

## سؤالات مسابقه بين المللی فیزیکدانان نوجوان IYPT 2016

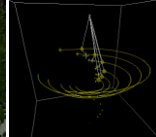
توجه: ۳ جایزه ویژه به برترین حل سوالات ستاره دار که به ترتیب لبه\*\*\* و \*\*\* و \*\* مشخص شده اند ( به هر سوال یک جایزه)

۱. خودتان اختراع کنید



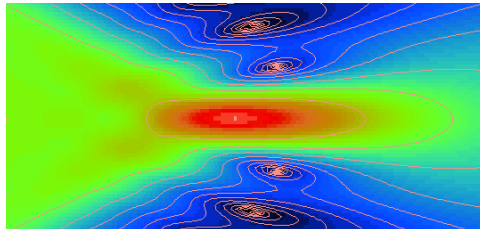
اعداد کاملاً تصادفی واقعاً منبعی بسیار ارزشمند و نادر هستند برای تولید اعداد تصادفی یک وسیله ی مکانیکی طراحی، ساخته و آزمایش کنید. تحلیل کنید که میزان تصادفی بودن تا چه میزانی در برابر اعداد دستکاری شده قابل اطمینان است.

۲. آونگ عقب مانده



آونگی از یک ریسمان محکم و یک وزنه تشکیل شده است. هنگامی که محور آونگ حول یک محیط افقی شروع به چرخش می کند تحت شرایط مشخصی وزنه شروع به ترسیم دایره ای می کند که شعاع کمتری دارد. حرکت آونگ و مدار (مسیر) پایدار وزنه را بررسی کنید.

۳. عدسی صوتی\*\*\*



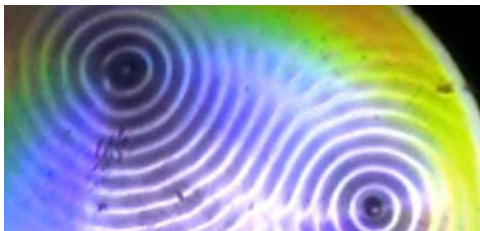
عدسی های فرنل با حلقه های هم مرکز در ابزارهای نوری کاربرد گسترده ای دارند؛ اما دستورالعمل یکسانی برای متمرکز کردن امواج صوتی وجود دارد. یک عدسی صوتی طراحی و تولید کرده و خصوصياتی مثل میزان تقویت در آن را به عنوان تابعی از پارامترهای وابسته بررسی کنید.

۴. شیطونک



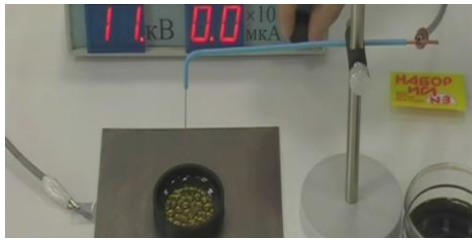
یک توپ با قابلیت کشسانی بالا را در داخل فضای بین دو صفحه پرتاب کنید. توپ شروع به جهیدن می کند و تحت شرایط خاصی می تواند حتی به سمت شما به عقب بجهد. حرکت توپ و متغیرهایی از جمله جهت گیری صفحات را که روی این حرکت مؤثرند ، بررسی کنید.

۵. آب فوق آبگریز



یک ظرف پر از آب صابون را روی یک بلندگو یا هر ویبراتور دیگری قرار دهید. در هنگام نوسان قطرات کوچکی روی سطح آب برای مدت زمان طولانی می ماند. این پدیده را بررسی کنید و شرح دهید.

۶. برق لانه زنبوری



یک سوزن فولادی را به صورت عمودی بالای یک صفحه فلزی افقی قرار دهید. مقداری روغن روی صفحه بریزید. با ایجاد اختلاف پتانسیل ثابت بالا بین سوزن و صفحه روی سطح روغن ساختاری سلولی پدید می آید. این پدیده را بررسی کنید و شرح دهید.

#### ۷. فواره آب داغ



قسمتی از یک پیپت Mohr را با آب داغ پر کنید. با انگشت شست خود قسمت بالایی پیپت را بپوشانید. پیپت را به سمت بالا برگردانید و فواره ای که از نوک آن خارج می شود را مشاهده کنید. پارامترهایی که در ارتفاع فواره تأثیر گذارند را بررسی کرده و برای رسیدن به بیشترین ارتفاع این پارامترها را بهینه کنید.

#### ۸. قطار مغناطیسی



آهنرباهای کوچک (نانو مغنت ها) به دو سر یک باطری استوانه ای کوچک متصل شده اند. هنگامی که این مجموعه را داخل یک سیم پیچ مسی قرار می دهیم طوری که آهنرباها با سیم پیچ در تماس باشند، قطار شروع به حرکت می کند. این پدیده را توضیح دهید و بررسی کنید چگونه پارامترهای وابسته بر سرعت و قدرت قطار تأثیر می گذارند.

#### ۹. امواج آبی



با یک استوانه افقی که به طور عمودی نوسان می کند، امواج آبی تولید کنید. وقتی فرکانس و/یا دامنه ی نوسان تغییر می کند، به نظر می رسد آب از استوانه دور و یا به آن نزدیک می شود. این پدیده را بررسی کنید.

#### ۱۰. حلقه های نوری

یک جت مایع را روی یک سطح بریزید. اگر نقطه تماس با نور لیزر روشن شود، حلقه های نوری اطراف جت مشاهده می شود (شکل را ببینید). حلقه های نوری را بررسی کنید و تعیین کنید این حلقه ها چه رابطه ای با پارامترهای وابسته در کل سیستم دارند.

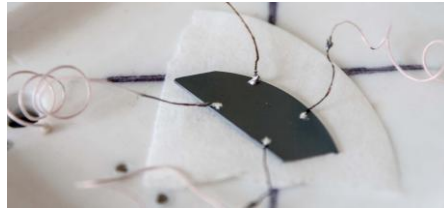


#### ۱۱. غلطیدن روی دیسک



اگر یک جسم غلطان سبک (مانند یک حلقه، یک دیسک یا یک کره) را روی یک دیسک چرخان افقی قرار دهید، بدون پرتاب شدن به بیرون دیسک، شروع به حرکت کند. توضیح دهید که چگونه انواع مختلف حرکت به پارامترهای وابسته را بررسی کنید.

#### ۱۲. روش Van der Pauw



مشخص شده است که رسانایی یک ماده تا هنگامی که یک لبه دارد (بدون حفره) مستقل از شکل نمونه اندازه گیری می باشد. این روش تا چه محدوده ای می تواند بکار رود؟ اگر نمونه دارای حفره باشد این اندازه گیری ها را بررسی کنید و توضیح دهید.

#### ۱۳. گیره کاغذی



چند برگ دو کتاب مشابه با جلد کاغذی را لای برگ های همدیگر قرار دهید دو کتاب را به یکدیگر فشار دهید. این دو کتاب را از قسمت شیرازه نگه داشته و سعی کنید آنها را از هم جدا کنید. پارامترهایی را که در جدا کردن کتاب ها از یکدیگر مزاحمت و یا محدودیت ایجاد می کنند را بررسی کنید.

#### ۱۴. شعله ی حساس

یک گاز اشتعال پذیر (مانند پروپان) به طور عمودی از یک نازل ریز به خارج جریان می یابد و از یک توری ظریف فلزی به فاصله تقریبی ۵ سانتیمتری می گذرد. گاز آتش زده می شود و بالای توری شعله ای ایجاد می کند تحت شرایطی، این شعله نسبت به صدا حساسیت نشان می دهد. این پدیده و پارامترهای وابسته به آن را بررسی کنید.

#### ۱۵. کولیس غیر تماسی\*\*\*



یک وسیله نوری اختراع کنید و بسازید که با استفاده از یک لیزر پویینتر بدون تماس، ضخامت، ضریب شکست و خواص دیگر یک ورقه شیشه ای را اندازه بگیرد.

#### ۱۶. گردابه های Frisbee

وقتی قسمتی از یک صفحه عمودی در داخل آب فرو رود و در جهت عمود بر صفحه کشیده شود، روی سطح آب یک جفت گردابه تشکیل می شود. تحت شرایط معینی، این گردابه ها در امتداد سطح مسیر طولانی را طی می کنند. پارامترهایی را که بر حرکت و پایداری این گردابه ها تاثیر می گذارند، بررسی کنید.

#### ۱۷. چمدان دیوانه\*\*\*

هنگامی که چمدان دو چرخ را می کشید، تحت شرایطی به این طرف و آن طرف تلو تلو می خورد تا حدی که واژگون شود. این پدیده را بررسی کنید. آیا با تغییر در بسته بندی بار، این اثر را می توان متوقف یا تشدید کرد؟

## Kit : Ilya Martchenko

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