with shoals, until in the reach where Bend is situated, and where the maximum volume has been abstracted for purposes of irrigation, the entire breadth of the Amú Darya is obstructed by a mass of sandbanks intersected by narrow and tortuous channels.

It appears, then, that such information as we have, regarding the change and the existent conditions of the old and new courses of the Amú Darya, presents a picture precisely the converse of that delineated in and quoted from Sir Charles Lyell's work. In lieu of a constant increase to the transporting capacity of the waters of the river, we see that in the Amú Darya such is replaced by a constantly diminishing transporting power, and that the old bed has been filled up and destroyed by the deposition of silt. This deposition of silt and deterioration of the bed can only have been caused by the abstraction of its waters for irrigation. Whether other circumstances assisted the consequent change of the flow of the Amú Darya is a question it is not my purpose to examine in this place. Enough has, I would submit, been adduced to show that the practice of irrigation, as conducted on the banks of the Amú Darya, produces phenomena whose action furnishes a probable explanation of a very curious and interesting geographical problem. HERBERT WOOD

THE PARIS INTERNATIONAL CONGRESS OF GEOGRAPHICAL SCIENCE

THE meeting of the International Congress, of which we published the programme a few months ago (vol. x. p. 267), has been postponed, owing to the large number of demands from foreign parts for room in the Exhibition. It will not take place in the beginning of spring as intended orginally, but will be opened on the 1st of August, perhaps by the President of the Republic, who seems to be deeply interested in the success of the enterprise. It will be held in the Pavillon de Flore. This magnificent building was left unfinished when the Empire was upset, and could not be burned by the Communists, as the woodwork had not been begun. It is now being decorated most tastefully, and will be inaugurated by the Congressionists.

An exhibition will also take place in the Pavillon de Flore and Orangerie situated close to the Place de la Concorde. All the Terrace du Bord de l'Eau, from the Pavillon de Flore to the Orangerie, will form part of the Exhibition. Temporary sheds of every description will be constructed in that splendid situation along the banks of the Seine and under the four rows of lofty trees. The *coup d'œil* will be splendid, and is sure to attract an immense number of spectators. The Exhibition will be opened on the 19th of July, and will last until the 4th of August. A very large number of gentlemen of all countries have been appointed members of the honorary committee. The president of the Congress is M. Delesse, a French engineer in the mining service, and a great geologist. M. Delesse is now the president of the Central Committee of the Geographical Society. Up to the present moment the vice-president has not been elected.

The Exhibition and Congress, as we formerly notified, have been divided into seven different groups: (1) Mathematical; (2) Hydrographical; (3) Physical; (4) Historical; (5) Economical; (6) Didactic; (7) Travels.

A programme of 123 questions has been published, and all these, as far as possible, will be discussed by the members of the Congress. The principal questions will be found in the article referred to.

ON THE ALTERATION OF THE NOTE OF RAILWAY WHISTLES IN TRAINS MEETING EACH OTHER

I AM not aware whether the following explanation of this curious acoustical phenomenon has ever appeared in print; if it has, it will, I think, bear repetition, as offering an interesting illustration of some of the laws of propagation of undulations through aërial media.

If two railway trains meet and pass each other at tolerable speed, and the driver of one of them is sounding his whistle, any person in the other train accustomed to music will notice that the moment the whistle passes him its note will be *lowered in pitch* in a marked degree.

It was at first supposed that, at the time of passing, the driver lowered his whistle intentionally, as a salute to the other train (like "dipping the ensign" at sea), but this was found not to be the fact, the driver himself being unconscious of any change. I believe the true explanation was first given by Mr. Scott Russell, but I do not know when or where.

It is an exactly parallel case to one which has recently attracted attention in astronomy, namely, the evidence afforded by the change in position of certain spectral lines, owing to the vapours which produce them approaching or receding from the observer. The explanation of this will be familiar to most of the readers of NATURE, and I have only to apply it to the case in question.

Every musical note propagates aërial waves succeeding each other with a known rapidity, corresponding to the pitch of the note; the higher the pitch, the greater the rapidity of succession of the waves, and *vice versâ*. Now, when a person advances to meet these waves, more of them will pass him in a given time than if he stood still, on the same principle that if a man meets a file of soldiers on march, more men will pass him per minute than if he were stationary. Thus the apparently increased rapidity of the waves will give him the impression of a *sharper* note.

On the other hand, when the trains have passed each other, the listener will be moving in the same direction as the sound-waves, and consequently a *less* number will pass him in a given time, causing the note to appear *flatter*.

The sum of these effects will be the sudden *drop* of the pitch of the note at the moment the listener passes the whistle.

We may reduce the effect to numerical calculation, premising that, in order to simplify the reasoning, we will suppose the source of the sound to be stationary, and the observer to move towards it with a given velocity.

Let n = number of sound-waves propagated by the given note per second; and let n_1 = the number which the listener will gain by his advance in the same time, which is the number he would pass *by his own proper motion* if the waves were standing still.

Then the effective number of waves per second which will meet his ear will be $= n + n_1$, this number determining the pitch of the note he hears. This may be called (by an astronomical analogy) the *apparent* pitch, as distinguished from the *true* pitch.

To find the value of n_1, let L = the *length* of the sound-wave $\left(= \frac{V}{n}\right.$ where V = velocity of sound in feet per second). Then, if v = velocity of motion of the listener he would pass, by his own proper motion, $\frac{v}{L}$ waves per second; whence $n_1 = \frac{v}{L} = \frac{nv}{V}$.

Hence the apparent pitch of the note is what will correspond to the number of vibrations

$$= n + \frac{nv}{V} = n\left(1 + \frac{v}{V}\right).$$

But we may simplify this by applying the harmonic principle, that a musical interval is measured by the ratio of the vibration numbers of its higher and lower limiting sounds. Let therefore δ = the interval between the real and the apparent sound; then

$$\delta = \frac{n\left(1 + \frac{v}{V}\right)}{n}$$

or $$\delta = 1 + \frac{v}{V} \quad \text{or} \quad = \frac{V+v}{V}$$

A very simple formula, in which the original number of waves disappears, showing that the interval between the two notes is irrespective of the original pitch of the whistle, and depends only on the velocity with which the listener approaches the source of the sound.

We have now to take the case where the listener, having passed the whistle, is receding from the source of sound. The note will then appear flatter than the real one, and its vibration number will be found by the same rule as before, merely giving v a minus sign.

$$= n\left(1 - \frac{v}{V}\right)$$

And the *interval*, i.e., the ratio of the vibrations of the higher to that of the lower, denoted by δ_1 will be

$$\delta_1 = \frac{n}{n\left(1 - \frac{v}{V}\right)} = \frac{V}{V-v}$$

These two intervals added together will express the *drop* of pitch of the whistle at the time of passing.

But to add intervals together we must multiply their ratios; hence if δ_2 represent the drop,

$$\delta_2 = \frac{V+v}{V-v}$$

from which the drop of the whistle corresponding to any speed may be found.

To simplify the reasoning, we have supposed the whistle to be stationary and the listener to move with a velocity $= v$. If both move, as is the usual case in railway trains meeting, v must be made = the sum of the speed of the two.

Taking $V = 1120$ feet per second for ordinary conditions, the following table shows the value of the *drop* for different speeds:—

Conjoint speed of the two meeting trains.		Corresponding drop of the note of the whistle.
Miles per hour.	Feet per second.	
24 ...	34 ...	A semitone $\left(\frac{16}{15}\right)$
45 ...	66 ...	A whole tone $\left(\frac{9}{8}\right)$
70 ...	102 ...	A minor third $\left(\frac{6}{5}\right)$
85 ...	125 ...	A major third $\left(\frac{5}{4}\right)$
108 ...	160 ...	A fourth $\left(\frac{4}{3}\right)$
152 ...	224 ...	A fifth $\left(\frac{3}{2}\right)$

I have made observations whenever I have had the opportunity, and find the results corroborate the deductions of theory. The most common interval observed in ordinary travelling is about a third, major or minor, corresponding to a speed of between thirty-five and forty miles per hour for each train.

W. POLE

GLASGOW SCIENCE LECTURES

UNDER the title of the Glasgow Science Lectures Association, an organisation has lately been formed in Glasgow, whose object is to provide annual courses of lectures on various branches of science by men of eminence in each department, so as to place in clear and comprehensive outlines the most important results of scientific inquiry before the public of Glasgow, and at such a rate as will secure to those who cannot otherwise obtain it the best information on the state of science, as established by the most recent investigations of its most distinguished workers. The scheme originated amongst a number of working men who were desirous of following the example of the science lecture movement which has been so successfully worked out in Manchester during the last six or seven years, but with this difference, namely, that the lectures should be self-supporting. To accomplish that end, and be in a position to pay the lecturers liberally for their services, they at once saw that the minimum rate of admission could not well be fixed at less than threepence, and they confidently believed that many of their fellows would be most willing to pay that amount for the privilege which it was proposed to place within their reach. They soon enlisted the sympathies and active co-operation of persons in a higher social sphere, and in due time the Association took active shape. A large executive committee was constituted, and Dr. Allen Thomson, F.R.S., one of the most distinguished members of the professorial staff of the University of Glasgow, cheerfully accepted the honorary presidentship of the Association, while a number of other prominent citizens were enrolled in the list of vice-presidents.

Owing to the fact that Prof. Roscoe had been the moving spirit of the Manchester Science Lectures for the People, he was very early communicated with, in the confident hope that valuable advice based upon his practical experience would readily be placed at the service of the originators of the Glasgow lecture scheme. They were not disappointed in their expectations, and, indeed, had they been lacking in enthusiasm and determination to make the scheme a success, they would have been stimulated to action by the various communications which they received from that gentleman.

It was very late in the past year before the Glasgow Science Lectures Association was sufficiently well organised to make any public announcement of its existence; but the active promoters of the movement were most anxious not to allow the whole winter to pass without having some lectures delivered under the auspices of the Association, no matter how short the course might be. Prof. Roscoe most kindly and cheerfully consented to take part in the first or introductory course; and considering that gentleman's peculiar relationship to the Manchester Science Lectures, the committee came to the conclusion that no person could more appropriately assist at the public inauguration of the movement in Glasgow. Accordingly, with his consent, Prof. Roscoe was set down to deliver the opening lecture of the introductory course, and other three distinguished men of science were selected to follow him, namely, Sir William Thomson, Dr. W. B. Carpenter, and Prof. W. C. Williamson, of Owens College, Manchester.

The inaugural lecture was delivered on the evening of Friday, the 8th of January, and it was in every sense a most auspicious beginning. The Glasgow City Hall was chosen as the place for the delivery of the lectures, as the committee were desirous of bringing together the largest audiences that could be convened in any place of public meeting. It holds well-nigh three thousand persons, and on the occasion in question it was crowded. The reception given to the eminent lecturer was most enthusiastic. Dr. Thomson occupied the chair, and in introducing Prof. Roscoe to the meeting and formally opening the first course of lectures, he delivered an exceedingly valuable address, in the course of which he justified the formation of such associations as the one under whose auspices the lectures were to be given. He said that he had no doubt that in the selection of the lecturers the committee of the