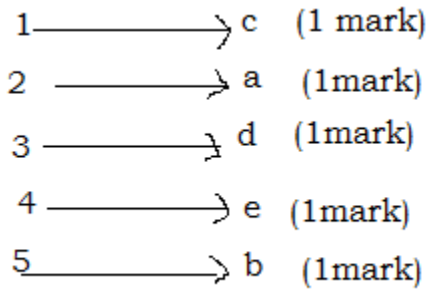
KIREHE PHYSICS MARKING GUIDE FOR SENIOR FOUR SECOND TERM EXAM 2022-2023

(For questions of more than one steps, marks are subdivided to each step but if a candidate get the final answer which is correct, he/she deserve his/her total marks of the question or sub-question)

1.

Physical quantity	Category
Energy	Scalar (1mark)
Linear momentum	Vector (1mark)
Pressure	Scalar (**1mark)**

2.



3. a) (iii) / 1mark b) (iv) / 1mark c) (iii) /2marks
4. data mass =2250kg velocity 25m/s
   momentum(p) =?

   $p = m \times v$ /**1mark**

   $p = 2250 \times 25 = 5.6 \times 10^4 kgm/s$ one mark for substitution and one mark for true answer with correct unit / **2marks**
5. a) Degradation of energy is the transformation of energy into some form in which it is less available for doing work **(1mark)**

   b)In a hydropower plant, water is usually reserved in constructions like a dam and it has potential energy **(1mark).** This is converted into kinetic energy **(1mark)** and the turbine of the hydropower plant converts the kinetic energy of falling water into mechanical energy **(1mark)** because water hits its blades and causing it to spin, then the generator converts the mechanical energy

from the turbine into electrical energy **(1mark)**

6. a) (i) Fossil fuel is a fuel formed by natural processes such as anaerobic decomposition of buried dead organisms (plants and animals) produced over a long time period (**1mark)**

(ii)Renewable energy is energy that is collected from renewable resources which are naturally replenished on a human timescale such as sunlight, wind, tides etc. **(1mark)**

b) (i)Peat **(1mark)**

Methane gas **(1mark)**

Petroleum **(**or petrol, paraffin, diesel oil, oil

(ii)Sunlight**,** Hydropower plant**, Biomass (1mark),**

Biogas**,** Geothermal energy**(1mark)**

7. a) It is used to examine small objects that naked eye cannot see**(1mark)** such microbes etc.
   b) (i)The myopia is eye defect or the vision condition in which people can see close objects clearly but objects farther away appear blurred **(1mark)**
   (ii)The use concave lens /diverging lens with suitable focal length **(1mark)**

8. Momentum (**1mark)** ii)Impulse **(1mark)** iii)Torque**(1mark)**
9. a) The answer is **(ii)** because for a compound microscope the objective has short focal length than eye piece. **(1mark)**
   b) The answer is **(ii)** so that final image be formed at the least distance of distinct vision D from the eye **(1mark)**
   c) Differences between compound microscope and astronomical telescope **(1mark)2 =2marks**

Compound microscope	Astronomical telescope
In normal adjustment, the final image is at near point.	The final image is at infinity
The objective lens has a short focal length.	The objective has a long focal length.
The object is near (it is used to view near and small objects)	The object is at infinity (used to see distant objects).
The distance between the objective lens and eye piece is greater than $f_o + f_e$.	Distance between the objective and the eye piece is $f_o + f_e$.

10. i)Critical angle is the angle of incidence in denser medium for which its refracted angle in rarer medium is 90^0 **(1mark)**

    ii) Total internal reflection is the coming back of light ray in the incidence medium when the angle of incidence become greater than critical angle for a given medium. **(1mark)**

    b) Conditions for total internal reflection are:

    -light comes from denser to rarer medium **(1mark)**

    - The angle of incidence must be greater than critical angle. **(1mark)**

11. mass =800kg $vi = 20m/s$ $vf = 30m/s$

    formula $\Delta k.e = \frac{m(v_f^2 - v_i^2)}{2}$ **(1mark)**

    $\Delta k.e = \frac{800(30^2 - 20^2)}{2} = 2\times10^5\ j$ **(1mark)**

12. focal length $f = 50cm$ $V = 2u$ **(0.5mark)**

    formula $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ **(0.5mark)** $\frac{1}{50cm} = \frac{1}{u} + \frac{1}{2u}$ **(0.5mark)** $u = 75cm$ **(0.5mark)**

    so $v = 75cm \times 2 = 150cm$ **(1mark)**

13. a i) the phenomenon is **reflection** **(2mark)**

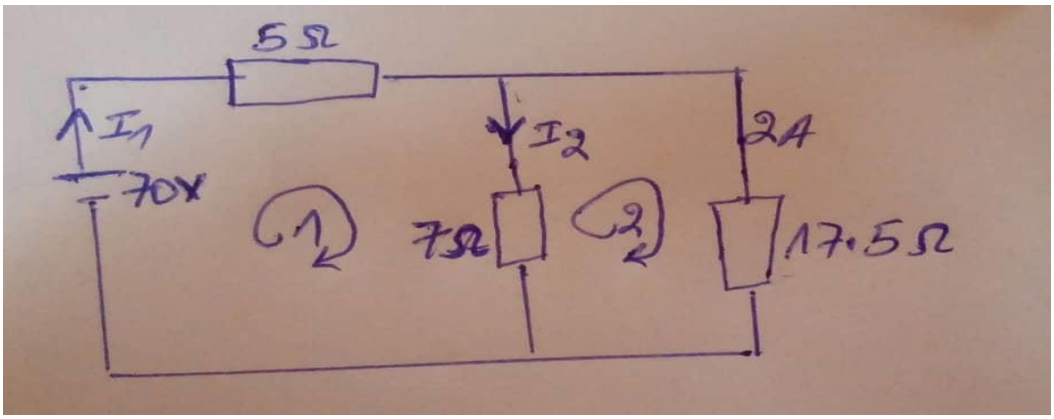
    ii) because the image formed by mirror is virtual **(1mark)**

14. a)momentum $p = mv$ **(0.5mark)** $v = at$ **(0.5mark)**

$m = \frac{p}{at} = \frac{800}{2.4\times12} = 27.77kg$ **(1mark)**

b) $f = ma = 27.77\times2.4 = 66.6N$ **(1mark)**

15.



Using loop rule **junction rule** $I_1 = I_2 + 2A$ **(1mark)**

$5I_1 + 7I_2 = 70v$ Eq (1) **(1mark)**

$7I_2 + 17.5 \times 2 = 0$ Eq (2) **(1mark)**

From Eq (2) $7I_2 = -35$ $I_2 = -5A$ **(1mark)**

Replace value of I_2 in eq (1) $I_1 = 7A$ **(1mark)**

SECTON B

16.a)(i)Electromotive force is energy per unit electric charge that is imparted by an energy source**(1mark)** such as electric generator

Or the work done on a unit of electric charge or the energy

thereby gained per unit electric charge

(ii)Resistance of the conductor is the opposition to the flow of

electrical current through a conductor**(1mark)**

You can also accept the potential difference across the

conductor divided by the electric current through it

b)(i)The 2 Ω and 4 Ω resistors are in series

$R_1 = 2\Omega + 4\ \Omega$

$= 6\ \Omega$**(1mark)**

The 3 Ω, 6Ω and 1 Ω resistors are in series

$R_2 = 3\ \Omega + 6\Omega + 1\Omega$

$= 10\Omega$**(1mark)**

The resistors having the resistances R_1 and R_2 are in parallel

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}$$

$$\frac{1}{R}=\frac{1}{10}+\frac{1}{6}=\frac{3+5}{30}=\frac{8}{30}$$

The equivalent resistance R =3.75Ω **(1mark)**

(ii)The internal resistance E=(R+r)I **(1 mark)**

$$r=\frac{E}{I}-R$$

$$r=\frac{6}{1.5}\Omega-3.75\Omega=0.25\Omega$$ **(1mark)**

(iii)The terminal voltage V=RI **(1mark)**

=1.5 Ax3.75 Ω=5.625V **(1mark)**

(iv)Ammeter **(1mark)**

(v)The reading is I=1.5 A **(1mark)**

(vi) 1)the current $I_1=\frac{V}{R_1}$ **(1mark)**

$$I_1=\frac{5.625}{6}A=0.9375A$$ **(1 mark)**

2) The current $I_2=\frac{V}{R_2}$ **(1mark)**

$$I_2=\frac{5.625}{10}A=0.5625A$$ **(1mark)**

17. a) Chromatic aberration **(1mark)** spherical aberration**(1mark)**

coma, astigmatism, barrel distortion, pincushion distortion

b) (i)Image position $\frac{1}{P'}=\frac{1}{f}-\frac{1}{p}$ **(1mark)**

$\frac{1}{P'}=\frac{1}{35}-\frac{1}{25}=-\frac{10}{875}$, p'=-87.5 cm **(1mark)**

(ii)the size of the image $\frac{h_i}{h_o} = -\frac{p'}{p}$ **(1mark)**

$$h_i = -(7cmx\frac{-87.5}{25}) = 24.5cm \textbf{ (1mark)}$$

(iii)Properties of the image

Image is virtual **(1mark)** p' is negative

Image is erect (upright) **(1mark)** h_i is positive

Image is magnified h_i is greater than h_o

c) (i)The process of splitting of white light into seven colours by prism **(1mark)**

(ii)1. The angle of refraction on AB

1xsin20˚ =1.6 sinr **(1mark)**

r=12.3˚**(1mark)**

2. The angle of incidence on AC

A=r+r' **(1mark)**

r'=40˚-12.3˚ =27.7˚(**1mark)**

3. The angle of emergence

1.6xsin27.7˚=1xsini' **(1mark)**

i'=48˚**(1mark)**

18.a)(i)Stable equilibrium **(1mark)**

Unstable equilibrium **(1mark)**

Neutral equilibrium **(1mark)**

(ii)Net force is equal to zero **(1mark)** or

$\sum F_{ext} = 0$ Algebraic sum of x and y components of the

external forces applied to the object must be equal to 0

respectively.

Net torque is equal to zero **(1mark)**

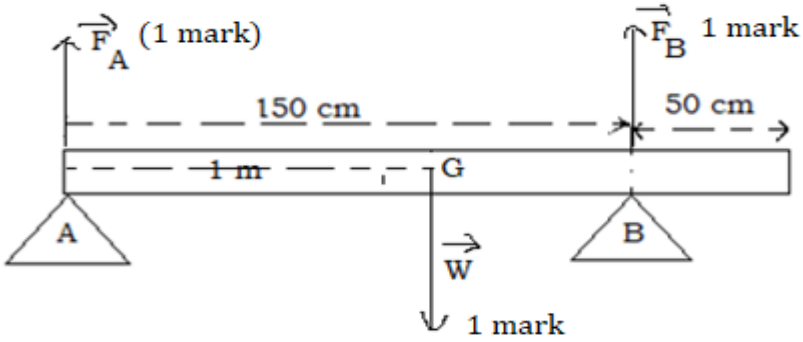
$\sum \tau = 0$ .The algebraic sum of the clockwise torques is equal

to the algebraic sum of the counterclockwise torques.

b) (i)Centre of gravity **(2marks)**

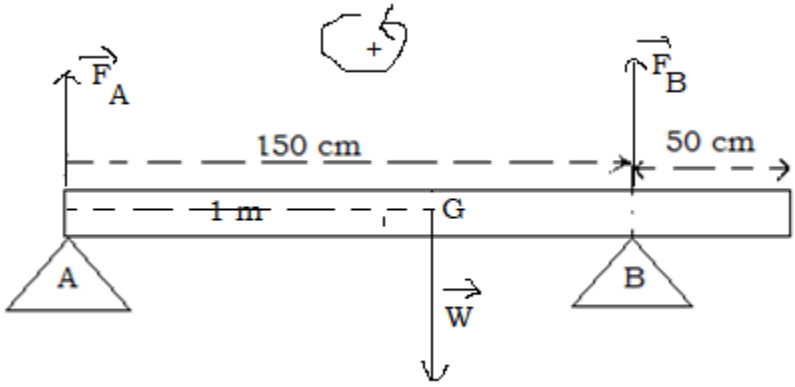
(ii)1m from the extremity A of the board **(1marks)**

(iii)Direction of forces



(iv)Torque is positive in anticlockwise direction and the reference

point is the support A



Torque of the support force $\vec{F}_A$ with respect to point A

$$\tau_A = 0 x F_A = 0$$

Torque of the support force $\vec{F}_B$ with respect to point A

$\tau_B = 1.5x F_B$ **(1 mark)**

Torque of the weight $\vec{W}$ with respect to point A

$\tau_w = -1x240Nm = -240Nm$ **(1 mark)**

$\sum \tau = 0$

1.5 F_B-240=0

F_B= 240N/1.5=160 N **(1mark)**

$\sum F = 0$

F_A+F_B-240N =0

F_A =240-160N=80N **(1mark)**

19. a) The period $T = \frac{2\pi R}{v}$ **(1mark)**

$$T = \frac{2\pi x5cm}{200\pi cm/60s} = 3s$$ **(2mark)**

b)(i)The speed of the car v=36 000 m/3600 s **(1mark)**

V=10 m/s **(1mark)**

(ii)The centripetal force $F = m\frac{v^2}{R}$ **(1mark)**

$$F = 2000\frac{10^2}{50}N = 4000N$$ **(2mark)**

c) (i)The time to reach the maximum height(Vy=0) **(1mark)**

0= -9.81 t+20 sin 25° **(1mark)**

$$t = \frac{8.46}{9.81}s = 0.86s$$ **(1mark)**

(ii)The maximum height $h = -\frac{1}{2}gt^2 + (v_0 \sin\theta)t$ **(1mark)**

$$h = -\frac{1}{2}x9.81m/s^2 x(0.86s)^2 + 20m/sx0.0.423x0.86s = 3.65s$$ **(2mark)**

(iii) The flight time of the object is t'=2t

=0.86 s x2= 1.72 s **(1mark)**

Or $-\frac{1}{2}x9.81xt'^2 + 20x0.423t' = 0$

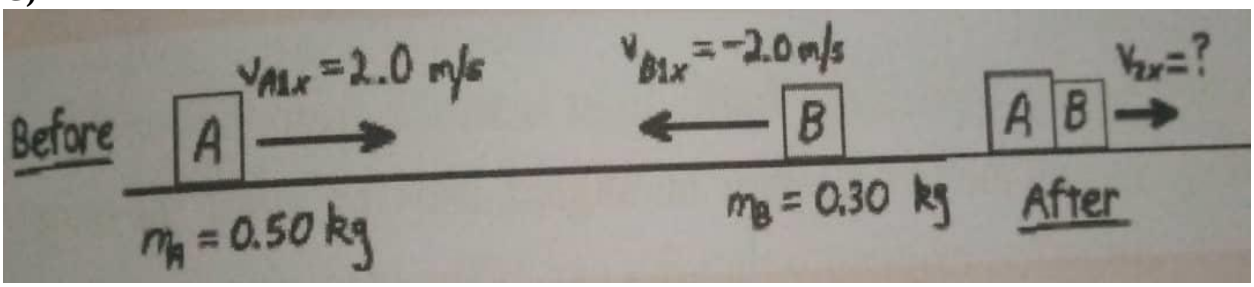
$$t'(-\frac{1}{2}x9.81xt'+20x0.423) = 0$$

20. a) Collision is an impact or contact between two or more particles (objects) that come together or close to each other, and exchange or transfer energy. **(2mark)**

b) An elastic collision between two objects is one in which total kinetic energy **(1mark)** (as well as total momentum) is the same before and after the collision **(1mark)**

An inelastic collision is one in which total kinetic energy **(1mark)** is not the same before and after the collision (even though momentum is constant). **(1mark)**

C)



i) Type of collision described below **is inelastic collision (1mark)**

ii) 1.from the conservation of the x-component of momentum

$m_A v_B + m_B v_B = (m_A + m_B)v_2 x$ **(1mark)**

$$v_2 x = \frac{m_A v_A + m_B v_B}{m_A + m_B} \quad \textbf{(1mark)}$$

$$v_2 x = \frac{(0.5)(2) + (0.3)(-2)}{0.5 + 0.3} = 0.5 m/s \quad \textbf{(2mark)}$$

The commun velocity is positive, the girders move together to the right (in the x-direction)

2. Before collision the kinetic energies of the griders A and B are:

$$K_A = \frac{1}{2} m_A v_{Ax}^2 = \frac{1}{2}(0.5)(2)^2 = 1j \quad \textbf{(1mark)}$$

$K_B = \frac{1}{2} m_B v_{Bx}^2 = \frac{1}{2}(0.3)(-2)^2 = 0.6\,j$ **(1mark)**

The total kinetic energies before collision is $K_A + K_B = 1J + 0.6J = 1.6J$ **(1mark)**

3. The kinetic energy after collision is

$K_{AB} = \frac{1}{2}(m_A + m_B)v_{2x}^2$ **(1mark)**

$= \frac{1}{2}(0.5 + 0.3)(0.5)^2 = 0.2\,j$ **(1mark)**