

SPECIMEN SET OF EXAMINATION PAPERS FOR EXTRA MASTER.

MATHEMATICS.

Paper 1 (3 hours).

1. A glass tumbler is partly filled with mercury (Sp. G. 13.6) in which is floating a 1 in. diameter sphere of alloy (Sp. G. 7.3). The remaining space is filled with fresh water, when it is found that the mercury occupies half the depth of the tumbler. If the inside diameters, top, and bottom of the tumbler are 3 and 2 in. respectively and the inside depth is 5 in., find the weight of its contents.
2. Two points of land are in transit bearing N. 40° W. from a steamer. On a westerly course the horizontal angle became maximum at 22° at the steamer after making 9.5 miles.
If the two points are 4 miles apart, find the course made good by the steamer.
3. Assuming the identities involving the Sine and Cosine of the half angles, deduce the formula for the solution of a spherical triangle.
$$\frac{\sin a}{\sin A} = \frac{\sin b}{\sin B} = \frac{\sin c}{\sin C}$$
4. Find the correct G.M.T. when the two stars α Ursa Majoris (Dubhe) and ϵ Ursa Majoris (Alioth) are at the same altitude at a position Lat. 60° N. Long. 30° W. on 25th June, 1929.
5. A steamer finds that by increasing her normal speed by 1 knot she can make a 2,640 mile passage in one day less. What is her normal speed?

GENERAL SCIENCE.

Paper 2 (3 hours).

(Only 8 of these Questions to be answered.)

1. A crank 15 in. long is driven by a piston and makes 140 revolutions per minute. Find the acceleration of the piston when it is $3\frac{1}{2}$ in. from the end of its stroke, taking the motion as simple harmonic motion.
2. What do you understand by the term Pressure, and in what units is it measured?
If a diver's tank has a volume of 2 cubic feet and contains air under a pressure of 30 atmospheres, to what extent will the air expand when it is released at a depth of 17 fathoms of water?
3. A load of 8 tons is lifted by a hydraulic press when an effort of 15 lb. is applied on the end of a 14 to 1 lever. Assuming an efficiency of 90 per cent., find the proportion between the diameter of the ram and the plunger.
4. Explain what is meant by the conservation of energy and momentum.
Two equal masses are attached to a rope passing over a light frictionless pulley. One mass is supported by means of a table and the other is raised 30 in. and then allowed to fall freely through that distance.
Find the velocity of the two masses after the rope has become tight.
5. A force of 14 lb. weight is applied at the end of a lever 3 ft. long in order to tighten up a nut on a screw bolt, 1 in. in diameter and with 8 threads to the inch. If the breaking tension of the material of the bolt is 14.4 tons per square inch, show that the bolt will just break.
6. Define the term Centre of Pressure.
Part of the side of a reservoir is a door A, B, C, D. The lower side C, D is horizontal, while the side A, B is hinged so that the door can turn freely. If the lengths of A, B and C, D are 2 ft. and 12 ft. respectively, what force must be exerted at the mid point of C, D in order to keep the door shut when the level of the water is at A, B?
7. A piece of wood weighing 40 lb. and specific gravity 0.75 is tied by a rope to the bottom of a tank of water so as to be totally immersed. What is the tension on the rope?
8. What is the meaning of Dew Point?
Describe some method of determining the Dew Point and show how to obtain the other quantities which are required in order to calculate the humidity of the air.