The British Sub-Aqua Club

FIRST CLASS DIVER

DIVING KNOWLEDGE EXAM: Oct 2016

ANSWER GUIDELINES

Please note that the answers provided here are for guidance only. The nature of the examination means that for some questions there may be other 'correct answers'.

MEDICAL

1. Treat as for DCI. Contact Coastguard/Hyperbaric Facility and ask for medical advice from a diving doctor. Conduct secondary assessment of casualty and any other instructions issued by doctor. Evacuate as instructed.

2. Signs: Rapid breathing, Distress, Confusion, Lack of co-ordination, Reluctance or inability to respond. Response: Try to re-assure (eye to eye contact), encourage them to flush bailout (e.g. give bailout signal), Standby to rescue. OCB Advantage: No need to remove a mouthpiece; just switch to breathable supply, especially if breathing rapidly and uncontrollably.

3. ConVENTID: Convulsions, Visual Disturbances, Ears, Nausea, Twitching, Irritability, Dizziness. DRABC – Danger, Response, Airways, Breathing, Compressions

4. SAMPLE is an acronym used to help remember secondary assessment. Signs & symptoms, Allergies, Medications, Pertinent Past medical history, Last oral intake, Events leading to the illness or injury.

5. Metabolism is process by which food and oxygen are converted to energy, carbon dioxide, water and waste by the body.

6. a) Sound travels much quicker in water than air therefore time differential between arrivals at sound to one ear compared to other is much smaller. b) Sounds and in particular shock waves associated with underwater civil engineering activities or underwater explosions such as piling can cause physical internal damage to the diver.

DECOMPRESSION

7. BSAC Level A1: 27% at 42m for 33m = 1min at 9m and 6min at 6m on 50%. For 27% only, required decompression = 1@9 and 12@6. As dive has missed the 9m stop this is added to the 6m stop so final bailout decompression requirements are 13min@6m.

8. i) Reduced time to exposure of risks associated with being underwater – cold, currents, boat traffic etc. ii) Permits realistic decompression times for mixed gas diving.

9. CNS= 0.56 x 180 = 100.8 %. UPTD= 1.48 x 180 = 266.4
Reduce set point to 1.2 so that CNS reduces to 79.20 (just underneath recommended maximum). Alternatively, reducing the total time would reduce exposure.

10. END = (Depth + 10) × (1 − Fraction of helium) − 10 = 60 x (1 – 0.30) – 10 = 32m.
EAD = (Depth + 10) × (Fraction of N2 / 0.79) – 10 = 60 x (0.50/0.79) – 10 = 28m. (This is stated in the data given). Oxygen is considered to have a similar narcotic effect to nitrogen and so EAD differs from END.

11. Different agencies have had different recommendations for conservation. Answers given here assume BSAC recommendations and steel 232bar cylinders. Answer for Aluminium 207bar cylinders would be different. For BSAC applying rule of thirds for bottom gas and following ADP guidance of safety factor of 1.5 for deco gas (although 2 acceptable). Bottom Gas required = 2563lt x 3/2 = 3844. Divide by 232 to get WC = 16.57lt. Therefore 2 x 10lt would be sufficient. Deco gas required = 773 lt x 1.5 = 1159.5. Divide by 232 to get WC = 5lt. Therefore 7lt 232bar will be sufficient. Note software is configured for a 20lpm RMV.

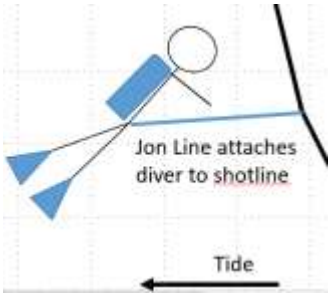
12. ZHL+C – Buhlmann model. Gradient Factors 50/90 drives the software to produce fewer deeper stops and more shallow stops.

EQUIPMENT

13. a) ADUS point cloud rendering of a battleship from internet. Raw data taken from a Multi-beam Sonar system.
b) Photogrammetric model created on FCD Preparation event using free cloud computing software. Raw data is digital camera images.

14. Additional oxygen required = (0.32-0.21)/(0.79)*232=32bar
Air top off is 232-32=200bar of which 0.21 x 200 = 42bar is oxygen.
Check (32+42)/232=0.319 (round up to 32%).
Alternative: 232 Bar 32% contains 68% nitrogen = 158 bar Nitrogen which must come from the compressed air. 158/0.79=200bar. 232-200=32 bar of oxygen.

15.



16. See SITA website for datasheets covering marking and testing. http://www.sita.org.uk/idest/. Visual – every 2.5 years and Hydrostatic 5 years. No legal requirement for colour coding of shoulders on diving cylinders but black and white shoulders encouraged.

17. 0.18* 4.0 = 0.72 bar

18. Be competent and confident to effect the repair. Remove old seal carefully from suit. Dry wrist area thoroughly. Ensure good bonding surface for glue (lightly roughen with sandpaper, degrease). Fit mandrel (e.g. suitable bottle) down arm to support cuff, fit new cuff over other end, prepare and apply contact adhesive, glue cuff to suit, other tape joint.
Newer seals may be of the field replaceable type and easily replaced by clipping in a new spare.

DIVE PLANNING AND TECHNIQUES

19. From Safe Diving: Emergency bailout plans (Technical diving) If a diver loses his travel or decompression gases due to any of a number of reasons (equipment failure, gas loss, etc), the decompression schedule may become very punitive. This is especially true of ineffective off gassing of helium. The decompression schedule would become very long and the diver may not have enough gas to finish the dive or, in Northern European waters, may not be able to cope with the cold conditions. It is vital that bailout gases are available to avoid this situation. All divers must plan decompression schedules to cover all potential gas failure possibilities and how they can set up spare cylinders in case they need them. These include: • Written or pre-programmed decompression schedules for longer bottom time than planned. • Written or pre-programmed decompression schedules if the diver is unable to use travel or decompression gases in case of a gas loss or equipment failure. •Spare decompression gas available to the diver in case of a gas loss or equipment failure. • How the divers would access the spare gas in an emergency (spare cylinders on decompression line or cylinders lowered to divers from diving platform). • Overall duration of emergency decompression considered relative to the expected water temperature. • A diver to surface signalling protocol to facilitate requesting gas or assistance in an emergency.

20. Uncharted rocks will make the skipper nervous about close in manoeuvring. Can be mitigated to some degree by careful manoeuvring and mapping of seabed using sonar and GPS to find safe route. Place datum shot line as visual reference as isolated danger mark not there. Against re-occurrence of fog ensure diver deploy DSMBs at certain time or distance from shot line to enable surface cover can track them. Split the wave so there is more surface cover available (including suited divers). Have boat tender on standby.
Place shot up tide of reef. Instruct divers to head in NE direction to get picked up at other side of reef (shallowest part circle 100m away)

21. 5.5-0.3 or 5.7-0.5m=5.2m, Mean Tidal Range = 5.21-0.76 = 4.45m, As higher tidal range than mean springs expect a higher flow than 0.8m, take ‘slack’ as less than 0.5knots so roughly 4 hrs after HW and 6hrs after HW: 12:36 to 14:36 BST.

22. Collapsible Flag, Torch, Delayed SMB, Brightly Coloured Hood, Strobe

23. Where the buddy is not a rebreather qualified diver then the buddy of a rebreather diver (whether SCR or CCR) should be as a minimum: • For dives to a maximum of 20m a BSAC Ocean Diver with basic nitrox training, the explicit approval of the Diving Officer and on a

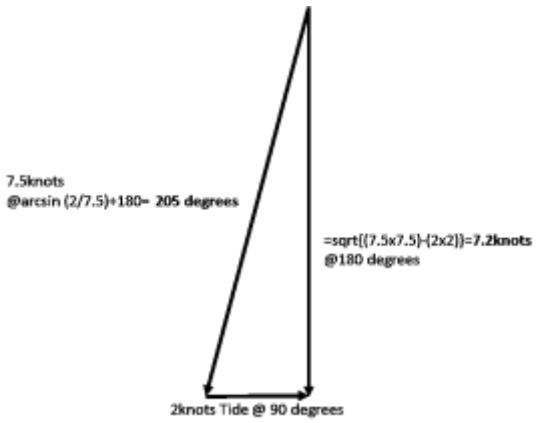
properly managed dive where surface rescue cover is immediately available. Both divers will be limited by the depth and no decompression limits of the Ocean Diver and no training should be allowed. The rebreather diver must be equipped with an alternate source (AS) accessible and usable by the Ocean Diver and consistent with their training.

40 From Safe Diving: • For dives to a maximum depth of 35m a qualified Sports Diver with nitrox training and with their DO's consent…. The DO (or DM acting on behalf of DO) should ensure that the diver who will buddy a rebreather diver is: • Experienced under the current diving conditions (i.e. depth, site and weather) . • Capable of recognising the conditions of hyperoxia, hypoxia and hypercapnia. • Capable of performing a rescue (CBL and surface support) on the rebreather diver in the case of an emergency. • Is using a gas mix appropriate to the intended depth and be suitably equipped. • carrying an independent bailout (i .e . redundant) breathing system . The capacity of this independent system (e .g . pony or twin set) should suit the dive profile of the dive being undertaken . • carrying a DSMB (or SMB as appropriate) and at least one other surface detection aid. The buddy check procedure should be modified to accommodate the rebreather layout and any controls the buddy may need to operate.

24. 4°50'W – (5 x 11') = 3°55'W

WEATHER AND SEAMANSHIP

25.



26. a) Relative bearing is constant between you and the vessel
b) Vessel is constrained by draft so alter course to port and pass the vessel to the stern.

27. Wind veering: The changing of the wind direction clockwise, e.g. SW to W
Sea state Moderate: Wave height of 1.25 to 2.5 m
Wind backing:
The changing of the wind in the opposite direction to veering (anticlockwise), e.g. SE to NE
Visibility Good: Visibility more than 5 nautical miles

28: Southerly/South Westerly; 1024 to 1003 mbar. Weather: rain and showers.

29. East Cardinal Marker: Danger to West. White light 3 quick flash every 10s or 3 very quick flash every 5s. Special marker buoy: Not primarily used to assist in navigation, special buoys indicate special areas or features such as military exercise zones, recreation zones, traffic separators etc. Yellow flashing light in pattern distinct from neighbouring lights.

30. Legal: SOLAS V require you to let the coastguard and other vessels in the vicinity know if you encounter anything that could cause a serious hazard to navigation if it has not already been reported. You can do this by calling the Coastguard on VHF, if you have it on board or by telephone them at the earliest opportunity. The Coastguard will then warn other vessels in the area. Practical: Recover the log to the beach above the HW mark.