Experimental Tools

“PHYSICS IS EVERYWHERE; FIND WHY AND HOW HERE”

Art of Physics Education（AoPE)

Many of you are eager to know what tools are needed for our experiments. We would like to tell you more than just the mechanics part right now so that you can plan for everything ahead of time.

We often use easy-to-find household materials in our experiments so that students can make connections with real-life applications and appreciate that physics is everywhere.

For some experiments in our Optics or Electromagnetism courses, we highly recommend the following affordable and integrated experimental tool kits, because many of those devices are not easy to find in our houses or expensive to buy individually.

E&M:

https://www.amazon.com/dp/B0953X8911/ (This is a new one, it even has an electroscope. I like this one.).
https://a.co/d/0kvaa4n
https://a.co/d/4fPIZSb This one is cheaper and includes most stuff we need

You can also get the following cheap multimeter as an additional item. It is handy and can be used to measure many things. If you design your own circuit, it can be useful.
https://a.co/d/gXFIglW

Optics:

https://a.co/d/hJMUxer (New in 2023. This one is enough. If it is not available, you can choose the following)

https://a.co/d/9u0I0Mx (out of stock since 09/2021)
https://a.co/d/6tbU6Sb These are useful and available in 2022. But we need the unique line-shaped light sources shown in the previous link.
https://a.co/d/cQFHVAX This one has most of the related tools for optics.

You can also consider a more comprehensive kit including **Optics, E&M, Mechanics, and thermodynamics** from China. Less than $70 (420 RMB) for all. This is the brand and store that we have tried. It is the same brand as the one offered on Amazon. (See the net page)

https://detail.tmall.com/item.htm?id=610825851655&skuId=5106761503078

You can join the WeChat Experimental tool group to pair up for affordable international shipping. Around 5 USD per kg and, maybe 60 USD for the full set. (1-2 months). When you buy them, please tell the seller that this is for international shipping so they can remove a couple of potentially trouble-some items like batteries in advance.

We didn't find the Amazon version for the mechanics set. For our Mechanics course, this brand of tool kit can still be useful but not that important. More than half of our mechanics experiments are using household materials and don't rely on those tools. Also, we will teach you how to build a balance on your own to understand the concept (not for accuracy). We also teach you how to make a pulley, etc. With the convenient tool kit, you may save some time. For thermodynamics, you need to get a thermometer ranging from -20 Celsius to 110 Celsius. Other things needed in our thermodynamics part can be found in a typical home. For mechanics, the set is recommended but not required.

Given this information, we hope that you can decide whether you want to purchase the full set and deal with international shipping or skip the mechanics set and get the Amazon ones on your own.

For thermodynamics, you just need 1 or 2 thermometers. One can measure up to 100 degrees C. One can measure as low as negative 20 degrees C. For example,
https://www.amazon.com/Midwest-Homebrewing-Winemaking-Supplies-DP-1K55-796C/dp/B0064O97V
https://www.amazon.com/DOQAUS-Thermometer-Upgraded-Instant-Reversible/dp/B08RWPPD8J/
The glass one helps the kids to understand the physics behind it. The digital one covers a large range and is not easy to break.

We use a lot of household items for thermodynamics experiments as listed below.

Supplies for Thermodynamics Experiments

Week	lesson	New supply list
01	T01A	Thermometers (liquid thermometers are preferred)
02	T01B	● Bottle (not easy to be damaged by hot water) and cap, straw, air-tight glue, hot water, and cold water ● (a ping pong ball, boiling water) or (balloon, hot water, ice cubes or ice water, freezer)
03	T01C	Hot water and ice water
04	T01D	Saucepan and stove
05	T02A	Paper, candles, support such as cups and metal grid, water or hot water
06	T02B	various items that may contain liquid water or foods of different hardness (A little bit of everything may be enough.), such as tap water, hot water, concentrated or diluted sugar water or beverages, concentrated or diluted saltwater, water mixed with ink, tofu, banana, toothpaste, mixed liquid seasonings, chewing gum, raw eggs, marshmallows, chocolate, air balloons, water balloons, etc.
07	T02C	● a transparent bottle (soft, easy to squeeze) ● Matches or something else can generate smoke
08	T02D	milk, sugar, flavor, Ice, salt
09	T03A	Ice, metal block, woodblock
10	T03B	white cloth, black cloth, ice
11	T03C	Ice, metal block, woodblock, a few food labels/nutrition facts
12	T03D	No new item is needed.
13	T04A	a cup with a smooth edge, a piece of flat cardboard or plastic sheet not much bigger than the cup, regular water, or drinks.
14	T04B	Straw, a plastic bottle with a cap, and a pair of small scissors Orange, small tube, stick
15	T04C	a soap bar or marshmallow in the microwave oven
16	T04D	No New item is needed
17	T05	Overall review