you only do with one hand?
(a) operate the diluent and inflator buttons
(b) operate the pull dump on the exhalation lung
(c) check the O2 and diluent gauges and either oxygen controller
(d) turn off the oxygen bottle

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4.
On a dive to 25m the advantage of switching to the high set point is
(a) it will conserve diluent gas
(b) it will increase no stop time and nitrogen narcosis
(c) it will decrease nitrogen narcosis and increase the no stop time
(d) it will eliminate the chance of decompression sickness

5.
How frequently should you check your ppO2?
(a) at least every minute and more frequently on ascents and descents
(b) only when switching to a higher set point
(c) every time you hear the solenoid open
(d) just during calibration and prebreathe

6.
For oxygen toxicity and decompression considerations the high and low set points should be considered to be
(a) exactly as set
(b) both higher and both lower
(c) the low point higher and the high point lower
(d) the low set point lower and the high set point higher

7.
You should make your descent on the low set point because
(a) as pressure increases with depth it could cause a potentially dangerous ppO2 spike
(b) the high set point should only be used on the bottom
(c) the higher ppN2 will lead to narcosis tolerance
(d) any set point over 1bar will lead to the continuous injection of O2 on the surface

8.
When you have done a positive and negative pressure test on the surface
(a) it is not necessary to do a bubble check in the water
(b) the three minute prebreathe will identify any minor leaks
(c) an in water bubble check is still necessary
(d) it is advisable to do a bubble check on reaching the bottom

9.0
To close the mouthpiece
(a) grip it firmly in your teeth and turn the top away from you
(b) grip it firmly in your teeth and turn the top towards you
(c) the mouthpiece need not be closed underwater as the water traps will prevent the loop from flooding
(d) quickly place an open circuit valve in your mouth and then close the mouthpiece

10.
During descent there are several important tasks
(a) check the harness straps are correctly adjusted and the over pressure valve on the exhale lung is on low setting
(b) operating dry suit inflator, adding diluent, equalising mask and ears and monitoring ppO2
(c) equalising ears and mask and monitoring gauge pressures
(d) adding diluent to inhale lung and equalising mask

11.
During ascent the reduction in ambient pressure will cause the gas in the loop to expand causing increased buoyancy and inhalation resistance. The additional gas volume can be vented by
(a) the overpressure valve on low setting automatically venting
(b) pulling the dump cord on the overpressure valve
(c) exhaling through the nose or around the mouthpiece
(d) all of the above could be used

12.
Inhalation and exhalation resistance is dependent on the volume of gas in the loop
(a) too much gas in the loop will make it difficult to inhale
(b) too little gas in the loop will make it difficult to exhale
(c) the ideal volume of gas in the loop will allow you to take one deep breath
(d) selecting the low setting on the overpressure valve will ensure there is always the correct volume of gas in the loop

13.
If the diluent contents gauge (SPG) is showing an unusual amount of diluent is being used the cause could be
(a) exhaling through the nose
(b) open circuit second stage free flowing
(c) diluent first stage leak
(d) any of the above

14.
If there is a significant loop leak the constant injection of diluent will
(a) invalidate planned decompression schedules
(b) mean the problem can be dealt with and the dive can continue as normal
(c) stop water from entering the scrubber
(d) will keep the ppO2 at the desired set point

15.
If you haven't heard the solenoid for over a minute you should
(a) check your ppO2
(b) turn off your oxygen cylinder
(c) press the manual O2 inflate on the exhalation lung
(d) quickly change to open circuit

16.
Each hand set or oxygen controller has its own 6 volt battery. The life of each battery is approximately
(a) 70 hours when used for the slave or master controller
(b) 35 hours when used for the slave or oxygen controller
(c) 35 hours when used for the slave and 70 hours when used for the master
(d) 35 hours when used for the master and 70 hours when used for the slave

17.
The counterlungs may be used for additional surface buoyancy by
(a) changing to open circuit
(b) screwing the pressure relief valve to the high pressure setting, closing the mouthpiece and inflating the lung
(c) adding extra O2 or diluent to the counterlungs
(d) screwing in the pressure relief valve and pressing the diluent addition button on the inhalation lung

18.
To practice using the Inspiration with the solenoid jammed in the open position is best done in a swimming pool by
(a) selecting a set point of 1.5 and controlling the injection of oxygen by opening and closing the oxygen cylinder valve
(b) turning off the oxygen cylinder valve and using diluent flushes every 3rd breath
(c) running the unit with the oxygen manual inject hose disconnected
(d) immediately doing a diluent flush and switching to open circuit

19.
To practise using the Inspiration with its solenoid jammed in the closed position is best done by
(a) manually adding O2 to reach a ppO2 of 1.4 when 1.3 has been selected, followed by a diluent flush
(b) manually adding O2 on a 40m dive to reach a ppO2 of 1.3 when a ppO2 of 0.7 has been selected
(c) manually adding O2 to reach a ppO2 of 0.9 when a ppO2 of 0.7 has been selected
(d) on dry land, procedure © with one of the hand sets turned off

20.
During ascent
(a) the ppO2 will rise
(b) it shouldn't be necessary to add diluent
(c) select the low set point
(d) screw down the pressure relief valve on the exhalation lung

SOLENOID OPERATION……

SECTION 2

DEFINITIONS

1.
Match the words in the left column with the correct definition

Hypercapnia	(a) Breathing mixtures with a ppO2 greater than 1.6 bar
Hyperoxic	(b) No oxygen
Hypoxic	© Abbreviation for partial pressure of oxygen
Linearity	(d)Display on the oxygen controller when the ppO2 in the loop rises to 1.6 or higher
Anoxia	(e)Reduced amount of O2. When ppO2 drops below 0.16 bar
ppO2 or PO2	(f)Display on the oxygen controllers when the ppO2 in the loop is 0.4 bar or less
HIGH OXYGEN	(g)Excess of carbon dioxide. Breathless, rapid breathing, headache, confusion, unconscious
LOW OXYGEN	(h)Output related to input is a straight line

SECTION 3

OPERATIONAL CONSIDERATIONS

1.
Which of these statements is correct?

(a) air is 21% oxygen, 4% carbon dioxide, 70% nitrogen and 5% other gases such as helium and neon
(b) air is 21.9% oxygen and contains many other substances including dust, argon and water vapour
(c) A person on a closed circuit rebreather metabolises 1.5l of oxygen per minute and has a SAC (surface air consumption) is 25l per min. The

amount of oxygen they use will always be the same regardless of depth or activity

(d) With 20.9% oxygen in the diluent cylinder and 99% oxygen in the oxygen cylinder the amount of oxygen metabolised by a diver is dependent on many factors including stress and water temperature

2.
A diver has a SAC of 20l/min. Assuming the work rate of this open circuit diver remains constant how much gas will she use per min at 35m
(a) 70l/min
(b) ambient pressure in bar X 20l = l/min
(c) absolute pressure in bar X 20l = gas consumption
(d) 35m X 20l/min = gas consumption

3.
Use the a, b, c, d below to answer the next questions (no account for CO2 and water vapour)……
(a) 2.7
(b) 86
© 12
(d) 33

3(i) What is the percentage of oxygen in the loop if the setpoint is 1.3 and the depth 30m? Air is the diluent.

3(ii)With air as the diluent and a set point of 1.3 the ppN2 in the loop at 30 m is approximately?

3(iii) With air as the diluent and a set point of 0.7 the % of oxygen in the loop at 50m would be?

3(iv) With a set point of 1.3 and a diluent of 16% oxygen, 84% helium what is the percentage of helium in the loop at 80m

4.
For this question which row has the correct data?
The oxygen controller works to an accuracy of (column 1). With a set point of 1.3 assume a set point of (column 2) when calculating decompression and a set point of (column 3) when calculating oxygen toxicity limits

	Column 1	Column 2	Column 3
(a)	+ - 0.07 bar	1.20 bar	1.40 bar
(b)	+ - 0.05 bar	1.35 bar	1.25 bar
©	+ - 0.01 bar	1.25 bar	1.35 bar
(d)	+ - 0.05 bar	1.25 bar	1.35 bar

5.

The oxygen cells have an expected life of (????? Has this defiantely changed)

(a) 4 years in air, 10 months in oxygen and up to two years in the inspiration.
(b) at least three years
(c) a maximum of 12 months
(d) the new cells are guaranteed to last 24months

6.

Which row (a), (b), (c) or (d) has the correct information?

	The ppO2 range of the controller	With these cell outputs 1.33 1.30 1.34 the controller will assume a ppO2 of	The default set points are	NOAA maximum CNS oxygen exposure limits per 24hr at 0.7ppO2 and 1.3ppO2 are
(a)	0.7 to 4.00	1.32	0.16 and 1.40	9.5 and 3.5 hours
(b)	0.00 to 2.55	1.35	0.7 and 1.30	as (a)
(c)	0.16 to 1.40	1.30	0.7 and 1.30	9.5 and 3 hours
(d)	0.00 to 2.55	1.355	0.17 and 0.21	3 hours and 3.5 hours

7.

If two of the O2 cells are malfunctioning the O2 controller will

(a) select the accurate cell and ignore the faulty cells
(b) select the faulty cells and calculate their average
(c) select the faulty cells if their readings are within 10% of each other
(d) indicate cell error no dive

8.

Select (a), (b), (c) or (d)

Water on the face of an oxygen cell tends to (column 1) and water in the back of the cell will (column 2)

	Column 1	Column 2
(a)	slow down the reaction to changing ppO2	speed up the reaction to changing ppO2
(b)	speed up the reaction to changing ppO2	speed up the reaction to changing ppO2
(c)	Push ppO2 readout higher	Push ppO2 readout lower
(d)	Slow down the reaction to changing ppO2	Push the ppO2 readout higher

9.
Select (a), (b), (c) or (d)
Cell outputs are accurate to (column 1) and the oxygen controller reading is accurate to (column 2) , allowing for normal use errors.

	Column 1	Column2
(a)	+ - 1.0%	+ - 0.05 bar
(b)	+ - 10.0%	1.0%
(c)	+ - 0.7%	1.3%
(d)	+ - 5.0%	+ - 0.10 bar

10.
The scrubber duration
(a) can be extended if you are only doing shallow dives
(b) when using 1.0 to 2.5mm diving grade sofnolime and with an average CO_2 production of 1.6l/min is 3 hours.
(c) can be accurately estimated by looking at the colour.
(d) will vary depending on the diluent gas

11.
The material used in the scrubber to absorb CO_2
(a) should be 1.0 to 2.5mm Sofnolime
(b) could be 2.5 to 5.0mm Sofnolime
(c) could be Draegersorb
(d) a, b, or c providing the scrubber is packed correctly and the limitation of the material is known

12.
Normal air contains (column 1) %CO_2 while expired air contains (column 2) %CO_2 and (column 3) %O_2

	Column 1	Column 2	Column 3
(a)	0.04%	4.0%	16%
(b)	21%	6.0%	18%
(c)	2.9%	14%	21%
(d)	0.4%	4.0%	16.0%

13.
The mass of 1.0 to 2.5mm Sofnolime needed to correctly fill the scrubber
(a) depends on how much is being replaced
(b) 2.25lbs
(c) 2.45kg
(d) depends on the depth and duration of the next dive

14.
Used Sofnolime
(a) should be disposed of immediately
(b) may be used on the garden to prevent club root instead of lime
(c) may be kept for use on shallow swimming pool sessions
(d) will have a deep purple colouration throughout and is useful if you have a cat as it is perfectly harmless

15.
The symptoms of hypercapnia are
(a) pins and needles
(b) vomiting and chesty cough
(c) scarlet lips and nail beds
(d) increased breathing rate, confusion, drowsiness, dizziness, headache, shortness of breath

16.
In which row are the ppO2 levels or O2% correct

	High O2 warning	Default set point	Low O2 warning	Minor hypoxia	Default set point
(a)	2.55	1.3	0.21	0.10	1.6
(b)	1.6	0.7	0.40	0.16	1.3
(c)	14	1.4	0.16	0.21	2.1
(d)	1.6	0.21	0.36	0.02	0.7

17.
In which row are the correct symptoms?

	hypoxia	hyperoxia	Pulmonary whole body oxygen toxicity	CNS oxygen toxicity	hypercapnia
(a)	Blue lips	Joint pains	dizzyness	conventid	shivering
(b)	vomiting	Blue nail beds	convulsions	conventid	Aching joints
(c)	Dry cough	headache	Shortness of breath	conventid	Ear ache
(d)	unconsciousness	convulsions	Dry cough	conventid	dizziness

SECTION FOUR

APPARATUS COMPONENTS

1.
During a dive the counterlungs must be kept (column 1) and the over pressure exhaust yalve adjusted so that it is (column 2)

	Column 1 counterlungs	Column 2 Exhaust valve
(a)	Down on the shoulders	Screwed fully anticlockwise
(b)	With two full breaths inside	Screwed fully clockwise
(c)	Full of gas	Fully open
(d)	On the shoulders	Fully closed

2.
When reinserting the mouthpiece under water
(a) press the diluent add to increase the gas in the loop
(b) you may get a buoyancy change
(c) hold the mouthpiece in your mouth, blow to remove water and rotate the top of the outer section towards you, check your ppO2.
(e) both b and c

3.
If the mouthpiece hose is connected the wrong way around to the T pieces of the counterlungs
(a) you will not be able to breathe from the mouthpiece
(b) this will prevent oxygen from being injected into the loop
(c) the loop gas will now circulate in an anticlockwise direction when looking at the front of the unit
(d) it is not possible to assemble the unit in this way

4. The convoluted hose with blue rings is
(a) on the inhalation side
(b) carries exhaled gas directly to the scrubber
(c) contains gas with the highest ppCO2
(d) is more likely to carry infections than the hose with the grey connector

5.
Both diluent and oxygen inflators
(a) may be used on either counterlung as the screwfitting and hose connections are the same
(b) are designed to work with a feed pressure of 20 bar
(c) are connected to the high pressure ports of the first stages
(d) should be tested for leaks by dipping them in water and can be identified by markings on their underside

6.
Assuming a Y or H valve has been fitted to the oxygen cylinder so a separate demand valve for open circuit oxygen can be used. The manual oxygen inflator hose and the hose for the solenoid should be run on the same first stage because if separate
(a) should the solenoid stick open you would not be able to turn the oxygen off
(b) on ascent the manual addition of oxygen would allow the oxygen pressure to build up and the solenoid may not be able to open against it
(c) it would not be possible to calibrate
(d) the oxygen cells would get a false reading

7.
All audible warnings are for one second at a time with a one second interval. These will occur when

	High ppO2	Low ppO2	Low battery replace no dive	Battery warning	Cell warning (old sets) or Cell error (new sets)
(a)	1.6	0.4	4.7v	5.1v	Over 10% deviation from average of closest two
(b)	2.0	1.6	4.0v	5.0v	Hyperoxic mix
(c)	1.4	0.16	5.0v	4.5v	Totally flooded scrubber
(d)	2.1	0.21	4.9v	5.1v	Water on the face of a cell

SECTION 5

POWER ON

1.
When switching on the unit it is best to
(a) use the right controller as master
(b) switch on the slave handset 5 seconds after the master
(c) turn on all gases switch on and listen for two beeps
(d) alternate right and left as master controllers to keep battery levels even

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2.
The set points can be altered and the menu mode can be entered
(a) on either controller providing they are below 6m
(b) on master or slave if they are on the low set point
(c) only with the master controller
(d) only on set up with the controller which is switched on first

3.
When the unit is first switched on the display will show BUDDY INSPIRATION and
(a) ask if the O2 is turned on?
(b) give two quick beeps
(c) check all batteries
(d) ask if you want to calibrate?

4.
When the unit is turned on and a cell is found to be faulty or missing
(a) you can still progress to dive mode as there are two properly functioning cells
(b) it is not possible to calibrate so you cannot dive
(c) providing the battery voltage is high there is enough power for the unit to function on two cells
(d) if cell 2 is faulty you can still set up using cells 1 and 3

5.
If both batteries have a charge of 5 volts
(a) it would not be possible to enter dive mode till the master controllers battery has been replaced
(b) both controllers will advise that their batteries should be replaced
(c) it is still possible to progress to dive mode but not advisable
(d) both (b) and (c) are correct

6.
The slave oxygen controller should be turned on when the Master reads DIVE NOW? Confirm because
(a) it isn't possible to turn both controllers on at the same time
(b) the Slave will take over as master if turned on earlier
(c) the Slave will do an independent check of the O2 cells and its battery
(d) the Slave will calculate the ppO2 from the 3 O2 cells whenever its turned on

7.
If the Master is in DIVE MODE when the Slave is turned on
(a) the Slave will take the pp02 readings from the Master
(b) the Slave will read NO DIVE
(c) the Master will become the Slave after giving a warning beep
(d) the Slave will still independently calculate ppO2 from the mVolt output of each cell but will not perform its oxygen cell, connections and battery checks

SECTION 6

CALIBRATION

1.
The mVolt outputs from the oxygen cells will be
(a) lower in a high ppO2
(b) Higher in a high % O2
(c) dependent on the amount of N2 and He in the loop
(d) both (b) and (c) are correct

2.
The oxygen cells
(a) are constantly working
(b) only produce a mVolt output when they are in a circuit with a charged battery
(c) must be calibrated for every dive
(d) produce the electricity to control the solenoid

3.
If the mVolt output from the three oxygen cells differs
(a) they are old and need to be replaced
(b) it indicates that there is water on their surfaces
(c) there is a faulty connection
(d) it is precisely what is expected

4.
It is acceptable to calibrate underwater
(a) if there has been no change in the O2 or diluent in the past 24hours
(b) it is never acceptable to calibrate underwater because of the increased ambient pressure
(c) providing the handsets are turned on correctly
(d) providing the oxygen is of a known percentage

5.
Should both handsets be accidently turned off underwater and then turned on again
(a) they must not be recalibrated as the calibration factors from the initial set up are stored
(b) they can be recalibrated after a diluent flush
(c) the Master must be turned on first to continue to dive safely
(d) the dive must be aborted on open circuit

6.
During calibration if the barometric pressure is significantly higher than 1000mb (say 1050mb or 1.05bar) and is not allowed for this will
(a) result in a lower ppO2 in the loop than is shown by the display and possible DCS
(b) not have any effect on ppO2
(c) result in a higher loop ppO2 than indicated which could lead to oxygen toxicity
(d) be compensated for by the 3 oxygen cells

7.
During calibration if the barometric pressure is significantly lower than 1000mb (say 850mb or 0.85bar) but is not allowed for this
(a) will lead to a ppO2 display higher than it actually is and possibly oxygen toxicity problems
(b) will lead to a ppO2 display lower than it actually is and possible DCS problems
(c) will mean bad weather or altitude makes for unsafe diving
(d) will make no difference to the ppO2 during calibration

8.
When the solenoid opens during “FLUSHING BAG” oxygen is injected into the scrubber lid and onto the oxygen cells until
(a) their mVolt output stabilises for that percentage oxygen
(b) the mVolt output for all three cells is the same
(c) the slowest cell is identified and its output ignored
(d) the two cells with the closest mVolt reading stop reacting

9.
If the O2 bottle is filled from a cylinder of known O2 %
(a) it is not necessary to analyse the gas as it has come from a known source
(b) it is always imperative to analyse a freshly filled bottle
(c) it is advisable to analyse the gas but in this case it is not necessary
(d) the oxygen cells would allow for any discrepancy

10.
An unused “J” cylinder of oxygen will contain
(a) 99.9% oxygen
(b) will have the oxygen percentage stamped by the valve
(c) will contain 210bar when full
(d) a percentage of oxygen depending on its use

11.
If the mouthpiece is left closed during calibration
(a) this will cause a rise in loop pressure and an inaccurate calibration
(b) it will make no difference to the calibration
(c) it acts as a check for loop integrity
(d) it is a good idea as it ensures no air can get into the loop to contaminate the oxygen being passed over the oxygen cells

12.
With newer sets, when prompted to CHECK DILUENT
(a) you would not be able to dive if the diluent is not turned on
(b) this is the time to analyse the diluent gas
(c) you should only dive if there is over 150 bar
(d) it is time to turn on the bottle, check the diluent inflator and HP gauge

13.
When prompted to OPEN O2 VALVE ! if the valve is not opened
(a) the calibration will take place using the gas in the scrubber lid as the mVolt outputs are stable
(b) you can enter dive mode with 21% in the lid
(c) the programme will take you back to the start
(d) you will be prompted NO OXYGEN CHECK VALVE

14.
Which would be a possible screen when entering dive mode?
(a) 0.70 0.70 0.68
(b) 0.68 0.70 0.72
© 0.68 0.70 0.71
(d) 0.70 0.71 0.73

15.
It is useful to observe displays before calibration as this
(a) will indicate if there is a slow reacting cell
(b) by keeping a record of the end values it would be possible to detect when the cells are starting to deteoriate
(c) it confirms all 3 cells are functioning
(d) all of the above

16.
At atmospheric pressure the cell outputs will be linear unless they are failing. This means that
(a) their mVolt output doesn't change during their useful life
(b) in air their converted output 20.9 and in pure oxygen 100 and 75 in 75% oxygen
(c) their mVolt output trebles if the O2 % doubles
(d) the mVolt output is 0.0 when not in use

17.
With a set point of 1.0, pure oxygen in the loop, the mouthpiece closed and the oxygen turned off
(a) the ppO2 displays will stay at 1.0 as the system is closed
(b) the handset will say NO DIVE as the oxygen is turned off
(c) if the ppO2 display decreases it indicates that a cell is worn out and needs replacing
(d) any fluctuation in ppO2 display will indicate failing batteries

18.
After setting up but prior to diving what would happen or what would be the implications if (air as diluent)

	You press the diluent inflate button	You notice one cell is reacting slowly	The ppO2 drops below 0.4	You manually inject oxygen
(a)	ppO2 values will drop	Possibly water on the cell face	Warning buzzer sounds	ppO2 will increase on all three readouts
(b)	ppO2 values will rise	The other two are definitely correct	There will be no audible or visual warning	You should reset the set points
©	You must go through the set up procedure again	Assume this cell needs to be replaced	Warning buzzer for one second	Pre breathe till the low set point is reached
(d)	ppO2 values will drop	The other two cells have a faulty connection	There will be a visual warning but no audible warning	High ppO2 warning

19.
With air as the diluent and 99.9% O2 what ppO2 (bar) would you expect at these depths?

	10m	15m	20m	25m	35m	45m
(a)	0.42	0.53	0.21	0.53	0.74	0.95
(b)	0.21	0.32	0.63	0.74	0.83	1.27
©	0.21	0.32	0.74	0.53	0.74	1.30
(d)	0.42	0.53	0.63	0.74	0.95	1.12

DIVE MODE

SECTION 7

1. True / false
You can only switch from one set point to the next by pressing and holding the middle button of the slave for two seconds.

2. True / false
The high default set point will lead to the continuous injection of O2 in the loop at any depth shallower than 6m.

3. True / false
The Slave takes all its information from the Master.

4.
After setting up it may take a few minutes of prebreathe before the low set point is reached because
(a) expired air takes time to warm the scrubber
(b) there is not enough moisture in the loop
(c) the high O2 in the loop has to be metabolised
(d) the cells react slowly when set up

5.
The initial use of the default low set point means that
(a) there is less likelihood of an O2 spike on descent
(b) oxygen will not be continuously injected into the loop before entering the water
(c) scrubber time will be significantly increased
(d) both (a) and (b) are correct

SECTION 8

MENU MODE

1. True / false

When a set point is altered this is stored in the controller so it can be used for the next dive even if the set has been turned off.

2. True / false

The two outside buttons on the Master have to be pressed down for two seconds when on the low set point in order to enter Menu Mode.

3. True / false

If Yes is the answer to the question RESET NOW? the timer will be reset providing the set is turned off within 15 seconds

4.
Menu Mode can be used for

	Adjusting intermediate dil and O2 pressures	Altering high set point	Altering low set point	Resetting ON time timer	Checking mVolt cell output
(a)	no	yes	yes	no	yes
(b)	no	yes	yes	yes	no
©	yes	yes	no	yes	no
(d)	no	no	no	yes	yes

5.
You can only enter menu mode
(a) when the Master is in dive mode with the low set point selected
(b) when the Master is in either low or high set points
(c) with either Master or Slave when they are on either high or low set points
(d) with either Master or Slave when they are on low set point

6.
After entering menu mode the controller will automatically switch back to dive mode
(a) after 20 seconds
(b) when all changes have been made
(c) if there is a pressure change
(d) if there is a lapse of 15 seconds after the last button was pressed

7.
The Elapsed ON Time measures
(a) the time left before the scrubber expires
(b) the number of hours the Master's battery has been in use
(c) how long the unit has been turned on since it was last reset
(d) the time since set up on each dive

8.
You can adjust the set points
(a) so they guarantee a safe ppO2
(b) only within a preset range
(c) so the high set point is between 1.0 and 1.5 and the low set point between 0.6 and 1.0
(d) so the low set point is between 0.5 and 1.0 and the high between 1.0 and 1.6

9.
Which row shows the correct values?

	Range of ppO2 displayed	High set point range	Default set points	Maximum time for Elapsed ON time	Low set point range
(a)	0.7/1.3	1.3/2.5	0.7/1.3	15sec	0.7/1.0
(b)	0.00/2.55	1.0/1.5	0.7/1.3	255hr	0.5/1.0
©	0.00/2.55	1.0/1.5	0.7/1.3	255hr59sec	0.5/1.0
(d)	20.9/16.0	1.0/ 2.5	0.0/1.7	25hr	0.21/0.79

SECTION 9

OXYGEN LEVEL WARNINGS

1.
Low and high oxygen level warnings will sound when
(a) the ppO2 drops below 0.04 bar or above 1.5 bar
(b) the ppO2 drops below 0.4 bar or above 1.6 bar
(c) the ppO2 drops below 0.04 bar or above 2.55 bar
(d) the ppO2 drops below o.21 bar or above 1.45 bar

2.
When there is a high or low O2 warning
(a) the solenoid will have stuck open
(b) you must turn the oxygen cylinder off
(c) the batteries will not have enough power to operate the solenoid
(d) the buzzer sounds for one second and the LOW OXYGEN or HIGH OXYGEN is displayed alternating with the set point

3.
The cause of the low O2 warning could be
(a) the O2 cylinder valve turned off
(b) the O2 cylinder is empty
(c) a diluent flush
(d) any of the above

4.
Surfacing directly after a low O2 warning is potentially dangerous as
(a) the solenoid could be jammed open
(b) this would increase narcosis
(c) it could cause a loop flood
(d) during ascent the ppO2 will drop as ambient pressure decreases

5.
It is best to open the oxygen cylinder valve one or two turns
(a) so it can be quickly turned off if the solenoid jams open
(b) so it can be fully turned on for extra oxygen if cylinder pressure drops
(c) so it is less likely to damage the valve
(d) as it is an easy way to distinguish between diluent and oxygen cylinder valves

6.
Once the controller has closed the solenoid it will remain closed for a minimum of six seconds. This means that
(a) during this time there is no way oxygen can be added to the loop
(b) during this time any CELL WARNINGS will be displayed
(c any longer time signals a definite cell problem
(e) the cells have a rest for six seconds

7.
'CELL STUCK' or 'OUT OF RANGE'
(a) may be displayed at any time during a dive
(b) indicates a cell may need to be replaced
(c) only during set up if there is no change in a cell output or if the output is below 8 mV or above 13.5 mV
(d) both (b) and (c) are correct

6. Which of the following would indicate (i) high O2 risk
(ii) low O2 risk
(iii) faulty connection
(iv) possibly two faulty cells

(a)

CELL WARNING
1.29 0.0 1.30

(b)

CELL WARNING
1.00 1.31 1.30

©

CELL WARNING
1.28 1.65 1.30

(d)

CELL WARNING
0.69 0.71 0.70

(e)

CELL WARNING
2.55 1.32 1.31

SECTION 10

MAINTENANCE

True/false
1.
The O2 cells must be replaced every 12 months

True/false
2.
There are parts of the unit which do not require at the minimum an annual inspection

True/false
3.
Any dive lubricant can be used on O rings which are not exposed to full cylinder pressure.

True/false
4.
When the unit is stored it should be upright or lying on its counterlungs with the BC and counterlungs partly inflated.

5.The scrubber should be refilled
(a) after 3 hours of use
(b) after 4 hours of use
© with 2.45 kg of 747 diving grade sofnolime with a granule size of 1 to 2.5mm
(d)both (b) and (c)

6.
Which line shows the correct information concerning the scrubber?

	The filter scrim	The scrubber should be filled to within how many mm from the top edge	The four retaining nuts should be	If the bore is scratched or the O ring damaged	The sofnolime dust is	The pH of the sofnolime is
(a)	Needs to be frequently replaced	6mm	Greased each time	You cannot calibrate	alkaline	alkaline
(b)	Retains the sofnolime and is water repellent	6mm	Hand tight	The scrubber may be bypassed	Potentially harmful	alkaline
(c)	Can be replaced with any fine mesh	5mm	Hand tight	It would be foolish to dive	Best not used in the scrubber	9
(d)	Will keep the O2 cells dry	4mm	Nipped up with a pliers	They should be replaced	Creates an extra hazard	3

7.
Cleaning and disinfecting the unit

(a) should be done at the end of each days diving
(b) should only be done monthly as frequent cleaning leads to unnecessary ware and tare
(c) only needs to be done if there is a change of user
(d) may be done with Miltons or any domestic bleach

ANSWER SHEET

Always know your ppO2

	a	b	c	d
1				
2				

SECTION1 IMPORTANT INFORMATION

	a	b	c	d
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

SECTION 2 DEFINITIONS

Hypercapnia	
Hyperoxic	
Hypoxic	
Linearity	
Anoxia	
ppO2 or PO2	
HIGH OXYGEN	
LOW OXYGEN	

SECTION 3 OPERATIONAL CONSIDERATIONS

	a	b	c	D
1				
2				

3 (i)				
	a	b	c	D
3 (ii)				
3 (iii)				
3 (iv)				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				

SECTION 4. APPARATUS COMPONENTS

	a	b	c	d
1				
2				
3				
4				
5				
6				
7				

SECTION 5. POWER ON

	a	b	c	d
1				
2				
3				
4				
5				
6				
7				

SECTION 6. CALIBRATION

	a	b	c	d
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

SECTION 7. DIVE MODE

	true	false
1		
2		
3		

	a	b	c	d
4				
5				

SECTION 8. MENU MODE

	true	false
1		
2		
3		

	a	b	c	d
4				
5				

6				
7				
8				
9				

SECTION 9. OXYGEN LEVEL WARNINGS

	a	b	c	d
1				
2				
3				
4				
5				
6				
7				
8 (i)				
8 (ii)				
8 (iii)				
8 (iv)				

SECTION 10. MAINTENANCE

	true	false
1		
2		
3		
4		

	a	b	c	d
5				
6				
7				

INSPIRATION QUESTIONNAIRE

ANSWER SHEET

Always know your ppO2

	a	b	c	d
1			X	
2				X

SECTION1 IMPORTANT INFORMATION

	a	b	c	D
1	X	X		
2			X	
3				X
4			X	
5	X			
6		X		
7	X			
8			X	
9	X			
10		X		
11				X
12			X	
13				X
14	X			
15	X			
16				X
17		X		
18	X			
19			X	
20		X		

SECTION 2 DEFINITIONS

Hypercapnia	(g)
Hyperoxic	(a)
Hypoxic	(e)
Linearity	(h)
Anoxia	(b)
ppO2 or PO2	©
HIGH OXYGEN	(d)
LOWOXYGEN	(f)

SECTION 3 OPERATIONAL CONSIDERATIONS

	a	b	c	d
1				X
2		X		

3 (i)				X
3 (ii)	X			
3 (iii)			X	
3 (iv)		X		
4				X
5	X			
6		X		
7			X	
8				X
9	X			
10		X		
11				X
12	X			
13			X	
14	X			
15				X
16		X		
17				X

SECTION 4. APPARATUS COMPONENTS

	a	b	c	d
1	X			
2				X
3			X	
4	X			
5				X
6		X		
7	X			

SECTION 5. POWER ON

	a	b	c	d
1			X	
2			X	
3		X		
4		X		
5				X
6			X	
7				X

SECTION 6. CALIBRATION

	a	b	c	d
1				X

2	X			
	a	b	c	d
3				X
4		X		
5	X			
6			X	
7		X		
8	X			
9		X		
10				X
11	X			
12				X
13				X
14	X			
15				X
16		X		
17			C	
18	X			
19				X

SECTION 7. DIVE MODE

	true	false
1	X	
2		X
3		X

	a	b	c	d
4			X	
5				X

SECTION 8. MENU MODE

	true	false
1	X	
2		X
3		X

	a	b	c	d
4		X		
5	X			
6				X
7			X	
8		X		
9			X	

SECTION 9. OXYGEN LEVEL WARNINGS

	a	b	c	D
1		X		
2				X
3				X
4				X
5	X			
6		X		
7				X
8 (i)			X	(e)
8 (ii)		x		
8 (iii)	x			
8 (iv)		x	x	(e)

SECTION 10. MAINTENANCE

	true	false
1		X
2		X
3		X
4	X	

	a	b	c	d
5	X			
6		X		
7	X			

INSPIRATION QUESTIONNAIRE

Diving with a buddy who has an Inspiration. (major copy from Stephen Bird)

A little background information on how it works

There are many similarities between open and closed circuit diving but it is the differences which are important.

The inspiration has three oxygen sensors which constantly check the ppO2 of the breathing gas. The readouts from these sensors can be seen on each of the two hand sets or oxygen controllers. Each hand set has an independent battery supply and can function independently. The first hand set to be turned on becomes the master. If the master is turned off during a dive the slave set will automatically take over . When the original master is turned back on it becomes the slave.

The Inspiration has two ppO2 "**set points**." …..back to a little IANTD revision

ppO2	**EFFECT**
0-0.10	Coma or death
0.10	Unconsciousness
0.12	Serious signs of hypoxia
0.16	Minor signs of hypoxia
0.21	Normal air
0.40	Inspiration low oxygen warning
0.70	Inspiration default **low set point**
1.30	Inspiration default **high set point**
1.40	Recommended recreational limit
1.60	Inspiration high oxygen warning

The low set point is used on the surface when setting up the Inspiration and the high set point is used on the bottom.

The diver has to manually switch from one set point to the other. The high set point is unsuitable on the surface where there is only 1 bar pressure as it would lead to the constant injection of O2 .

During a dive the diver has to constantly monitor the ppO2 checking the master hand set every 30 seconds to one minute. There is an audible warning if the ppO2 drops to 0.40 bar or rises to 1.60 bar. There are other audible warnings accompanied with text messages on the hand sets if there is a problem. These warnings (one second on and one second off) do not mean there is a catastrophic problem.

The most important thing for an open circuit diver to remember is not to hold their breath on ascent. The closed circuit diver must **always know their ppO2** .

As the oxygen in the breathing loop is used the oxygen sensors measure this and the data is sent to the oxygen controller. The oxygen controller then opens the solenoid valve which injects oxygen into the breathing loop to bring it back to the set point. During the bottom portion of the dive the solenoid would be opened for about one second in every 6. The Rebreather diver will be listening for this as another check that the system is working correctly.

INSPIRATION QUESTIONNAIRE

During descents and ascents the rebreather diver has more tasks to concentrate on than an open circuit diver.
On the descent in addition to ear clearing, suit squeeze and buoyancy the diver has to

(a) monitor ppO2 by frequently checking the master hand set. As the pressure increases with depth the ppO2 will increase or spike, which could lead to hyperoxia. On the low set point of 0.70bar ppO2 this can easily spike to over the high set point with a rapid descent to 20m. (theoretically, 3bar absolute pressure X 0.7bar ppO2 = 2.1bar ppO2) The descent may be slower than normal but the metabolism of oxygen and the addition of diluent will reduce the ppO2
(b) the single breath of gas in the counterlungs will be compressed so it will be impossible to breathe. Additional diluent gas has to be added manually by frequently pressing the diluent inflator on the inhalation lung to bring the loop volume back to one breath.

On the ascent the reduction in pressure will lead to a corresponding drop in ppO2. The diver has to

(a) constantly monitor ppO2 and be wary of hypoxia. The solenoid valve will be staying open longer (possibly over 10secs at a time) and the diver will be listening for this.
(b) the expanding gas in the loop is easily vented and should not cause a buoyancy problem.

Before a dive and at home the system is serviced and checked for leaks. On the boat the oxygen controller takes the diver through a set up procedure which is followed by a 3 minute breathe test. This tests the batteries, oxygen cells, oxygen controllers and solenoid. A final leak test is best carried out when submerged. There shouldn't be any bubbles from the unit.

A buddy should know how to open and close the closed circuit mouthpiece and how to manually inject diluent into the inhalation lung. If the mouthpiece is removed and not closed water will enter the lung and could cause some very expensive damage.
With the mouthpiece closed the counterlungs can be used for additional buoyancy on the surface.

Diluent flushes

If there is a problem with the ppO2 there are two instant bailout procedures.

(1) switch to open circuit, the problem can then be investigated "at leisure" while breathing a known safe gas
(2) do a diluent flush. This involves completely flushing the loop with the diluent gas. The oxygen percentage of this gas is known and is neither hypoxic or hyperoxic and so is instantly safe to breathe. The three readouts from the oxygen sensors can then be checked. If the diluent was air and the flush is done at 30m the sensors should read 0.84. (4bar X 0.21 = 0.84ppO2)
(3) diluent flushes are also done for gas switches. The Inspiration will maintain a constant ppO2 on the ascent but may take a little time to 'catch up.' After flushing out the bottom gas, if the deco

gas is EAN 36 and the set point 1.3 then the Inspiration will add oxygen to reach that set point. To calculate the % of O2 at any depth with that set point we can use the formula;

Fg=PPg/P or in other words;

percentage O2 in breathing gas= $\frac{\text{partial pressure of oxygen}}{\text{absolute pressure}}$

At 6m the Inspiration will deliver $\frac{1.3\text{ppO2}}{1.6\text{ bar}}$ = 81%O2

Diluent flushes may also be used during deco to reduce the amount of water vapour in the loop and to flush out any helium that may have been off gassed.

Air breaks at 6m
These are achieved by changing the set point;

PPg= Fg X P PPg = 0.21 X 1.6 bar PPg= 0.34

The low ppO2 warning is activated at 0.4bar so at 6m it is necessary to use a set point of 0.5 bar

Fg = 0.5ppO2 / 1.6bar abs = 31%O2

In fact the 1.6bar pressure at 6m makes air the equivalent of 34%

All of the convectional buddy checks also apply to closed circuit. The standard Inspiration harness has a lot of clips and may be difficult to remove in the water.

On no account should the oxygen controllers or the cylinder valves be turned off
when the unit is in the water.

As with any diving it is important to know the symptoms of hypoxia, hyperoxia and hypercapnia.

The Inspiration is a robust piece of equipment but the handsets which are on fairly long hoses are easily damaged if the unit is dropped on them. Very expensive.

It is invaluable to let your buddy have a go under very close supervision in a swimming pool. This is worth a thousand words.
A great piece of kit get down to AP valves and buy one.