

certain proportion of common air, has been known to explode when a naked light has been brought in contact with it: What is the composition of the gas? Where is it found—in bunkers, 'tween decks, pockets, and coal-shoots? How may it be got rid of as soon as it evolves from the coal? How many cubic feet of air to one of the gas forms a violent explosive mixture?

195. A lighted lamp or candle has sometimes been lowered into an apparently empty paraffin-tank and produced an explosion resulting in injury to the person holding the light: what did the tank probably contain, and what produced the explosion?

196. In vessels carrying coal cargoes it has been observed that, generally speaking, the gas which escapes from the body of the coal is found more abundantly in the forward end of the hold than at the after end: why should this be so?

197. In recently opened ballast-tanks, double bottoms, and boilers a light lowered into either has sometimes been extinguished: what would, in all probability, cause this?

198. In double-bottom steamers where does the bilge-water lie, and where are the roses of the bilge-pipes fitted?

199. What is the advantage of a large rose over a small one?

200. Why, especially in vessels carrying cargoes liable to shift, should engine bilge-suctions be fitted to both wings of the bilge?

201. In a heavily listed vessel, why is it difficult to keep steam?

202. If the engine bilge-pumps get choked and water accumulates in the stokehold bilges, what effect does the water have upon the bilge-boards and stokehold-plates when the ship is rolling violently?

203. In a triple-expansion engine what spare gear do you consider necessary in the case of a foreign-going ship? Also, what stores would you provide for a voyage to England?

204. What means are sometimes provided for temporarily coupling together the broken parts of, say, a tunnel-shaft? Describe the fitting.

205. Does the pressure on the thrust collars vary with the horse-power, or with the speed of the ship, or how?

206. If the holding-down bolts of a thrust bearing should become slack, what effect would it have upon the working of the engines?

207. In an engine with three cranks which of the three is subject to the greatest torsional stress (1) in going ahead, (2) in going astern?

208. Is it usual to make the crank-shaft of a triple- or quadruple-expansion engine in one piece? And is the diameter of the shaft uniform from end to end? Give your reasons for the practice which obtains.

209. In a "built" crank-shaft how are the webs rigidly secured to the pins and to the body of shaft?

210. There are various descriptions of donkey-engines in use on board ship for pumping purposes; some pumps are fitted with escape-valves, some are not: why should this be?

211. Explain the functions of an air-vessel fitted to a feed-pump. Make rough hand sketches of (1) a satisfactory vessel, (2) an unsatisfactory vessel, where, say, the air-spring has been destroyed by carelessness, or has never been properly provided.

212. Should cocks or escape-valves be fitted to air-vessels: why, or why not?

213. Where, by preference, should the escape-valve of a feed-pump be placed? Why?

214. Scum-cocks are sometimes fitted to boiler-shells at a height convenient for engineers to manipulate when standing in the stokehold; the scum-pipes in such cases are led upward, inside the boiler, to a little above the combustion-chamber tops: what danger may arise from this arrangement?

215. Cocks for testing the water-level of boilers are sometimes fitted within reach of the engineer who is standing in the stokehold; these may have internal pipes leading upward and terminating at various levels: under what circumstances may these become misleading?

216. Why should the pipe which leads from the bottom of the water-gauge column to the bottom of the boiler-front, or back, be covered with non-conducting material? Why, also, should it never have lengthy horizontal bends?

217. In your own experience, how frequently is this pipe removed and cleared?

218. Why, even with the best of water-gauges, is it advisable to occasionally use the drain-cock?

219. Steam-loops have sometimes been inadvertently made in the length of piping leading from the top of the water-gauge column to the top of the boiler: roughly sketch such a loop, and explain the danger arising from its existence.

220. Describe your method of thoroughly testing the water-gauge system to satisfy yourself that all the cocks and pipes are clear. [Your answer can be written on a supplementary sheet of foolscap, which the Examiner will hand you. Hand-sketches, mere lines indicating pipes and circles indicating cocks, should be made. Identify the cocks and pipes by letters or numerals.]

221. Describe the construction of a water-tube boiler, mentioning the type selected.

222. In a water-tube boiler, how is an economizer fitted, and what is its duty?

223. How is the water-gauge fitted in a water-tube boiler? Are glass gauges used?

224. The pressure of the steam in water-tube boilers is sometimes greater than at the engines: why is this, and what percentage above the engine-pressure does it amount to? How is this difference of pressure maintained?

225. Describe any automatic method of feeding water-tube boilers. Of what materials are the tubes made?

226. Describe the construction of any steam-turbine you are acquainted with which is used on board ship. How is the expansion of steam effected? How many propeller-shafts are employed, and how many propellers?

227. Is the same power in a steam-turbine available to go astern as to go ahead?

228. Of what material are the propellers made in a steam turbine?

229. How many pounds of coal per indicated horse-power per hour are burnt with this type of engine? Name the type of boiler in use.

230. Describe one of the several classes of refrigerating machinery in use on board of ship. Several types exist, one being more economical than the rest: which is it?

231. Describe the defects to which the selected type is subject. How are the defects overcome?

232. How frequently are the parts opened out for examination? Name the parts.

233. How frequently are the condensers of refrigerating plants opened for examination? How frequently are the coils tested by hydraulic pressure? On which side of the coil is corrosion most commonly found? Why should this be so?