2. Distinguish between *true solar day*, *mean solar day*, and *sidereal day*. Explain clearly why a sidereal day is always of the same length.

3. What simple method would you adopt of determining the latitude of the place in which you live ?

4. Define a unit of work.

A mass of ' *m* ' pounds falling from rest reaches the ground at the end of two and a half seconds : what is its energy at the moment of impact ?

What kind of energy does such a body possess (*a*) before falling, (*b*) when just reaching the ground ?

5. State the reasons why mercury is so generally used in thermometers.

A thermometer plunged into a hot liquid registers 203° Fahrenheit : what temperature would be indicated by the centigrade scale ?

6. In summer the absolute humidity of the air may be much greater than in winter, and yet the latter season may show a larger rainfall : explain this.

7. Observations taken in the Southern Hemisphere show that on a certain day the readings of the barometer indicate that the atmospheric pressure is greatest towards the N.E. and gradually diminishes towards the S.W. : what deductions can you make as to the direction of the wind ?

8. What causes lead to the production of oceanic circulation ? Account for the current known as the Gulf Stream.

9 Give as many proofs as you can to show that glaciers are in motion. Why are they sometimes called rivers of ice ?

10. What is meant by specific gravity ? The specific gravity of the earth as a whole is considerably greater than that of the rocks forming its crust : can you offer any explanation of this ?

11. An exposure of rock shows a bed of limestone overlaid by beds of shale and sandstone, the sandstone being on the top : classify these rocks, and describe as far as you can the probable conditions under which they were formed.

12. The island of Ascension is a mass of volcanic rock rising out of mid-ocean, yet it possesses a *fauna* and a *flora* : how do you account for this ?

No. 42.—Sound, Light, and Heat.—For Civil Service Junior.

Time allowed : Three hours. [*Candidate may answer questions either in Sound and Light or in Heat, but not in both. All answers should be illustrated, where possible, with diagrams.*]

A.—SOUND AND LIGHT.

1. The velocity of sound in air is largely influenced by the temperature, but not by the pressure of the atmosphere : explain this.

2. What do you understand by wave motion ? Define, by reference to a diagram, the meaning of the terms " wave length," " phase," and " amplitude."

3. Give a short account of the phenomenon known as interference.

4. Describe any method whereby the velocity of light has been accurately determined.

5. State the laws of reflection of light.

Two vertical plane mirrors meet at an angle of 60°, and a luminous point is placed between the mirrors and equidistant from each : construct a diagram showing the number of images of the point which will be formed in each mirror.

6. Define the terms " principal axis," " principal focus," and " focal length " of a concave mirror ; and explain two methods whereby the focal length of a concave spherical mirror can be determined experimentally.

7. What do you understand by a real and a virtual image ? If you wished to demonstrate the existence of virtual images, what apparatus would you employ?

8. How can it be shown that white light is composite in its nature ?

B.—HEAT.

1. Two similar thermometers are exposed to the sun's rays, but the bulb of one of them is wrapped round with a single thickness of flannel: will both thermometers indicate the same temperature ? Give reasons for your answer, and mention any other experiments which support the truth of your statement.

2. How is a common thermometer constructed ? How would you ascertain whether the fixed points upon a mercurial thermometer were correctly placed ?

3. You are told that " two solid bodies have the same mass, and that one is much hotter than the other, but contains far less heat " : explain clearly what this statement means. How would you find out whether the statement is true or not ?

4. What is meant by the coefficient of linear expansion of a substance ? A bar of metal 1 meter long at 0° C. was found to have increased in length by 2 millimeters when the temperature was raised to 97° : what was the coefficient of expansion of the metal ?

5. Define the terms " unit of heat," " specific heat," and " latent heat of fusion." How can it be shown that the latent heat of fusion of ice is smaller than the latent heat of vaporisation of water ?

6. State clearly how you would find the boiling-point of a strong solution of common salt. Give a neat sketch of the apparatus you would employ.

7. Give a short account of the phenomena of ocean currents.