

PHYSICS 1 2020 - NECTA FORM FOUR

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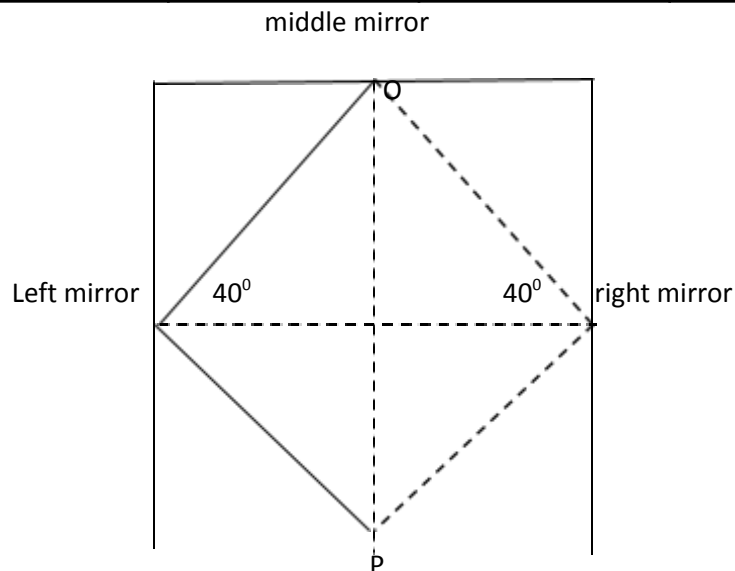
1.

i	ii	iii	iv	v	Vi	vii	viii	ix	x
C	C	B	A	C	D	C	B	C	B

2.

i	ii	lii	iv	v
D	F	E	B	C

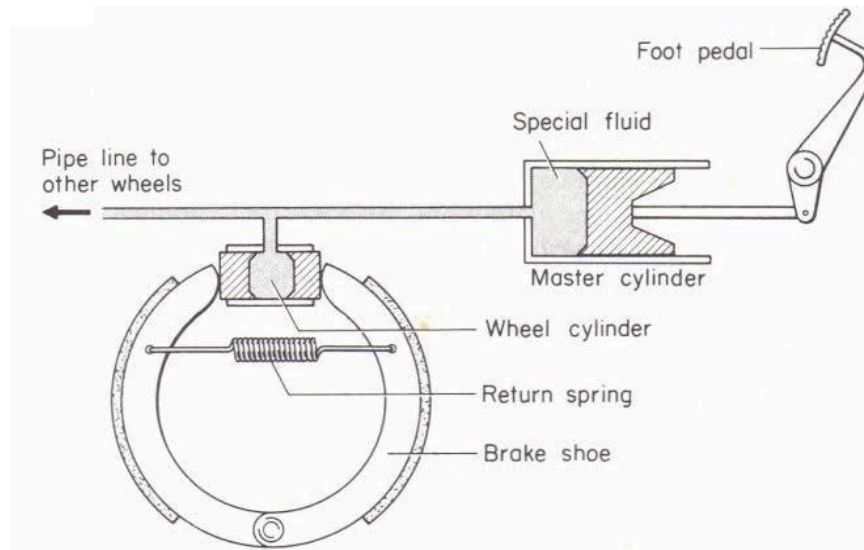
3. (a)



(b) (i) The shutter acts as a gate in a camera

(ii) It controls the duration of time that light is allowed to pass through the lens and fall on the film.

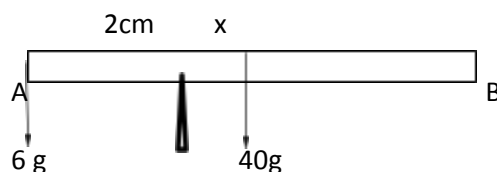
4.(a) Consider the diagram of hydraulic braking system.



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When a force is applied to the brake pedal, it pushes the piston in the master cylinder forward creating the pressure in the brake fluid. This pressure is transferred to the slave cylinder and multiplied, it pushes the brake shoe against the brake drum that is attached to the wheel of a vehicle, friction between the brake shoe and the brake drum slows down the wheel's rotation hence the vehicle stops.

b) Consider a uniform pencil AB



Sum of clockwise moment = sum of an-clockwise moment

$$40g \times x \times 10N/Kg = 60g \times 2cm \times 10N/Kg$$

$$40X = 120cm$$

Divide both sides by 40

$$X = 3cm \text{ A half of a pencil AB} = 3cm + 2cm = 5cm \text{ So, Full length of a pencil AB} = (5cm \times 2) = 10cm$$

5(a) The recoil velocity of a gun is much less than velocity of bullet simply because, the gun has greater mass than bullet, since the linear momentum is directly proportional to the mass and its velocity.

(b) Data Given

Diameter of larger cylinder(D) =8x

Diameter of small cylinder(d) =x

$$\text{Then, } V.R = D^2/d^2 = (8x)^2/x^2$$

$$V.R = 64.$$

$$\text{Efficiency} = 80 \%$$

$$V.R = 64$$

But ,

$$\text{efficiency} = MA/VR \times 100\%$$

$$90\% = MA/64 \times 100$$

$$M.A = 57.6$$

6.(a) The black color being a better absorber of heat, hence bulb Q gets more heated faster than P due to heat radiated by the heater, this resulting in the expansion of air inside bulb Q. The expanded air requires more space and thus pushes water towards X. Hence, the level of water in Y falls while that in X rises.

(b) The newly constructed Tanzania Standard gauge rails expand during days, hence rails gap become smaller due to expansion, while standard gauge rails contracts during winter days, hence rails gap become wider due to contraction.

7.(a) When the bulb C blows off and the key is closed, only the bulb A and B will give out light, while the bulb D will not give out light.

(b) It possible for a radioactive element to emit beta particles (electrons) from its nucleus, since it occurs when the ratio of neutrons to protons in the nucleus is too high. An excess neutron transforms into a proton and an electron. The proton stays in the nucleus and the electron is ejected energetically. The nucleus ejects the beta particle and some gamma radiation.

8.(a) Speed of light wave= $3 \times 10^8 \text{m/s}$

$$\text{Periodic time (T)} = (1.4\text{s} - 0.6) = 0.8\text{s}$$

$$\text{Since, frequency} = 1/T = 1/0.8 = 1.25$$

$$\text{but } v = f \times \text{wavelength}$$

$$300000000 = 1.25 \times \text{wavelength.}$$

Wavelength = 240000000 m

(b) Earthquake occurs when rocks at a fault line slip or break, and two sections of Earth's crust physically move relative to one another. That movement releases energy, and two types of seismic waves radiate outward from the earthquake through Earth's interior and along its surface.

9.(a) Piano wire can be tuned to emit a note of the same frequency as a vibrating tuning fork in the following ways; -

(i) Frequency is inversely proportional to the length of the wire

- The length of the wire should be adjusted so as to produce an appropriate frequency.

(ii) Tension (T) of the wire: The frequency of wire is directly proportional to the square root of tension.

- Tension of the wire should be adjusted to produce appropriate frequency

(iii) Linear density of the wire (Mass per unit area)

- The linear density of the wire should be adjusted to produce the same frequency as tuning fork, since the frequency is inversely proportional to the square root of linear density of a wire.

(b) Given that

Resistance of galvanometer $R_g = 20\Omega$

Electric current of Ammeter $I_A = 15\text{mA}$ Electric current of a galvanometer $I_g = 10\text{mA}$

from: The converting the reading coil Galvanometer into Ammeter reading the resistance of high resistance (Shunt resistance (R_S)) should be connected in parallel with a galvanometer.

then,

$$I_A = I_g + I_S$$

$$15\text{mA} = 10\text{mA} + I_S$$

$$I_S = 5\text{mA}$$

But also potential difference across galvanometer (V_g) = Potential difference across shunt resistance (V_S)

$$V_g = I_g R_g$$

$$V_s = I_s R_s$$

$$I_s R_s = I_g R_g$$

$$5\text{mA} \times R_s = 10\text{mA} \times 20\ \Omega$$

$$5R_s = 200$$

$$R_s = 40\Omega$$

Therefore, in order to design galvanometer to register 10mA full scale deflection, A resistance of 40 Ω should be connected in parallel to the galvanometer.

10.(a)

Conductor There is no forbidden gap.

Semi-Conductor There is small forbidden gap

Insulator

There is large forbidden gap.

(b) (i) Current at x

From: When resistor connected in parallel current flowing in the circuit is different but while voltage is the same

Total current = Current passing in X + Current passing at 4?

$$5.2\text{A} = x + 3.2$$

$$x = 5.2\text{A} - 3.2\text{A} = 2$$

Therefore, current at x = 2.0A

But, Point at x and point at r are in series, hence current is the same

Therefore, current at r = 2.0A

But voltage at r and voltage at 4? is the same

$$V = IR$$

$$V = 3.2 \times 4 = 12.8V$$

Therefore, voltage at r is 12.8

$$12.8 = 2 \times r$$

$2r = 12.8$, divide by 2 both sides

$$r = 6.4?$$

hence, value of r is 6.4?

(c) Effective resistance = Total resistance in the circuit.

For parallel connection, $1/R = 1/R_1 + 1/R_2$

$$R = (4 + 6.4) \div 25.6$$

Hence, effective resistance is 2.46 ohms.

11. (a) Intrinsic semiconductor

Is semiconductor which is pure enough such that the impurities in it do not significantly affect its electrical behavior

- The conductivity of intrinsic semiconductor increases with increase in temperature
- In low temperature the valency band is completely full, making the material an insulator

(b) Most transistor in use is n-p-n because the majority charge carriers are electrons which move faster than holes.

(c) The students in the next class can hear the shouting due to the Diffraction of the sound.