

## Handout Optic

### Part 1: Properties of Light

Part 1 is designed as a shared work experience. That is why there are file cards here with work instructions on them. The evidence of the experiments can be collected in a worksheet at the end to the area, properties of light.

#### Card 1

Introduction: History “The people of Schilder build a city hall“

The children walk into a dark room with a can and try to catch light. The can is then opened in a darkroom.

**M1: You can't catch light. Without light it is dark.**

#### Card 2

The darkroom is opened very slowly – outlines, shadows and then colours.

**M2: At first you can only see outlines, then shadows and with more light colours.**

#### Card 3

Experiment with a flashlight, a hose and a spray bottle. When can you see light?

**M3: Light is only visible when it strikes something: e.g. water drops, dust particles, objects...**

#### Card 4

Experiment with flashlight and flexible hose. When is the flashlight switched on?

**M4: Light can only shine straightforward.**

#### Card 5

Put the candle in the darkroom, wind screen with a hole pattern. How do the light rays look?

**(M4: Light can only shine straightforward.)**

#### Card 6

Building of a pinhole camera

**(M4: Light can only shine straightforward.)**

## Part 2: Light and colour

The second part is developed as a series of experiments. There are ten experiments, that are described on the file cards. On the back of the file cards are the solutions or explanations.

The results can be recorded on a worksheet to the area Light and colour.

Part 1: surface – and luminous colour

### **Experiment 1a**

Mixing surface colours (mixing of two colours)

### **Experiment 1b**

Mixing surface colours (mixing of three colours)

**M1: The more surface colours are mixed, the darker the colour gets.**

### **Experiment 2**

Mixing luminous colours – 3 light beamers are mixed

### **Experiment 3a**

Changing of the luminous colours through coloured plastic layers – shoebox, lid with coloured plastic layers, fruits.

**M3: When using the coloured plastic sheets there are three possibilities:**

- a. The colour stays the same or might even get stronger
- b. The colour changes
- c. There is no more colour visible, the object nearly seems black.

### **Experiment 3b**

Disk game – 3 students put on the coloured glasses and search in a box for a specific colour of disks.

**Explanation similar to M3.**

### **Experiment 3c**

Secret language – students read a prepared secret language and then create one themselves.

**Explanation similar to M3.**

Part 2: White light consists of many colours.

### **Experiment 4a**

Generating rainbows with a flashlight and a glass of water.

**M4: The white light (sunlight) consists of 6 (or rather 7) spectral colours: red, orange, yellow, green, blue, violet. When the white light is broken the single colours are visible in the colours of the rainbow.**

### **Experiment 4b**

Glasses with spectral plastic sheets.

**Explanation similar to M4.**

### **Experiment 4c**

Making soap bubbles.

**Explanation similar to M4.**

### **Experiment 5**

Building a spinning top and turning it fast.

**Addition – M5: Through the fast spinning movement is the human eye not able to see the colours individually. The colours mix and (nearly) seem white.**

### Part 3: Light and shadow

The third part is developed as a series of experiments. There are five experiments that are described on the file cards. On the back of the file cards are the solutions or explanations. The results can be recorded on a worksheet to the area Light and shadows.

#### **Experiment 1**

Migrating shadows – Changing the direction of shadows with a flashlight.

**M1:** The shadow always originates behind the spot that is being shined at with the flashlight.

#### **Experiment 2**

Objects of shadows – observing different objects as shadow outlines.

**M2:** There are only outlines visible, not concrete objects.

#### **Experiment 3**

Shadows change – Through the change of the distance of the flashlight to the object the shadow can change its size.

**M3:** The shadow gets bigger and less clear when the light source is close to the object. When the light source is farther away, then the shadow gets smaller.

#### **Experiment 4**

2 shadows – making shadows with two light sources.

**Addition – M4:** Every light source has its own shadow. If there is an overlap of shadows from two light sources then the dark area is called umbra shadow and the light area is called penumbra shadow or half shade.

#### **Experiment 5**

Colourful shadows – Making shadows with coloured light beamers

**Addition – M5: Colourful shadows can be developed with two colourful light sources. In the area of the umbra shadow the combination colour of both light colours emerges.**