

Entropy and the arrow of time

(session 1 of 3)

Learning outcomes: 1. The concept of order and disorder
2. Nature tends towards increasing disorder

	Subject	Description	Resource	Time
1	Introduction	Split the kids in pairs and ask them what is disorder. Can they write a definition of it? (<u>TIP for teachers</u> : a practical useful definition in physics might be: “ <i>disorder is the lack of any correlation or symmetry in the system</i> ”)	Sheets of paper	5’
2	Discussion	Pick up some definitions and discuss them with the kids.	Whiteboard	10’
3	Activity	• Push away all the chairs/desks and group the kids in the centre of the room. • Throw a balloon in the air and ask them to hit it every time they can. • After a few minutes, the balloon will still be roughly in the centre. Point out that they have used a lot of energy but in a disorderly manner, without achieving a net result. • Compare that with a video of a grain of dust in water (Brownian motion). The grain moves about in a disordered manner, always remaining roughly in the same place. • Later, ask them to do the same thing, but always hit the balloon in the same direction. This is an ordered action, with a net result (balloon to one side of the room)	A balloon and a video	20’
4	Video	Slow-motion movie of glass shattering . Same video played backwards. Discuss how time always travels in a direction where disorder increases.	Video	10’
5	Discussion	Can the kids provide examples of an ordered system evolving into a disordered one? And vice versa? Point out that ordering always requires an external effort (tidying up your room!)	Whiteboard	10’
6	Conclusion	Wrap-up focussing on what they have learnt. Namely: 1. Concept of order and disorder 2. Nature likes disorder! 3. Time flows in a direction of increasing disorder.	Whiteboard	5’