

MODIFICATION/DESIGNING**F4 CHAPTER 2: FORCES AND MOTION I**

1. Suggest the suitable cloth, equipment and techniques to improve long jumper athlete and their safety.

suggestion	Explanation
Use tight and light suit	Less air friction
Use spikes shoes	Better grip support while running and prevent slippery
Landing on sandy ground	Increase time of impact during landing , reduce impulsive force and prevent injury
The athlete has to sprint before jumping	Can increase kinetic energy
Athlete has to bend the body during fall	Increase the time impact , reduce impulsive force

2. Explain the simple characteristic of a rocket that can travels with greater acceleration.

Suggestions	Explanations
Choose metal with high strength and hardness	Even under pressure the shape will not change/break easily
Frame of rocket is made of low density metal	Lighter, can accelerate faster.
Multistage rocket invented	Each stage has burning fuel, pump and combustion chamber. It will slip off when fuel of each chamber completely burn. When the mass decreases, the acceleration increases
Rocket need to carry a tank of oxygen	To enable the combustion of fuel in space
Silver color rocket	Reflect light efficiently so the temperature of the rocket will not rise easily
Cover the body of rocket with heat insulator	Friction between air and the body will increase heat. The insulator will reduce heat conductivity
Aerodynamic shape	Reduce air friction, move faster

3. Suggest and explain the build of water bottle rocket in school competition to move higher altitude and has longer time in the air.

Suggestions	Explanations
The body of rocket must be tough	Do not break easily under high pressure and when landing
Smaller mass	Rocket will accelerate faster
The shape is streamline/aerodynamic	Reduce air resistance
Nose cone or bullet shape on top of body	To improve the aerodynamic of rocket
45° angle of launching	The rocket can travel maximum distance
The volume of water is half or 1/3 from the whole volume	Not too heavy so as to increase the momentum and the impulsive force
Attach 3 or 4 fins at the tail of rocket and space out equally	Rocket will move smoothly and stable with no tumble.
Attach parachute	will make the rocket floating and has longer time on the air before landing//decrease the speed of falling due to air resistance

4. Give suggestions to improve the design of a jet engine so that it can be used for larger airplane at the higher speed.

Suggestions	Explanations
Increase more fuel injectors	More fuel to be burnt to produce greater thrust/force
Increase the size of the combustion chamber	More space for fuel to burnt to produce high pressure gas
Decrease the diameter of the nozzle	Exhaust gas can be ejected at higher speed
Increase number of blades	Can draw in more air into the engine
Blade and engine make of strong materials	Can withstand strong pressure and will not easily break

5. Base on the physic principle, suggest the design of roller skate track so it can be used to oscillate skate continuously.

Suggestions	Explanations
Semicircular curve shape track	Exchange between kinetic energy and gravitational potential energy can happen easily
Smooth surface	Reduce frictional force/easy to slide
The slope slightly increase and decrease	Easy to oscillates cause by smooth changing of energy
Use strong material such concrete of foundation of the track	Withstand high impact as large force produce due to jumping and landing of skate
Soft layer at the surface of concrete	Reduce impulsive force when landing, low risk if accident

6. Explain the most suitable design of motorcycle that can move fast, safe and save time in racing.

Suggestions	Explanations
Lower height of seat	Lower center of gravity, more stable and safer during turning.
Bigger width tires	Bigger surface area, better support, low pressure acts on the tyres and more friction when breaking.
Less thread pattern of tires	Increase the surface area in contact with the road for better gripping
Smaller mass	Light, small inertia so motorcycle can moves faster
With anti-braking system (ABS)	Prevent locking and skidding of wheels

7. Suggest the suitable cloth and the best techniques to catch ball to prevent injury for goalkeeper.

Suggestion	Explanations
Wear glove	Reduce pain and protect player's hands when catching the ball
Use soft material for glove	Lengthen the time impact, reduce impulsive force.
Wear cloth which made from high specific heat capacity material	To reduce heat lose and maintain the body temperature of player.
Base of shoes has stud	The stud will sink into ground and give good gripping without slipping.
When catching the ball, the goal keeper should move his hand backwards	This action is to lengthen the time of impact between ball and hand, so to reduce the impulsive force.
The ball should have enough air pressure inside	Shorten the time of impact between the foot and the ball, to increase the impulsive force then the ball can move in high speed and travel further distance.

8. Using physics concept, suggest and explain suitable athlete's attires, running, jumping, landing techniques and other aspects to help the long jumper can jump further.

Suggestion	Explanation
Use tight and light suit	Less air friction
Use spike shoes	Better grip support while running and prevent slippery
The athlete have to sprint before jump	Can increase the kinetic energy//momentum
The athlete have to push the body forward while jumping	Increase the elastic potential energy//able to increase longer distance of jumping
Athlete have to bent the body during landing	Increase the time of impact, reduce impulsive force, less injured

9. Safety feature in car

Characteristic	Explanation
The bumper of car is prone to crash	To increase the time of impact, reduce the impulsive force
The sitting space of the passenger is reinforced	To protect the passenger
Use safety belt	During collision, safety belt will hold the passengers from been thrown forward due to inertia
Use air bag	Will inflate when accident occurs, protect the driver from hitting onto steering
Antilock breaking system(ABS)	Prevent locking of wheels and prevent car from skidding
Strong steel struts	Give good protection from side on collision
Tires with tread	Good gripping between tires and the road and prevent skidding of car.

10. Explain the design of and how kayak which can travel faster and safer.

Suggestion	Explanation
Streamline /aerodynamic shape of body	Reduce water resistant and the kayak can move faster
Smooth surface body /coated with wax	Reduce friction of body in water
Low density material	Light , easier to float, easy to carry and sail faster
Strong material body and peddle	Everlasting , not easily break
Wider peddle surface	Greater force because more water are peddled up
Wear safety jacket	Passenger can float in water.

11. Give suggestion to design a sail boat which can travel faster and smooth.

Suggestion	Explanation
Streamline /aerodynamic shape of board	Reduce water and air resistance, so the boat can move faster
Smooth surface board/coated with wax	Reduce friction in water
Installed keel below the boat	The boat will not easily over turn
Low density material of sail	Light, easier to float and sail faster
Strong material of sail	Withstand strong wind, not easily damage
Wider sail	To increase the surface area and produce larger force

12. Suggest how to increase the safety for motorbike racer to reduce injuries / accident

Suggestion	Explanation
Wear helmet	To protect the head on collision.
Use helmet with hard outer casing and soft inner liner	Helmet reduce head injuries in a crash by spreading the impact with hard outer casing and absorb energy with soft inner linear of Styrofoam
Use safety jacket	To protect the biker from injuries , cut ,burn during impact
Use gloves	To protect the hand
Use padded leathers suit	Will soften any impact and protect the skin from abrasion

13. Explain how you would design the pile driving system. The ram hammer is lifted to a height by the crane and allowed to fall on the pile.

Modification	Reason
Large hammer weight	To produce large momentum when it hits onto the pile
Ram hammer made from hard material such as alloys	Not easily break/last longer
Hammer raised at higher position	Increase the gravitational potential energy thus increase the momentum upon impact
Stronger End of the top of the concrete pile	To avoid breaking at the top of the concrete pile by the hammer
Sharp End of the bottom of the concrete pile	To increase the pressure and easily for the pile to penetrate into the ground

14. Explain the suitable loaded lorry which can carry liquid, such as petrol

Suggestion	Explanation
The load of lorry should be divided into many smaller tanks	To reduce effect of inertia
Make tanks of shining or silver colour	Not easily heated up
Far gap distance between tractor and trailer	Provide space and easier for turning of the tractor.
Use more tires	Pressure will be distributed to all tires, able to carry more loads. Lower pressure better support and more stable.
Small belting/chain touching on road at behind of lorry	To discharge electrostatic charge and prevent sparks that might ignite the petrol
Use antilock breaking system (ABS)	The lorry can stop easily without skidding

15. Diagram shows a rolling-down giant ball used in an extreme sport challenge.



Explain how you would design the rolling-down giant ball to make the ball safer and long lasting.

Suggestion	Explanation
Use rough sponged outer surface.	To prevent slippery and have good gripping on ground.
The ball make of elastic material.	Can go back to its original shape in a very short time.
The ball make of water proof material.	Does not absorb water and become heavy.
The ball make good insulator material.	Does not easily heated up.
Make of high strength material.	Not easily break and last longer.
Has small entrance.	Prevent participants been thrown out.
Has soft inner surface.	Act as a cushion and prevent injury on the participants.

F4 CHAPTER 2: GRAVITATION

16. Properties of Earth Imaging Satellite

Properties	Reasons
1. Elliptical shape orbit.	1. Satellite can travels over a specific region for a longer time and out of contact for a short time when it is zipping around the other side of the Earth.
2. Low altitude.	2. Can capture very detailed and clearer pictures.
3. Short orbital period.(T < 24 hours.)	3. Revolving the Earth many times in 24 hours hence pictures of different regions can be captured in a day.

17. Properties of Communication Satellite

Properties	Reasons
1. Circular orbit.	1. The circular orbit implies a constant satellite velocity and satellite is always at a specific a fixed position on the surface of the Earth.
2. High altitude.	2. Revolves at a speed which match the rotation of the Earth .
3. Period of 24 hours.	3. So they seem stationary, relative to the Earth's surface. This allows the satellites to observe and collect information continuously over specific areas.

F4 CHAPTER : Heat

18. Most suitable design of thermometer to use in Antarctica

Suggestion	Explanation
Use alcohol as liquid – in glass thermometer	Freezing point of alcohol is -115°C .So , it will not freeze at low temperature
Use thin wall of bulb	Easily flow of heat in and out thus thermal equilibrium achieves in a very short time, the thermometer becomes more sensitive.
Use small diameter of capillary tube	Alcohol can expand at higher rate for the small change in temperature and becomes more sensitive.
Use thick glass wall for stem	No easily break
Use round glass stem	Can act as magnifying glass , so the alcohol level can be clearly seen and read

19. Most suitable design of clinical thermometer

Suggestion	Explanation
Use mercury	Easy to read because it is opaque
The scale range from 35°C to 42°C	Suitable to measure human body temperature
Small diameter of capillary tube// extra fine bore tube	Mercury can expand at high rate for a small change in temperature
Use thin glass wall of bulb	Sensitive to the change of temperature
Use round glass stem and wall	Can act as magnifying glass. So, mercury can be seen Clearly

Capillary tube with kink	To stop the mercury level from falling on its own and allows the user to note the reading when the thermometer is taken out.
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20. Explain the design and the characteristics of the cooking pan

Suggestion	Explanation
Base is made of a good heat conductor	Will be heated quickly and save energy
High density of base	Heavier base make the pot stable and not topple easily
Body is made of low specific heat capacity material	Easily get heated up.
Handle is made of high specific heat capacity material	Not easily heated up.
Choose low density material for handle	Does not add extra weight on the pan
Transparent pot cover with a release hole.	Able to see the food and the cover will trap the heat so foods can be cooked in a shorter time and the hole is to release high air pressure

21. Suggest and explain the design of water heater to boil a large quantity of water faster ,efficient and safely

Suggestion	Explanation
Use high resistant wire as heating element	High resistant to produce more heat
Heating element in the form of coils	Longer wire, increase the resistance to produce more heat
High melting point	Not easy to melt at high temperature
Lower rate of rusting	Does not get rust easily
Use thermostat	When temperature reaches 100°C, the water heater will automatically turn off

22. Determine the modification to be made for container, so fruits can be kept cool, remain fresh and easily seen by customers.

Suggestion	Explanation
Use container with high specific heat capacity	Able to slow down the loss of heat from the container
Place small ice packet below the bottom of the cut fruits	Ice absorb a large quantity of latent heat when melt, so fruits will be chilled and remain fresh
Add salt to the packet of ice	Salt will lower the freezing point of ice, so this will slow down the melting of ice
White surface colour of container	Can reduce the absorption of heat from the surrounding
The container has double wall	Reduce heat transfers from surrounding into the container. The air inside the container remains cool
Transparent wall of container	Customers can see and choose the fruits easily

23. Investigate the most suitable liquid that can be used as coolant for car radiator using physics concept.

Suggestion	Explanation
Low freezing point liquid	Will not freeze easily during winter
High boiling point liquid	Does not easily boil
High specific heat capacity liquid	Can transfer large quantity of heat with a small rise in temperature. Able to cool down the engine more efficiently
Low ability to react with metal	Does not corrode the radiator.

24. Most suitable thermometer for laboratory to measure temperature of ice and boiling point of water

Suggestion	Explanation
Size of the bulb is small	Does not need a lot of heat to heat up the mercury, increase the sensitivity of thermometer
Use thin wall of bulb	Heat can transfer easily and thermal equilibrium achieves in a short time
Use mercury	Freezing point of mercury is -39°C and boiling point is 357°C . So mercury thermometer is suitable to measure temperature for ice and boiling water. Furthermore Mercury does not stick to glass wall.
Narrow capillary tube	The thermometer is more sensitive

Thick and round glass stem	Act as a magnifying glass for easy reading of scale
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25. Modified and explain the design of an efficient solar water-heating system on the roof.

Suggestion	Explanation
Long metal Pipe	Longer metal pipe has greater surface area which can absorb more heat
Use metal pipe	Metal is good heat conductor, the pipe will be heated up faster
Use insulator plate beneath the absorber panel	Act as Insulator to prevent heat loss
Use black absorber panel	Black is a good heat absorber
Cover the top of the panel with glass	To trap heat energy

26. Design a solar reflector that can boil 500ml water in short time.

Suggestion	Explanation
Use concave shape as solar reflector	Will reflect and focus all heat to a focal point
Shinning or silver colour surface solar reflector	Good heat reflector
Water is filled in a metal container	Metal is a good heat conductor and water will be heated up faster
Use black surface container	Can absorb more heat
The container is placed at the focal point of the reflector	Heat energy is focused to the focal point.

27. Suggest the design of heating system in the house and characteristics of heating agent. The house used central heating system with boiler, radiator and pipelines.

Suggestion	Explanation
Use strong material for the piping	Not easily break
Use metal pipe	Good heat conductor and Increase the rate of heat transfer
Use long pipe in the form of coils	Large surface area and more heat is transferred
Use high boiling point liquid	Liquid will not evaporate easily
Low rate of rusting pipe	Last longer, not easily rust
Big size of radiator fan	Can blow and warm up air in a larger area

28. Suggest the characteristics of material to build food container which can keep the food warm.

Suggestion	Explanation
Food container should made of low density material	Light , easily handle and able to be carry from one place to another.
High melting point container	To prevent the container from melting under high temperature
High specific heat capacity of material for container	Less heat lost and able to keep the temperature of foods
Low thermal conductivity of material	The outside of the container will not get hot thus easily to handle by hand
Double wall	To reduce heat loss.

29. Explain the characteristic and design of thermos flasks to maintain hot water.

Suggestion	Explanation
Use hollow plastic stopper	Air acts as a layer of insulator. So reduce heat loss through the stopper.
Vacuum space between walls	Prevent heat loss through conduction and convection
Has double walls	Able to create a space for vacuum between walls
Walls coated with shiny paint	Reduce heat through radiation
Double walls made of glass	Glass is bad conductor, will reduce heat loss.

30. Explain the design of radiator of the car and characteristic of cooling agent which can absorb heat at short time,

Suggestion	Explanation
Use cap of radiator with valve	To release the high pressure built up in the radiator when temperature is too high

Increase the number of fin blades	To increase the surface area for more heat lost
Use larger fan	Draw in more air through the fin thus increase to cooling effect
Use cooling agent liquid with high boiling point	It won't easily boil and evaporate in high temperature
Use cooling agent liquid with higher specific heat capacity	Able to absorb large amount of heat

31. Explain the use of suitable materials and design to improve the ventilation of a house and to ensure the temperature inside the house is not high.

Suggestion	Explanation
Build more windows for the house	To allow more cool air to enter the house
Size of window must be large	To allow more cool air to enter the house
Wall is made of high specific heat capacity material	Wall is not easily heated up
Roof is made of high specific heat capacity material	Roof is not easily heated up
Put a layer of insulator sheet below the roof	To block heat from transferring into the house
Has holes on the upper part of wall	Allow hot air to flow out
House is painted with light colour paint	Light colour is a poor heat absorber

32. Diagram 9.2 shows an aluminium pail filled with some ice cubes is used to cool the canned drinks.



Suggest and explain how to produce a portable container that is able to cool canned drinks in a shorter time and to ensure the canned drinks remain cold for a longer period.

Suggestion	Reason
Add more ice	Large mass of ice can absorb more heat from the drinks.
Container made of heat insulator / polystyrene	To reduce heat absorbed from the surrounding.
Container made of substance with high specific heat capacity	Heated up slower
Use white container	Do not absorb heat // Absorb less heat
Low density of container	Lighter and easily handle.
Cover the container // lid	Reduce heat absorbed through radiation // To reduce heat absorbed from the surrounding.

33. Diagram shows a two-door refrigerator for household use.



Using the knowledge about heat flows, explain the modification needed to produce a refrigerator which is constantly cold, energy saving and lasting for the purpose of keeping the freshness of the food stored in it.

Characteristics	Reason
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<i>The deck is made of plastic</i>	<i>Does not rust and long lasting</i>
<i>Use LED lamp or lamp of low power and just light when the door is open</i>	<i>Does not heat up the refrigerator inside due to the lamp of bulb</i>
<i>Use high power of refrigerator</i>	<i>The refrigerator will be more cold to keep the freshness of food stored</i>
<i>The freezer must be installed at the highest part inside the refrigerator</i>	<i>The cool air has higher density will move down to cool the lower part of food and thus causes the air circulation. Hot air at lower part will move up and cooled down by the freezer.</i>
<i>The specific heat capacity of the cover of refrigerator must be high.</i>	<i>Slower conducting the heat outside into the refrigerator.</i>

34. An earth-monitoring satellite falls into the earth's atmosphere at a high velocity and reaches a high temperature. This is caused by the earth's gravitational force and air resistance. Using the appropriate physics concepts, suggest and explain suitable designs or ways to protect the satellite and its equipment:

Suggestion	Explanation
Aerodynamic shape	To reduce air resistance
Covered with heat shield material or insulator	To protect the capsule from high temperature
High melting point	Do not melt easily
Landing in water with air bag	Increase time of impact and easily float in water
Light material // small mass // low density	-Reduce the inertia // -reduce the momentum // reduce the impulse
Have parachute // Retro rocket	To reduce the speed and reduce the momentum on landing
Hard material // stiff composite	Not easy crush upon impact

35. Designing a cooling pad that can lower down fever fast and convenient to use.



Design	Explanation
Use high specific heat capacity of coolant.	Can absorb more heat.
High melting point of coolant.	Not easily melt.
Use hydrogel type of coolant.	Provide moisture and does not dry the skin in contact.
Low density material of coolant.	Light, easily handle and portable.
Strong protective film.	The pad will not easily break.

F4 CHAPTER 5: WAVE

36. To build a beach

Suggestion	Explanation
Chose bay area	Calmer waves due to refraction which diverge waves away from bay area
High retaining walls	Prevent over flow during high tide and reduce the direct impact of the waves on the shore
Build concrete wall	To reduce the erosion

Concrete barrier structure with a gap	Waves pass through the gap will be diffracted and reduce the waves amplitude
Concrete barrier to form shallower water	To reduce the speed of waves
Plant more trees around the beach	To reduce erosion
Uneven surface of retaining wall	To absorb waves energy and reduce reflection of waves

37. Explain the designing or modification in building a quality concert hall.

Suggestion	Explanation
Cover the hard wall with soft board or thick curtain	To absorb sound waves and reduce the reflection of sound
Fixed two loud speakers at the front corners of the hall	More audient can hear loud sound
Fixed two speakers at higher position	No obstacle to block the sound waves
Cover the floor with carpet	To absorb sound waves and reduce the reflection of sound
Thick concrete wall for the hall	To produce a sound proof hall that reduce the disturbance from external noise.
Uneven surface of ceiling	To absorb sound waves and reduce the reflection of sound

38. Explain the characteristics of satellite communication signals receiving system.

Suggestion	Explanation
Concave parabolic shape of disc	To focus the receiving wave signals to a focal point
Large diameter of disc	To receive and reflect more waves signal
Place a receiver at the focal point of the concave disc	To collect maximum signals
Place parabolic disc higher from the ground	To reduce the blocking of incoming signals by obstacles
Smooth surface of the disc	For good reflection of wave signals
Position the disc to a specific satellite	To receive the highest wave signals from the satellite

39. Diagram shows a communication system involved in transmitting information between two distance locations.

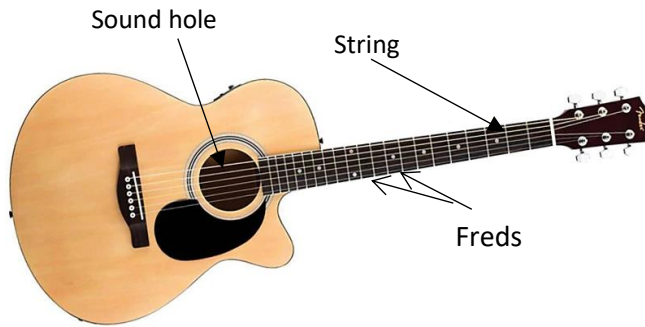


Diagram 10.3

You are required to give some suggestions to design a communication system which can improve the quality of signal transmission.

Suggestion	Explanation
Use microwave as transmission wave	Microwaves pass easily through the atmosphere, so they can pass between stations on Earth and satellites in orbit.
Use high frequency wave as transmission wave	High energy wave which allow the wave to reach a satellite in high orbit
Short wavelength wave as transmission wave.	Less diffraction so the wave can travel further distance. Short wavelength allows conveniently-sized antennas to direct them in narrow beams.
Use concave dish as receiver	Able to focus wave signals to a focal point
Use large diameter dish receiver	To reflect more waves and receive maximum wave signal
Use large diameter transmitter dish	This produces very little <u>diffraction</u> , giving a narrow beam signal that does not spread out.
Install transmitter and receiver dish on top of hill	No obstacles

40. Diagram 10.3 shows a guitar used by a student on a stage of your school hall in a singing competition without using a microphone.



Suggest and explain how to design a guitar which can produce high pitch and will not break easily when it is plucks.

Suggestion	Explanation
<i>Use metal string.</i>	<i>Stiffer and not easily break, can produce louder sound.</i>
<i>Set string in high tension.</i>	<i>Can produce high frequency sound.</i>
<i>Use strings of different thickness.</i>	<i>Can produce wide range frequency of sound.</i>
<i>Wide pacing between freds.</i>	<i>To produce different notes easily.</i>
<i>Big sound hole.</i>	<i>More air particles vibrate in resonance to produce louder sound.</i>

41. Suggest and explain how ordinary fishing boat can be upgrade to the new boat which complete equipment to detect the crowd of fish.

Suggestion	Explanation
Attach radar system to the ship	This equipment needs to detect crowd of fish and for measurement the depth of the crowd of fish
a) Ultrasonic transmitter	-Use to produce ultrasonic pulses
a) Microphone receiver	To detect ultrasonic pulses
b) CRO	-To measure the depth of fish by calculating $d=vt/2$; d =depth, v =velocity, t =time
Use ultrasonic wave	-Ultrasound not produce sound -Ultrasonic wave has higher frequency, more energy, so it can move further
Use high energy wave	The penetrating power is higher

F4 CHAPTER 5: LIGHT

42. Determine and explain in the designing of a magnifying glass to be used for enlarging the image of stamps

Suggestion	Explanation
Choose convex lens	The image can be magnified
Excellent clarity of lens	Can see clearer image
Small focal length	Able to focus nearer object
Medium diameter of lens	Can easily handle and hold by hand
The object is place less than the focal length	The image is magnified and upright

43. Explain the suitability of a mirror that be used in shop to watch over customers

Suggestion	Explanation
Use convex mirror	Wider field of view
Greater reflectivity of material	Clearer image
Choose a bigger size of mirror	Enable wider view and sharper image
Place the mirror at the corner of shop ceiling	Easier to look at and won't disturb the customers pathway
Low density	Lighter to hang up

44. Design fiber optic

Suggestion	Explanation
The refractive index of the outer layer is lower than the refractive index of the inner layer	For total internal reflection can happen in the fiber optic.
Use high flexibility material	so that it can be bent easily
Use strong material	Does not break easily
Use thin material	Light // can be used in small area
Low density material	Light and easily handle
High purity inner core.	Light travel a long distance in optical fibre without loss of energy.

45. Determine and explain the design of microscope using lens P and Q with focal length of 15 cm and 5 cm respectively. Suggest modifications that need to be done to get brighter and bigger image.

Suggestion	Explanation
P as the eye piece and Q as the objective lens	Focal length of P is longer than Q
Adjust the eye-piece so that object distance from the eye-piece is less than the focal length of the eye-piece.	To produce virtual, Inverted and bigger image//the eye-piece acts as a magnifying glass
Distance between lenses $> f_o + f_e$	To produce bigger image from the eyepiece // to increase the magnification
Store in a cool and dry place	To prevent the formation of fungus on the lenses
Use more powerful lens for the eyepiece	To produce bigger image
A concave mirror is placed below the slide	To focus more light and produce brighter image

46. Explain the suitable characteristics of a mirror to be used as outdoor safety mirror at the corner of the road

Suggestion	Explanation
Use convex mirror	Wider field of view
Excellent weather resistance	Able to withstand bad weather
Excellent impact resistance of material	Save cost, everlasting
Bigger size mirror	To enable a wider view and sharper image
Greater reflectivity of material	Clearer image even in bad weather
Place at the sharp road corner , at bending road	To minimize from accident occur, to enable motorist see the oncoming traffic
Small roof	Protect from rain drops for better image

47. Designing of Astro disc using appropriate physics concepts.

Suggestion	Explanation
Choose parabolic convex curve disc	The reflected signals can be focused at the focal point
Signal receiver is placed at the focal point of the disc	To receive the strongest signals and produce sharp and clear image
Smooth surface of disc	For better reflection of signals
Install the disc at high position	No obstructions in signals receiving
Facing the disc towards satellite	For better and maximise signals receiving

48. Modified a slide projector that need to be placed in school hall and can be seen by many students with clearer image.

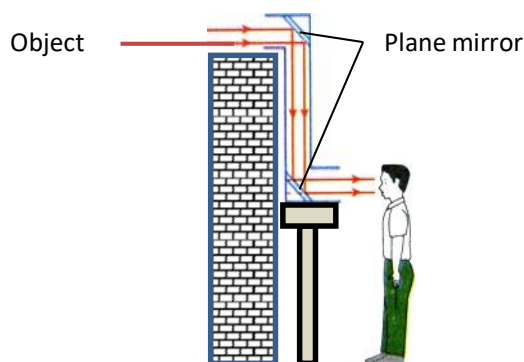
suggestion	Explanation
Use high power bulb	To produce high intensity light for a brighter image
The filament of the bulb is at the focal point of the concave mirror	To produce parallel reflected rays for image to be formed on a screen
Projector is placed further away from the screen	To produce larger image
Installed an electric fan in the projector	As a cooling system to lower the temperature of the projector
Use condenser convex les	To focus more light onto the slide and produce brighter image
Use a concave mirror instead of plane mirror	To focus the more light directly towards the lens hence increase the intensity of light to produce brighter image

Place the filament of the bulb at the centre of curvature of the converging mirror	To reflect more light towards the lens to increase the intensity of light.
Use heat filter	To filter excess heat and prevent slide been overheated

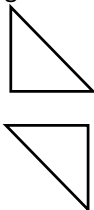
49. Determine and explain the design of a telescope using lens J and K with lens K is thicker than lens J which can produce bigger and clearer image.

Suggestion	Expalnation
Choose lens K as the eyepiece lens	Thicker lens has higher power with shorter in focal length <i>Magnification</i> , $M = \frac{f_o}{f_e}$ Small focal length of the eyepiece can produce bigger image.
Choose lens J as objective lens	Thinner lens has lower power with long focal length Larger focal length will increase the magnification of the telescope
Adjust the distance between the two lenses equal to the sum of their individual focal length, $L = f_o + f_e$	To produce final image at infinity as not to strain observer's eye
The lenses made of high clarity glass	To produce sharp and clear image
Use bigger diameter of objective lens	To allow more light to enter the telescope and produce a clearer and brighter image

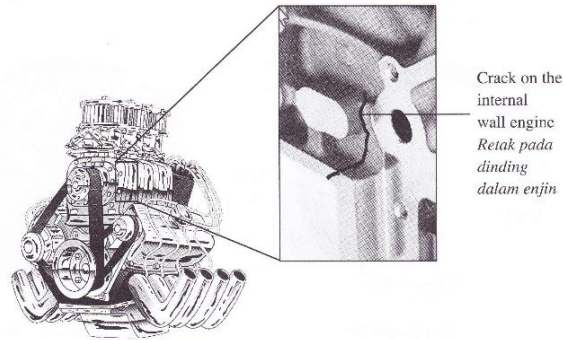
50. Diagram 9.4 shows a student uses a simple mirror periscope to see an object behind a wall.



You are required to modify the simple mirror periscope into a prism binocular that can produce clearer image.

Suggestion	Explanation
Use two 45°-90°-45° prisms	For total internal reflection to happen and produce bright image.
Prisms are arranged with the hypotenuse sides in parallel and facing out. 	To produce 90° reflection of light.
Prisms make of low density material.	Light and easily handle.
Install low power objective lens.	Large focal length, can focus far distance object and produce high magnification. $M = \frac{f_o}{f_e}$ $F_o \uparrow, M \uparrow$
Install high power eye piece.	To produce high magnification.
Big diameter objective lens.	To allow more light enters the periscope and produce bright image.

51. Diagram shows a crack on an internal wall surface of a car engine. The crack cannot be seen from the outside.



Suggest a design of a device that can be inserted into the car engine.

State and explain the modifications based on the aspects such as the type of cable, the characteristics of the cable used, and the additional features needed to display clear image and manoeuvrable in the coiled space of the car engine.

Suggestion	Explanation
Use fiber optic type of cable.	Total internal reflection occur and produce a clear image.
Use long cable.	Able to inspect deep into part of engine.
Use small diameter cable.	Can insert into narrow space part of engine.
Install high power lamp at the end of the cable.	To produce a brighter image.
Use high flexibility cable	Easily bend into space of the engine.

F5 CHAPTER 1: FORCES AND MOTION II

52. Explain the suitability feature of arm exercise equipment.

Suggestion	Explanation
Spring make of high strength material like steel	Can withstand large force
Two // more spring arrange in parallel	The spring system is stiffer/increase spring constant
Spring with thicker wire	Wire will not easily break
Smaller diameter coil of spring	The spring will not be too soft and easily bend
Choose large force constant spring	Will make strong spring, the spring will be more stiffer and will not break easily

53. Explain the characteristic of a spring to make baby's cradle.

Suggestion	Explanation
Choose spring with large spring constant	the spring will be more stiffer and not easily break
Choose thicker wire to make the spring	The thicker the wire the stiffer the spring is.
Small diameter coil of spring	The spring will not be too soft and produce large extension
The spring is made of high strength material like steel	Steel and alloy is stiffer than iron, not easily break
The arrangement of springs is two or more line in parallel	The spring becomes stiffer and can withstand larger load

54. Explain the most suitable design of spring for shock absorber for motorcycles.

Suggestion	Explanation
Small diameter of spring coil	Enough space for the spring to be installed and the spring becomes harder
Choose large diameter of wire	The larger the diameter wire the stiffer the spring
Spring wire make of high strength material	Can support motorcyclist and passenger with larger load
Higher spring constant	Produce small compression of the spring
Small natural frequency	To reduce bumping, comfortable for user

55. Diagram shows an archer aiming an arrow to a target board. Using appropriate physics concept, explain the use of suitable equipment and techniques to improve his performance.

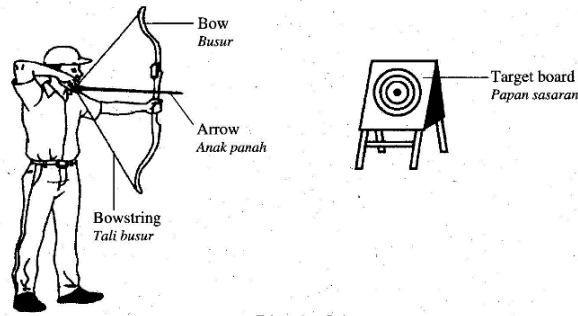


Diagram 9.4

Suggestions	Explanations
Use small mass arrow	The arrow can move in high speed
The arrow has sharp point/aerodynamic shape	To reduce air resistance and the arrow can move in high speed
High elasticity bowstring	Can store large elastic potential energy when stretching
High strength bow	Will not easily break
Aiming the arrow a little higher above centre of target	To compensate the gravitational pull on the arrow while flying

56. Diagram 14.4 shows a trampoline. It uses the elastic property of a material to rebound a person upwards.



You are required to give some suggestions to improve the design of the trampoline so that it can be used by the children safely and can jump higher.

Suggestion	Reason
Use more spring in parallel	Increase the Spring constant and can withstand large force
High spring constant	Can withstand large force
Main frame is made of steel	Strong material which does not break easily
Use nylon for fabric	Does not tear
Has net around the edge of trampoline	To prevent the children from slipping out to the floor

57. Suggest and explain how to make suitable beach motorcycle which able to move on the sand smoothly and comfortable.

Suggestions	Explanations
Deep thread patter // more definitive pattern	Better grip on sand, able to move smoothly on sand
Large tire (big surface contact with ground)	Reduce total pressure of motorcycle, increase stability and the motorcycle would not get stuck in the sand
Soft seat and water resistance	Comfortable for riders and would not get wet easily
Excellent resistance to rusting	Everlasting. Would not rust easily
Installed shock absorber with higher spring constant and small natural frequency.	Reduce bumping and reduce oscillations.
Low density body	Lighter, would not stuck in sand

58. Diagram C shows a pole vaulter performing a jump.

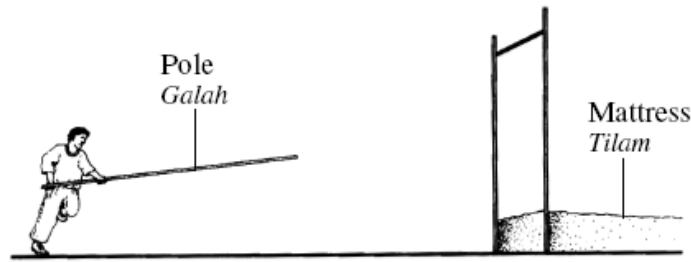
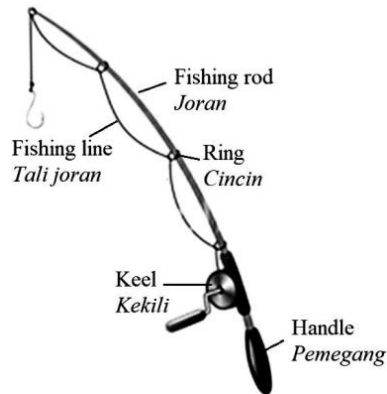


Diagram C

Using appropriate physics concepts, explain the use of suitable equipment and techniques to improve his performance.

Suggestions	Explanations
Wear tight attire.	To reduce air friction.
Wear spiked shoes.	For good gripping on the ground and prevent slippery.
Run in high speed or sprint.	To produce large kinetic energy to transform into potential energy and achieve higher height.
Use elastic pole.	The pole can be bent and stored large elastic potential energy.
Use light pole.	Light and can run in high speed.
Use strong pole.	Not easily break.
Use thick mattress.	Can absorb impact and reduce impulsive force.

59. Diagram 9.4 shows a fishing rod. You are required to give suggestions to improve the capability of the fishing rod.



State and explain your suggestions based on the characteristics of the length of rod, density of the keel, the size of the ring, the material of fishing line and the fishing rod.

Suggestions	Explanations
Long rod.	More elastic and not easily break.
Low density of keel.	Light and easily handle.
Small diameter of the ring.	Fishing line not easily get tangled.
High elasticity and strong material fishing line.	Easily bend and not easily break.
Fishing rod made of carbon fibre material.	Light, elastic and strong.

F5 CHAPTER 2: PRESSURE

60. Efficient brake system

Suggestions	Explanations
Type of liquid: oil	Uncompressible so pressure can be transmitted equally in all direction
Thick brake line/pipe	To withstand the high pressure from the liquid
The ratio of cross sectional area for wheel piston and master piston is high	To produce larger force on wheel piston

The chosen of type of brake for front rear wheel: Front wheel - disc Rear wheel - drum	Disc brake is more efficient than drum brake
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61. Explain the design of hydrometer which can be used to determine a wide range of densities of liquid.

Suggestions	Explanations
Small and long stem	Increase sensitivity where the scale division are far apart so that small changes in density can be detected
Glass wall	Do not corrode and small adhesive force with liquid
Large diameter of bulb	To gain larger buoyant force/ displaces more liquid / able to float easily
Calibration of scale : - Placed the hydrometer in alcohol. The liquid level at the stem is marked (upper level) - Placed the hydrometer in high density liquid like mercury and marked the lower level (lower level)	Able to measure a wide range of densities of liquids.
Put lead shots at the base of the bulb	Hydrometer can stay upright while floating in liquid

62. Describe the suitable design to build mobile tent for an event which will be constructed at an open space for a week. Using appropriate physics concept, suggests and explain.

Suggestion	Explanation
Choose low density metal for frame	Light weight, strong and easily handle
Use hollow frame which can assemble easily	Hollow frame is not heavy, but equally strong, easy to mobile anywhere, faster to put up, can reduce the cost of construction and transportation
Water proof canvas	If raining, would not getting wet
Anti-rust frame	Can withstand rain and long lasting
Sharp end frame to be planted on ground	Small surface area, so higher pressure onto the ground for the frame to support the tent in stable

63. Explain the necessary modification for the structure of dentist chair for children that are suitable and save for an adult.

Suggestion	Explanation
Increase the cross-sectional area of big piston and decrease the cross-sectional area of small piston	To increase the output force acting on the big piston / to lift heavier adult
The wall of pipe is made up of strong alloy to hold the fluid	To withstand the strong pressure that might cause breaking of the pipe
Installed electric touch control	To lift or lower the chair to the desire height easily and safely
The surface area of the seat enlarged	To support the adult with the large bodies
Use non-corrosive oil in jack	Does not corrode the piping and cause leakage

64. Explain the building and designing of a hot air balloon which can fly higher altitude faster and suggest some safety aspect.

Suggestion	Explanation
Large balloon	Produce bigger buoyant / upthrust force, increase the volume of air displaced
Many hot air burners	Heat up the gas inside the balloon faster
Synthetic nylon balloon	Air proof, light weight, can stand high temperature and strong
Light basket for passengers	Balloon can move upward faster
Fly on early morning or late afternoon	The temperature outside the ballon is cooler compare to the inside of ballon, so the ballon will rise faster and higher

65. Explain the basic structure of small submarine that can be used for underwater exploration.

Suggestion	Explanation
Strong material	Can withstand high water pressure
Aerodynamic shape	Reduce water resistance and move faster
Thick wall	Does not crush easily under high pressure

High density materials	Increase mass / can submerge easily
Big ballast tank	To displace more water to gain large buoyant force
Sonar transmitter and receiver	To detect incoming objects and depth of water

66. Suggest the design of submarine which can submerge and float in the sea.

Suggestion	Explanation
Big ballast tanks	Able to displace more water to gain large buoyant force
Aerodynamic // streamline body	To reduce water resistance
Use hard and stiff materials for body	To overcome the pressure of water in the sea
Attach periscope	To view surface surrounding area while submarine is in the water
Use nuclear power source to generate power	Long lasting power, does not need to refuel frequently

67. Explain the characteristic of material to be used for making the sole of jungle trekking shoes.

Suggestion	Explanation
Rubber sole	Good impact absorber
Low density	Light weight
Many studs	Give extra gripping on ground and prevent slippery
Low expansion effect	Not loose easily
Excellent ability of stretch	Comfortable to feet, less pressure on feet

68. Using physics concept, explain necessary deep sea diving suit and other accessory to carry.

Suggestion	Explanation
Use water proof suit	Keeps the diver dry.
Use body tight suit	Helps in streamlining so that the diver can dive efficiently
Use thick glass of diving mask	Enable the diver to see surrounding and at the same time able to withstand the water pressure
Use atmospheric pressure ("hard") suits	To maintain the surface pressure inside the suit.
Bring along oxygen gas tank	To provide oxygen for the diver
Use very heavy suit	The diver enable to stand on the floor of ocean and able to overcome buoyancy of water

69. Modified a commercial airplane to cargo airplane that needs to carry more loads, use less of fuel, high efficiency and safe to travel.

Suggestion	Explanation
Increase the size of the body	To increase the space for more loads
Increase the length of the wing	To produce extra lifting force
Increase the thickness of the body	To withstand a large different in air pressure over high altitude
Use more powerful engines	To overcome bigger inertia and gain enough speed in short runway
Increase the number of tires	To support large mass of loads and high pressure while landing
Protective bar between the cabin and the pilot	To prevent moving objects to smash onto the cockpit while decelerate during landing

70. Design Vacuum Cleaner

Suggestion	Explanation
Large fan	Draw out more air and produce low pressure in vacuum cleaner
Powerful of electric motor	Can turn in high speed to create low pressure in vacuum cleaner
Narrower inlet opening	Increase the speed of suction air and create low pressure
Use large air filter	To collect more dust
Larger spaced for depositing and collecting dust particles	Allow air flows easily through the filter and the vacuum cleaner can work efficiently

71. Design perfume sprayer

Suggestion	Explanation
Large size of air bulb	Compress more air/can exert large pressure
Bulb make of rubber material	More elastic/easier to squeeze, can squeeze repeatedly
Narrow air tube	Allow air flow in high speed to create low pressure
Low density material for perfume container	Light and easily handle
Narrow nozzle at the end	The paint can be sprayed evenly

72. Design hydraulic jack

Suggestion	Explanation
Bigger area of slave piston (big piston)	To produce large output force
Small area of master piston (small piston)	Small input force is needed to push the small piston
Longer handle	Easier to apply force onto the small piston
Low density of a body	Light and easily handle
Oil as hydraulic fluid	Non-compressible and liquid pressure can be transmitted equally in all directions
Release valve between small and main reservoir (reset)	Liquid can flow into small reservoir to lower the slave piston down

73. Design hydrometer

Suggestion	Explanation
Bulb with lead shot at the lower section	To ensure the hydrometer floats upright and not overturn in liquid
Bulb with bigger diameter at the bottom	To displace more liquid to gain enough buoyant force in order to be able to float
Cylinder with smaller diameter at the upper section	A small reading scale can be incorporated/increase the sensitivity
Smaller scale	increase the sensitivity
Filled with air	Light and can easily float
Glass wall	Not easily corrode

74. You are required to give some suggestions on how to design a boat as to increase the floating force and safer.

Suggestion	Reason
<i>Material used must be with low rusting rate (fibre composite)</i>	<i>Long lasting without rust</i>
<i>Shape of boat is streamline</i>	<i>Reduce water friction while cruising</i>
<i>Density of boat is light</i>	<i>Can carry more load before it sinks</i>
<i>Has life jacket and tyre</i>	<i>For passenger to float during emergency</i>
<i>Installed Global Positioning System GPS</i>	<i>To show exact position of boat on the Earth anytime</i>

75. Modification of a ship that can carry more and heavier load, move faster and safer while travelling.

Suggestion	Explanation
Use strong material	Can withstand larger force and not easily break
Low density material	Light weight, can move faster
Has plimsoll line	Safe to travel on fresh and salt water
Big size	Can place more goods
Aerodynamic/streamline shape	Reduce water friction.

F5 CHAPTER 3: Electricity

76. Suggest the installation of lamps in a library, for economical yet high efficiency.

Suggestion	Explanation
Circuit connection of lamps is in a parallel circuit	If any lamp burns out, others can still be used
Attach shiny reflector	Can reflect more light and the room becomes brighter.
Low power lamp	Safe energy consumption and reduce energy costing
Use LED type of lamps	Safe energy consumption yet produce high intensity light
Long life span lamps	No need to replace more often
Install Automatic Infra-Red sensor	Lamps will light up only when the sensors sense the

existence of human body heat/Infra-Red
--

77. Explain the modification of table lamp to be use in study room.

Suggestion	Explanation
Use the fluorescent lamp	Fluorescent lamp consume less power and more economical and also produce less heat
Attach a lamp cover to the bulb	To protect the eye from the bulb's glare and to direct light from the bulb
Use the adjustable stand	The height of the lamp can be adjusted
Use portable type of stand	Easy to be use anywhere in a room
Connect the lamp to the earth wire	To protect user from electric short circuit

78. Suggest the suitable design of fuse to protect an electrical equipment which is label 240V,2400W

Suggestion	Explanation
Use thin fuse wire	High resistance, easily heated up and melt if exceed the current limit
Fuse wire is in a ceramic cartridge	Can withstand higher temperature
Fuse rating is 13A	Maximum rating must be slightly higher than normal usage current
Low melting point	Easily melt when current exceed the current limit
Low specific heat capacity	The fuse wire easily get heated and melt
Material of high resistant	High resistance, easily heated up and melt if exceed the current limit
Resistance to oxidation	Not easily oxidise and can last longer

79. Diagram shows a variable resistor which the resistance can be varied to a maximum of 10 Ω.

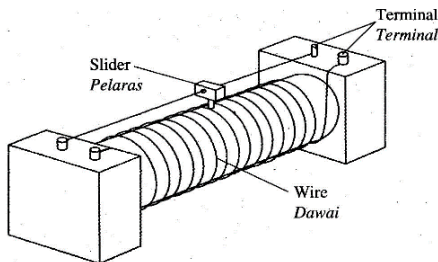


Diagram 10.4

You are required to modify the design so that the maximum resistance is greater than 10 Ω.

Modification	Reason
Use thinner resistant wire	Thinner wire has high resistance
Increase the number of turns of wire	Longer wire used and resistance increases
Use wire of high resistivity	To increase the resistance of the wire
The slider must make good contact to the wire	For good electrical contact and easy for current to flow

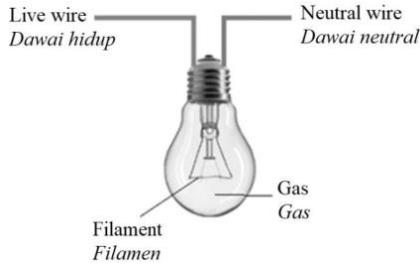
80. You have to choose one of the cables to be used in the National Grid Network. Explain the suitability of each of the characteristics of the cables.

Suggestion	Explanation
Use large diameter cable wire	To reduce the resistance of the cable
Low density cable wire	Light and will not sag hanging on pylon
The rate of expansion should be low	Less expansion and less sagging in the cables during hot days
High melting point	Cables does not melt in high temperature
Use uninsulated cable wire	To reduce the weight and reduce sagging
Use low resistance cable wire	To reduce power lost during transmission of power

81. Investigate the characteristic of electric oven that can toast more cupcakes in a shorter time

Suggestion	Explanation
Big space oven	Can bake more cupcakes at one time
Install heating element on top and bottom of the oven	To produce more heat
The wall is made of good insulator	To reduce heat lost
Install a fan inside the oven	To regulate the temperature in the oven
Internal space of oven is painted silver	Reduce heat lost through radiation and more heat can be reflected
Install thermostat to the oven	To control the temperature

82. Diagram 10.3 shows a filament lamp in an electrical wiring system in a house.



As an electrical engineer at Power System Consulting, suggest modifications that can be made to the structure of the filament lamp in Diagram 10.3, so that it can produce a brighter light. State and explain the modifications based on the characteristics of the coil and the characteristics of the gas filled in the filament bulb.

Suggestion	Explanation
Use high resistance wire as filament example tungsten wire.	To produce more heat and light energy.
Use thin resistance wire as filament.	High resistance and easily heated up to produce light.
The filament is made into coils.	Long wire can be installed into the bulb.
Fill the bulb with inert gas example nitrogen gas.	To prevent oxidation of the filament wire.
Low pressure gas is filled in the bulb.	To prevent high pressure build up when bulb is heated up.

83. Explain the design of an electric kettle

Suggestion	Explanation
Use high resistance wire as heating element	To produce more heat energy.
Higher number of loops of heating coil	Longer wire has high resistance to produce more heat
Use high power rating	To produce more heat energy in the coil
High melting point of coil wire	Not easily melt under high temperature
Low rate of rusting	Does not get rust easily
Use thermostat	To cut off the circuit when temperature achieve 100°C
Use 3 pins plug in	For safety purposes in case of any short circuit

84. Design of incubator used to hatch eggs

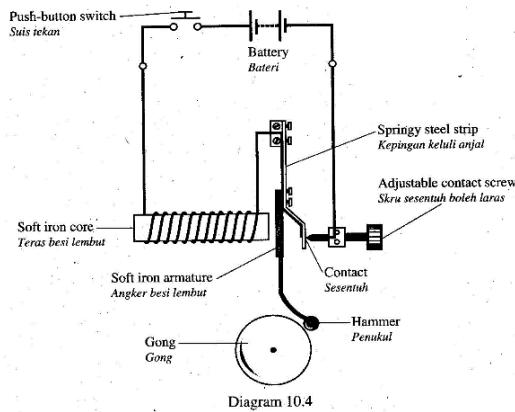
Suggestion	Explanation
Bulbs are connected in parallel circuit	When one bulb damage, it does not affect on the another bulbs
Multi-level rack	More eggs can be incubated at one time
Install fan	Heat can distributed uniformly
Low power rating bulbs	Not to produce too much heat
Install timer	To set the correct timing during the incubation of eggs
Install thermostat	To control the temperature

85. Design circuit for a house

Suggestion	Explanation
Connected in parallel	Allow each electric appliances to be switched on and off independently
Connect fuse to the live wire in the fuse box	To cut off the flow of current when a high electric current flows through the circuit
Install a circuit breaker	Automatically cut off the circuit whenever there is a surge in electric current flows in the circuit
Earth connection to the metal case of electrical appliances	To allow current to flow to the earth when short circuit happen
Use low power lamps / install fluorescent lamp	To save the energy consumption and reduce surrounding temperature

F5 CHAPTER 4: Electromagnet

86. Using appropriate physics concepts, explain the use of suitable equipment to design an electric bell which can produce louder sound.



Designing	Reason
Increase the number of turns of coil	To produce stronger magnetic field strength that increase the pulling force on the hammer
Increase the size of the Gong	Will cause more air particles to vibrate and produce louder sound
Use a higher elasticity of springy steel strip	For a better vibration of the hammer hitting on the gong
Use two pieces of soft irons to form two solenoids	Will increase the magnetic field strength and the pulling force on the soft iron armature
Use thick copper wire as the coil wire	Low resistance allow larger current to flow in the solenoid

87. Suggest modification on dc motor to increase efficiency of the motor.

Suggestion	Explanation
Low density material	Light and easily handle
Increase the number of turns in the coil	To increase the magnetic force and motor can turn faster
Use high strength magnet	To increase the magnetic force and motor can turn faster
More segments of coils	Will increase the power of the motor
Use concave shape magnet	The motor turns smoothly
Use thick insulated copper wire as coils	Reduce the resistant and motor can turn faster

88. Using a 12 V a.c power supply, explain the modification that needs to be done on the motor and the external circuit to enable the motor to be a d.c electric motor and rotate faster.

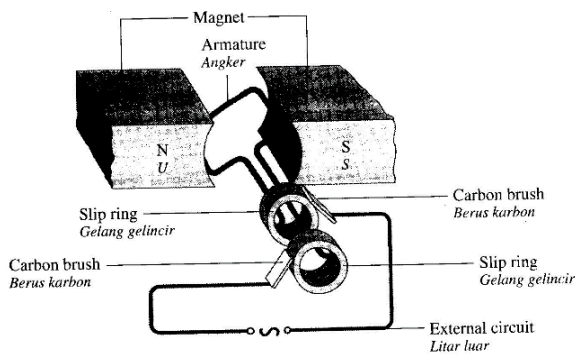
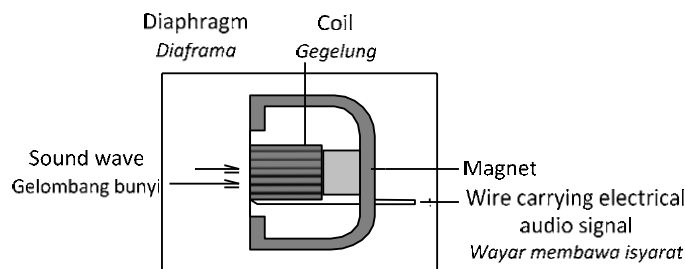


Diagram 10.4

Suggestion	Explanation
Use diodes and capacitor as rectifier	The 12 V a.c has to be rectified into d.c by using diodes in bridging circuit with a capacitor to smoothen the d.c
Replace the two slips rings with a commutator	To reverse the direction of current flows into the coil in every half turning of the coil
Increase number of turns of coil	To produce larger turning force on the coil
Use stronger magnet	To produce larger turning force on the coil
Use concave shape magnets	To produce radial magnetic field for a smooth turning of coil

89. Diagram shows a cross section of a moving coil microphone.



Using an appropriate concept in physics, suggest and explain suitable modifications or ways to enable the microphone to detect sound effectively and generate bigger current.

Characteristic	Reason
Use thicker diaphragm	Can withstand high pressure of sound vibrations
High strength of diaphragm	Long lasting
Use more turns	To produce larger induced current
Bigger diameter of wire coil	Reduce resistance of wire
Higher strength of magnet	Produce stronger magnetic field

90. Investigate the characteristics to improve the efficiency of a transformer.

Suggestion	Explanation
Use soft iron core	Easy to magnetized and demagnetized
Laminated core	Reduce eddy current and reduce energy lost
Use thick wire coils	Low resistance, less energy lost
Use insulated copper wire to make the coil	Low resistance and less energy lost
Wind the secondary coil on top of the primary coil	Reduce leakage of magnetic field lines

91. Design a moving coil ammeter that can function better and able to detect small change in current

Suggestion	Explanation
Use stronger magnet	Strong magnetic field and produce larger magnetic force to turn the coil for a larger deflection of pointer
Use concave shape magnet	Produce radial magnetic field/to get linear scale
Use cylindrical core	To produce uniform magnetic field
Use soft iron core	To concentrate the magnetic field
Using hair spring of lower stiffness	Smaller opposing force to stop the turning of coil
Use lighter pointer	Small inertia for easier deflection
Use low density coil wire	Light and easily to turn

Increase the area of coil	To produce large magnetic force for the turning of coil
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92. Suggest and explain the Design of adaptor to charge the DC 8V hand phone from 240V power supply.

Suggestion	Explanation
Use step down transformer	Able to reduce output voltage
Ratio of turns of primary coil to secondary coil is 30 : 1	Can reduce the output voltage from 240V to 8V
Connect four diodes in bridging circuit	To produce a full wave rectification of AC to DC
Connect a capacitor	To smoothen the output DC
Use insulator as the casing	To protect user from electric shock
Use low density material of coil wire and casing	Light and easily handle

93. Figure 12.1 shows how a model of an electric transformer system can be set up in a laboratory. The model consists of a power station that generates 12 V of alternating current (ac) that transmits the electrical energy to the users using transmission wires and transformers P, Q and R.

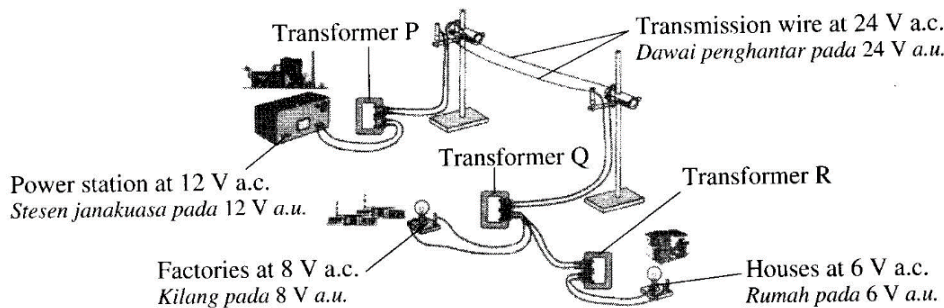


Figure 12.1

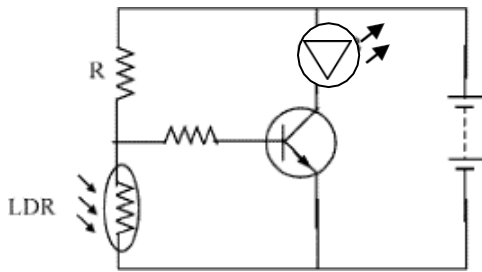
You are required to set up a model as in the Figure using the information in the Table.

Number of turns of the coil <i>Bilangan lilitan gegelung</i>	Type of transformer core <i>Jenis teras transformer</i>	Materials of transmission wire <i>Bahan dawai penghantar</i>
1200	Solid copper core <i>Teras kuprum pepejal</i>	Constantan <i>Konstantan</i>
1000	Laminated copper core <i>Teras kuprum berlamina</i>	Copper <i>Kuprum</i>
500	Solid soft iron core <i>Teras besi lembut</i>	Aluminium <i>Aluminium</i>
400	Laminated soft iron core <i>Teras besi lembut berlamina</i>	Nichrome <i>Nikrom</i>
160		
120		

Answer:

Suggestion	Reason
For transformer P: (12 V → 24 V) $N_p = 500, N_s = 1000$	$\frac{V_s}{V_p} = \frac{N_s}{N_p} \quad \frac{24}{12} = \frac{1000}{500}$
For transformer Q: (24 V → 8 V) $N_p = 1200, N_s = 400$	$\frac{V_s}{V_p} = \frac{N_s}{N_p} \quad \frac{8}{24} = \frac{400}{1200}$
For transformer R: (12 V → 6 V) $N_p = 500, N_s = 120$	$\frac{V_s}{V_p} = \frac{N_s}{N_p} \quad \frac{6}{12} = \frac{120}{500}$
Use laminated soft iron as core	Soft iron easily magnetize and demagnetize Laminated core can reduce eddy current
Use copper wire	Low resistance so can reduce power lost

F5 CHAPTER 5: Electronic

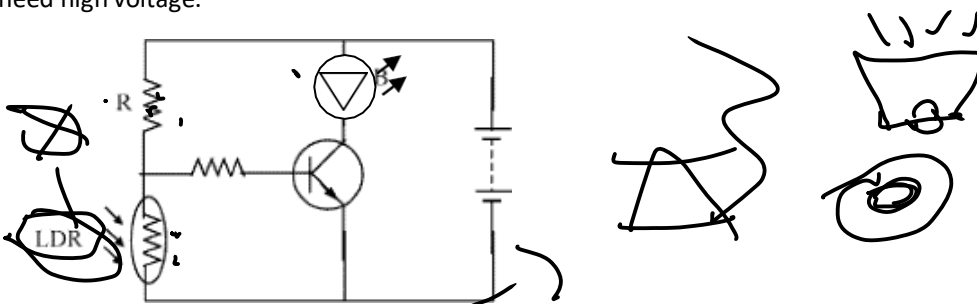


94. Modified the automatic switch light (diagram above) which can switch on at night and switch off during morning to be an automatic switch on fire alarm, explain using diagram and the function of component.

Suggestion	Explanation
Replace LDR with a thermistor	Resistance of a thermistor varies with the change of temperature
Replace LED with alarm// siren	Able to produce alarm sound if fire is detected
Interchange LDR with R	During fire, R has greater resistance compare to LDR so voltage in the base circuit is higher than 1V and transistor allows current to flow and alarm is triggered

When the temperature is high, the resistance of thermistor decreases. This will increase the voltage across R. So current will flow into the base circuit of transistor, the transistor then allows a large current to flow in the collector circuit. The alarm will be switched on.

95. Suggest the modification on the circuit in the Diagram so that it can function as an automatically fire alarm switch that need high voltage.



Suggestion	Explanation
Replace LDR with thermistor	To detect heat
Replace LED with a relay switch which is connected in the collector circuit	To switch on high voltage secondary circuit
Interchange the resistor R and thermistor	To increase the base voltage when heat is detected by the thermistor
Use 240 V power supply in secondary circuit	For Siren to function under high voltage
Connect a diode parallel to the relay	To protect transistor from burn out due to high current induced when soft iron in the relay demagnetised

F5 CHAPTER 6: Nuclear Physics

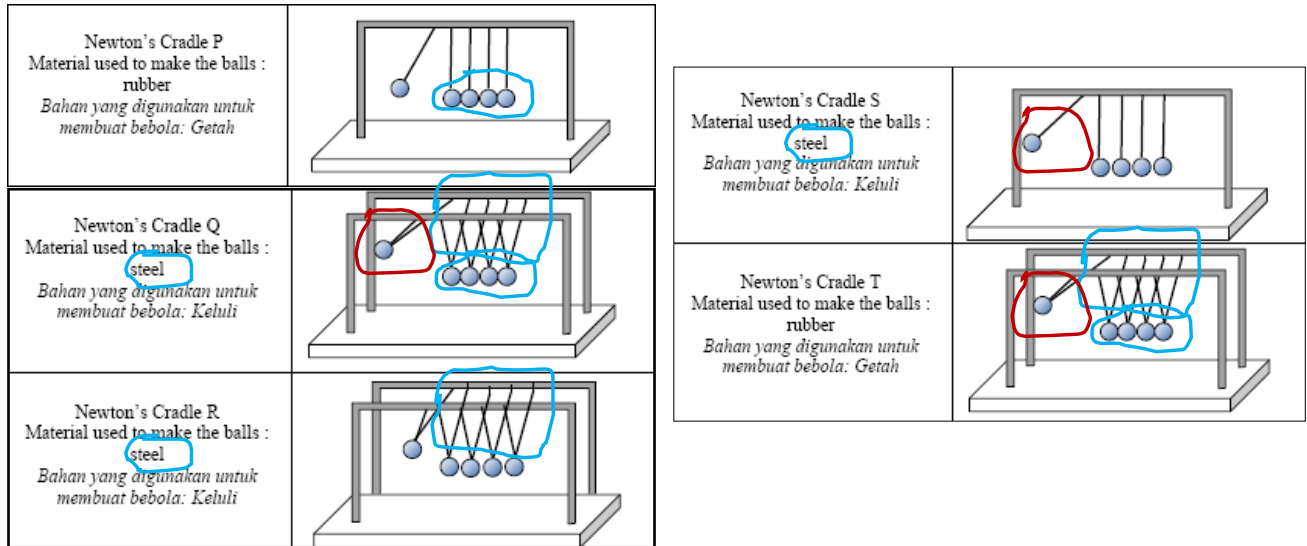
96. Suggest the design of nuclear reactor.

Suggestion	Explanation
Use uranium-235	Use as nuclear fuel
Nuclear fission	A type of chain reaction that produce huge of heat energy
Boron or Cadmium rod is used as control rods	To control the rate of nuclear fission
Use graphite as moderator	To slow down the fast moving neutrons
Build thick concrete wall	Thick concrete wall can prevent the escape of radioactive radiations, keep the radiations inside the reactor
Carbon dioxide or water is used as cooling agent	To absorb heat from the reaction for turn turbine generator.
Build the reactor plant near to river or sea	Need large amount of water to cool down the reactor

DECISION MAKING

F4 Chapter 2: Forces and Motion I

97. Diagram shows five designs of 'Newton's Cradle', P, Q, R, S and T, with different specifications. You are required to determine the most suitable design to make the ball at the end swings up to higher level and at bigger speed. Study all the five designs from the following aspects:
- The arrangement of the balls
 - The type of material used to make the balls
 - the number of string used to hang the balls
 - The type of material used to make the balls
 - the position of the ball to start the oscillation



Answer:

Characteristic	Reasons
The balls touch each other	This will reduce losses of energy which will reduce the speed of the balls
The type of material used to make the balls is steel	Steel balls are hard and produce highly elastic collision. Energy can Easily be transferred through the intermediate balls.
Two strings used to hang each ball	This string arrangement restricts the balls' movements to the same plane. the position of the ball to start the oscillation
High position of the ball to start	High potential energy and will change to high kinetic energy. The last end ball will swing at bigger speed.

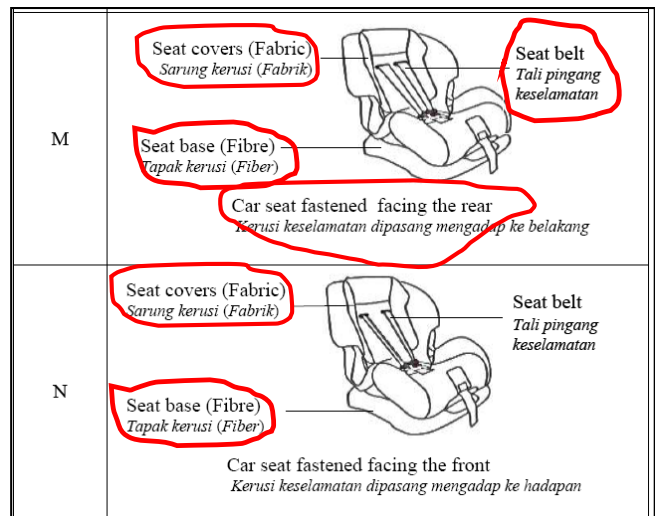
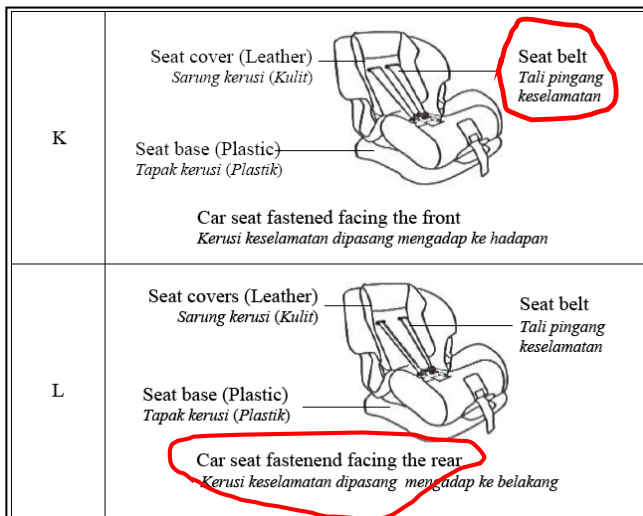
Newton's cradle Q is the most suitable because the balls touch each other, used steel balls, two strings used to hang each ball and high position of ball to start.

98. Diagram 11.4 shows the side view of a car.



Diagram 11.4

Table 11 shows four safety car seats K, L, M and N with different specifications. You are required to determine the most suitable car seat and the way it is positioned on the front passenger seat, for babies' safe travel. Explain the suitability of each characteristic of the car seat and position. Determine the most suitable car seat and position. Give a reason for your choice.



Answer:

<i>Characteristics</i>	<i>Explanation</i>
1. Seat cover: Fabric	1. Cooler / able to absorb sweat
2. Seat base: fibre	2. Strong / does not break easily
3. Seat belt : wide	3. Exert less pressure on baby
4. Car seat fastened facing the rear	4. Children are not exposed to danger from broken glass or flying pieces of debris

Car seat M is the most suitable because it has fabric seat cover, fibre seat base, wide seat belt and car seat fastened facing the rear.

99. Diagram 12.3 shows four racing motorcycles, P, Q, R and S, with different specifications. You are required to determine the most suitable motorcycle to move fast and safe when racing.

<p>Racing bike A</p> <p>Type of brake : without ABS</p> <p>Mass : 205.0 kg</p>	 <p>Seat height 905 mm</p> <p>Width of the tyre 1440 mm</p>
<p>Racing bike B</p> <p>Type of brake : without ABS</p> <p>Mass : 220.0 kg</p>	 <p>Seat height 1010 mm</p> <p>Width of tyre 940 mm</p>
<p>Racing bike C</p> <p>Type of brake : ABS</p>	

(Antilock Brake System) Mass : 208.0 kg	
Racing bike D Type of brake : ABS (Antilock Brake System) Mass : 242.0 kg	

DIAGRAM 12.3/ Rajah 12.3

Study the specifications of all the four motorcycles from the following aspects:
 Explain the suitability of the aspects. Justify your choice.

Answer:

Specification	Reason
With ABS	Motorcycle does not stop immediately/ can be controlled if direction changes/ does not move side ways / more friction with ABS.
Bigger width of tyre	Bigger surface area, better support / low pressure acts on the tyres/ more friction when breaks.
Smaller mass	Lighter, can move faster / low inertia.
Lower seat height	Lower centre of gravity/ more stable/ safer when turn.

Racing bike C is the most suitable because it has ABS brake, bigger tyres, small in mass and lower seat height.

100. Diagram 11.2 shows a tennis player hitting a tennis ball with his racket.



Techniques and characteristics of string	Action after hitting the ball	Time contact between the ball and racket	String tension	Material of the string
P	Continue to swing the racket after hitting the ball	Long	High	Steel
Q	Continue to swing the racket after hitting the ball	Short	High	Nylon

R	Stops the racket immediately after hitting the ball	Short	Low	Steel
S	Stops the racket immediately after hitting the ball	Long	Low	Nylon

You are required to investigate the techniques done by the player and the characteristics of the racket's string. Determine the most effective technique done by the tennis player and the most suitable characteristics of the racket's string to produce high speed motion of the tennis ball after being hit.

Answer:

Characteristic & technique	Reason
Continue to swing the racket after hitting the ball	Extended the stopping time of the racket that will reduce the impact toward hand. Increase the stopping time will increase the impulse and increase the speed of the ball.
Short time contact between the ball and racket.	To increase the impulsive force.
High string tension.	Shorten the contact time with the ball / produce high impulsive force
Nylon as for the material of the string	More elastic and produced higher elastic potential energy.

Technique and characteristic Q is the most suitable because it has continue to swing the racket after hitting the ball, short time contact between the ball and racket, high string tension and nylon as for the material of the string.

101. Diagram 11.2 shows a goalkeeper for field hockey game.



Table 2 shows the characteristics of the goalkeeper's equipment.

Set of Equipments	Stick Material	Density of Head Protector	Left Hand Protector	The Thickness of the Leg Guard
K	Carbon fibre	High	Hard Plastic	Thin
L	Wood	High	Hard Foam	Thicker
M	Carbon fibre	Low	Hard Foam	Thicker
N	Wood	Low	Hard Plastic	Thin

Table 2

Choose the most suitable equipment to be used by the goalkeeper and provide the reasons for your choice.

Answer:

Characteristic	Reason
Stick made of carbon fibre.	Light weight and strong, not easily break.
Low density of head protector.	Light and easily move.
Hard foam left hand protector.	The foam can absorb impulsive force and it is hard so can protect the hand.
Thicker leg guard.	Can absorb large impulsive force.

Set equipment M is the most suitable because it has stick made of carbon fibre, low density of head protector, hard foam left hand protector and thicker leg guard

97. Diagram 11.2 shows the design and specifications of four different track bicycles, P, Q, R and S for track cycling competition in a velodrome.

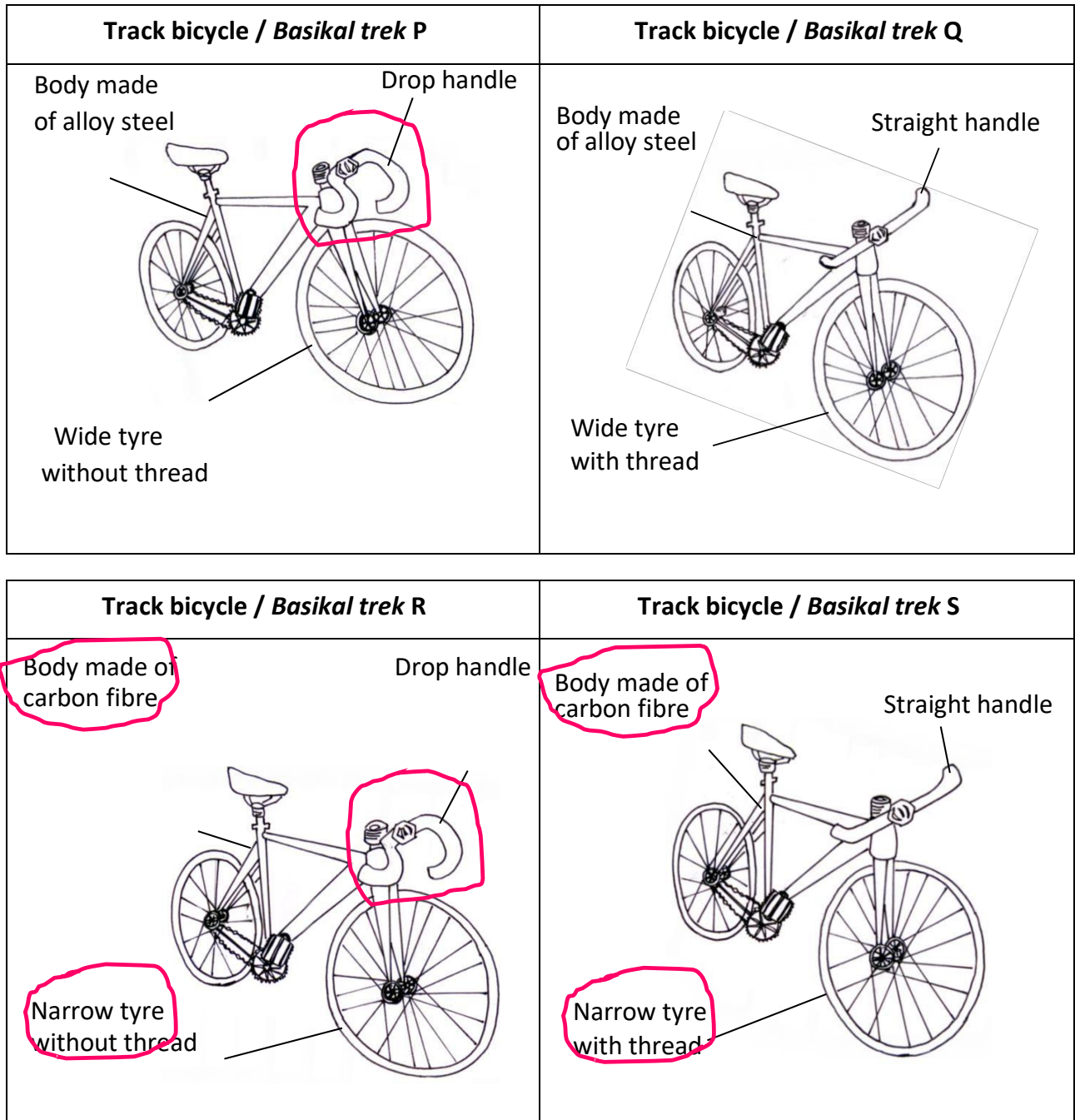


Diagram 11.2/ *Rajah 11.2*

Study the specifications of all four track bicycles. Explain the suitability of each design and its specifications. Determine the most suitable track bicycle that can travel with higher speed.

Answer:

Specification	Reason
<i>Body made of Carbon fibre.</i>	<i>Lighter / Small mass / Low density so the bicycle can accelerate faster.</i>
<i>Drop handle.</i>	<i>Cyclist at aerodynamic position / reduce air resistance.</i>
<i>Narrow tyre.</i>	<i>Lighter / reduce the friction.</i>
<i>No thread.</i>	<i>Reduce the friction.</i>

Track bicycle R is the most suitable because it has Body made of carbon fibre, drop handle, narrow tyre and tyre with no thread.

98. Diagram 11.2 shows a waterslide for children at Tasik Kenyir Water Park.



Design	Height of water slide/m	Volume of water on slide	Type of slide fence	Height of slide fence/m
S	15	Large	Hard	0.5
T	8	Small	Soft	0.5
U	15	Large	Soft	1.0
V	5	Small	Hard	1.0

Study the specifications of all four designs. Explain the suitability of each specification of the waterslide. Choose the most suitable design and justify your choice.

Answer

Specification	Reason
High height of water slide.	Large gravitational potential energy convert to large kinetic energy thus the speed of an object is high.
Large volume of water on slide.	To reduce frictional force.
Soft type of slide fence.	To produce small impulsive force and reduce injury.
High height of slide fence.	To prevent overthrow.

Design U is the most suitable because it has High height of water slide, Large volume of water on slide, Soft type of slide fence and High height of slide fence.

F4 Chapter 3: Gravitation

99. Determine the best specifications for a geostationary communication satellite and the method to launch the satellite.

Method	Launch location	Launch site	Altitude of satellite	Launch direction.
P	At the equator	At a very big stadium	36000 km	To the West
Q	Near the equator.	Near the sea	36000 km	To the East
R	At the South pole	Near the sea	3600 m	To the West
S	At the North pole	At a very big stadium	3600 m	To the East

Answer

Specification	Reason
Launch position at equator or near equator.	Easily set the satellite in an orbit above the equator.
Launch site near the sea.	Any miss launching will allow the rocket fall back on the sea.
At an altitude of 36000 km.	Orbital altitude of 36000 km will result in orbital period of 24 hours.
Launch direction to the East.	To set the direction of rotation of satellite in the same direction of the rotation of the Earth.

Method Q is the most suitable because the launch location is at the equator, launch near the sea, at an altitude of 36000 km and launch direction to the East.

F4 Chapter 4: Heat

100. You are given four choices of materials P, Q, R and S. The table below shows the characteristics for the four materials. Determine the most suitable material to be used to make a boat and give your reasons.

Material	Rate of rusting	Density	Specific Heat Capacity	Strength
P	Low	900	Low	Low
Q	High	500	High	High
R	High	387	Low	Low
S	Low	452	High	High

Answer

Characteristic	Reason
Low rate of rusting	Not easily rust so can last longer
Low density	Light and easily float in water
High Specific heat capacity	The boat will not easily be heated up
High strength material	Difficult to break/damage, can last longer

Material S is chosen because it has low rate of rusting, low density, high specific heat capacity and high strength

101. Diagram shows a food delivery used by a food delivery man.



Type of bag	A	B	C	D
Material of bag	Steel	Polystyrene	Aluminium	PVC plastic
Specific heat capacity of food box/ $\text{Jkg}^{-1} \text{ } ^\circ\text{C}^{-1}$	490	1450	921	1170
Density of food bag	Large	Small	Small	Large
Inner layer of food bag	Dull surface	Shiny	Shiny	Dull surface

Explain the suitability of each specification of the four types of food delivery bag and determine the most suitable food delivery bag for the purpose of maintaining the temperature of hot foods.

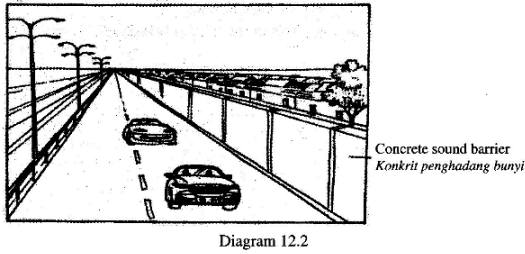
Answer:

Specification	Reason
Polystyrene as material of the bag.	Light and good heat insulator.
High specific heat capacity.	Will not cold down easily.
Small density of food bag.	Light and easily handle.
Shiny inner surface.	Reduce heat lost and can retain the temperature of foods.

Type of bag B is the most suitable because it made of polystyrene material, high specific heat capacity, small density and has shiny inner surface.

F4 Chapter 5: Waves

102. Diagram shows concrete barrier which is used to reduce the noise level produced by the vehicles at a housing area.



Concrete sound barrier Konkrit penghadang bunyi	Height Ketinggian	Surface Permukaan	Thickness Ketebalan	Sound absorption Penyerapan bunyi
W	Low Rendah	Even Sekata	Thick Tebal	Low Rendah
X	High Tinggi	Uneven Tidak sekata	Thick Tebal	High Tinggi
Y	Low Rendah	Uneven Tidak sekata	Thin Nipis	High Tinggi
Z	High Tinggi	Even Sekata	Thin Nipis	Low Rendah

Table 5

Explain the suitability of each specification of the concrete sound barriers and determine the most suitable concrete to be used to minimize the noise level.

Answer:

Specification	Reason
High concrete barrier	Can block more sound waves
Uneven surface	A good sound absorber
Thick wall	Difficult for wall to vibrate and reduce the transmission of sound
High sound absorption	Can absorb more sound energy.

Concrete sound barrier X is the most suitable because it is high, uneven surface, thick wall and has high sound absorption.

103. Diagram 21.3 shows the use of ultrasound scanner across the mother's womb to see the unborn babies.

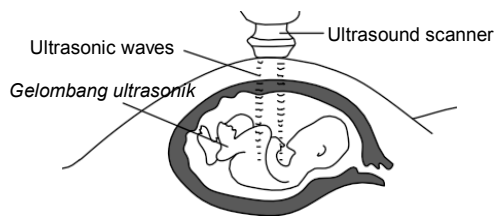


Table 21 shows the characteristics of the ultrasound scanner W, X, Y and Z.

Scanner	Type of wave	Frequencies range (Hz)	Penetrating power	Ionizing power
W	Mechanical	< 20 000	High	Low
X	Mechanical	> 20 000	Low	Low
Y	Electromagnet	< 20 000	Low	High
Z	Electromagnet	> 20 000	High	High

Explain the suitability of each characteristic in Table 21 that can be used as ultrasound scanner to scan the image of foetus safely.

Answer:

Characteristics	Reason
Use mechanical wave	Ultrasonic needs medium to travel
Use high frequency	The scanned image is clear
Use low penetrating power	Does not hurt the foetus
Use low ionizing power	Does not change the structure of cells of foetus

Scanner X is chosen because it uses mechanical wave, with high frequency, low in penetrating power and has low ionizing power.

F4 Chapter 6: Light

104. Table shows 5 materials which can be used to make an optical fibre. You are asked to investigate the characteristics of the materials in the Table which could be used to make the optical fibre.

Explain the suitability of **each** characteristic and hence, determine the most suitable material to be used to make the optical fibre. Give a reason for your choice.

Material	Refractive index	% of light energy absorbed	Elasticity	Strength
P	1.70	2 %	High	Low
Q	1.80	10 %	Low	High
R	1.75	2 %	High	High
S	1.52	3 %	High	High
T	1.48	10 %	Low	Low

Answer:

Characteristic	Explanation
High refractive index	Easy for total internal reflection to occur
Small % of light energy absorbed	More light can pass through and produce brighter and clearer image
High elasticity	The optical fibre can be bent easily
High strength	Not easily break and last longer

Material R is chosen because it has high refractive index, small % of light energy absorbed, high elasticity and high strength.

105. Diagram shows an astronomical telescope to be used to view distant objects.



Telescope	Type of lens	Focal length of objective lens	Power of objective lens	Diameter of lens
S	Convex	40	10	5.0
T	Concave	10	40	5.0
U	Convex	10	40	2.5
V	Concave	40	10	2.5

Explain the suitability of each characteristic of the telescope and determine the most suitable telescope to be used to observe very far object. Give reason for your choice.

Answer:

Characteristics	Reason
Use convex lens	To converge light to form image at focal point
Focal length of objective lens must be long	To produce large magnification of image.
Low power of objective lens	To produce high magnification of image
Diameter of lens must be big	To allow more light to enter the telescope and produced a brighter and clearer image.

Telescope S is the most suitable because it uses convex lens, focal length of the objective lens is long, power of the lens is low and the diameter of the lens is big.

106. Diagram 11.2 shows a man is using a binocular to watch a bird. The binocular is unable to produce a clear vision of the bird.



Binocular	Arrangement of the prisms on one side of the binocular	Angle of prism	Material for the prism	Critical angle of prism
K		45° - 90° - 45°	Plastic	Big
L		45° - 90° - 45°	Glass	Small
M		30° - 90° - 60°	Glass	Big
N		30° - 90° - 60°	Plastic	Small

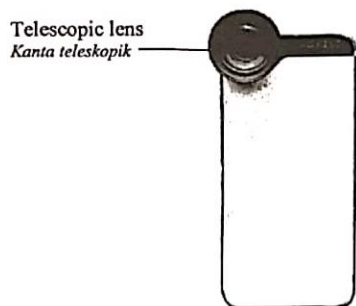
You are required to investigate the designs and characteristics of the binoculars K, L, M and N as shown in Table

Answer:

Design/Characteristics	Reason
Two prisms with hypotenuse in parallel and facing in each other. 	To produce 180° reflection of light.
Prism with 45° - 90° - 45°	Enable total internal reflection to occur in the prism.
Glass type of prism.	Not easily fade and produce clear and sharp image.
Small critical angle.	Enable total internal reflection to occur easily in the prism.

Binocular L is the most suitable because it has two prisms with hypotenuse in parallel and facing in each other, prism with 45° - 90° - 45°, Glass type of prism and Small critical angle.

107. Diagram shows a smart phone with a telescopic lens. The telescopic lens is widely used to take photo of distance object and to enhance the quality of photos and videos.



Lens	Angle of view	Purity	Density	Focal length
P	Wide	Low	High	Long
Q	Narrow	High	Low	Long
R	Narrow	High	Low	Short
S	Wide	Low	High	Short

Answer:

Characteristic	Reason
Narrow angle of view.	Light will be more focused and produce clearer image.
High purity.	More light can passed through the lens and produce brighter image.
Low density.	The smart phone will be Light and easily handle.
Long focal length.	Can focus far distance object.

Lens Q is the most suitable because it has narrow angle of view, high purity, low density and long focal length.

F4 Chapter 4: Heat

108. You are given four choices of materials P, Q, R and S. The table below shows the characteristics for the four materials. Determine the most suitable material to be used to make a boat and give your reasons.

Material	Rate of rusting	Density	Specific Heat Capacity	Strength
P	Low	900	Low	Low
Q	High	500	High	High
R	High	387	Low	Low
S	Low	452	High	High

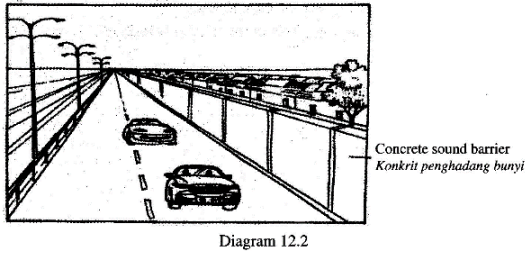
Answer

Characteristic	Reason
Low rate of rusting	Not easily rust so can last longer
Low density	Light and easily float in water
High Specific heat capacity	The boat will not easily be heated up
High strength material	Difficult to break/damage, can last longer

Material S is chosen because it has low rate of rusting, low density, high specific heat capacity and high strength

F4 Chapter 5: Waves

109. Diagram shows concrete barrier which is used to reduce the noise level produced by the vehicles at a housing area.



Concrete sound barrier Konkrit penghadang bunyi	Height Ketinggian	Surface Permukaan	Thickness Ketebalan	Sound absorption Penyerapan bunyi
W	Low Rendah	Even Sekata	Thick Tebal	Low Rendah
X	High Tinggi	Uneven Tidak sekata	Thick Tebal	High Tinggi
Y	Low Rendah	Uneven Tidak sekata	Thin Nipis	High Tinggi
Z	High Tinggi	Even Sekata	Thin Nipis	Low Rendah

Table 5

Explain the suitability of each specification of the concrete sound barriers and determine the most suitable concrete to be used to minimize the noise level.

Answer:

Specification	Reason
High concrete barrier	Can block more sound waves
Uneven surface	A good sound absorber
Thick wall	Difficult for wall to vibrate and reduce the transmission of sound
High sound absorption	Can absorb more sound energy.

Concrete sound barrier X is the most suitable because it is high, uneven surface, thick wall and has high sound absorption.

110. Diagram 21.3 shows the use of ultrasound scanner across the mother's womb to see the unborn babies.

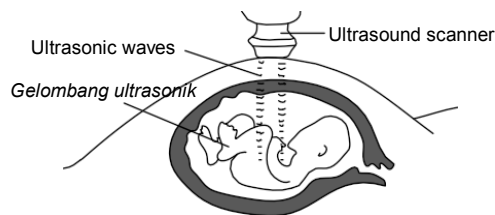


Table 21 shows the characteristics of the ultrasound scanner W, X, Y and Z.

Scanner	Type of wave	Frequencies range (Hz)	Penetrating power	Ionizing power
W	Mechanical	< 20 000	High	Low
X	Mechanical	> 20 000	Low	Low
Y	Electromagnet	< 20 000	Low	High
Z	Electromagnet	> 20 000	High	High

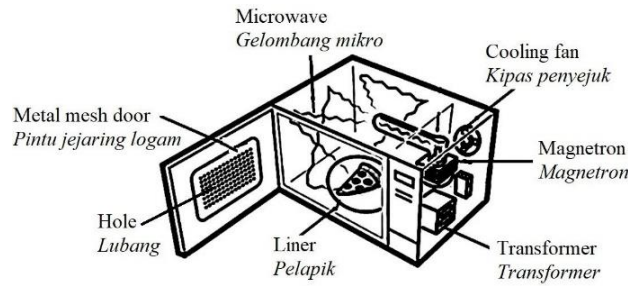
Explain the suitability of each characteristic in Table 21 that can be used as ultrasound scanner to scan the image of foetus safely.

Answer:

Characteristics	Reason
Use mechanical wave	Ultrasonic needs medium to travel
Use high frequency	The scanned image is clear
Use low penetrating power	Does not hurt the foetus
Use low ionizing power	Does not change the structure of cells of foetus

Scanner X is chosen because it uses mechanical wave, with high frequency, low in penetrating power and has low ionizing power.

111. Diagram 12.3 shows a microwave oven.



Microwave oven	Liner	Material of the liner	Transformer	Metal mesh door
P	Rotating	Metal	Step down	Small hole
Q	Non rotating	Glass	Step down	Big hole
R	Rotating	Glass	Step up	Small hole
S	Non rotating	Metal	Step up	Big hole

Table 12 shows the characteristics of four microwave oven model, P, Q, R and S with different specifications. Determine the most suitable model of the microwave oven that can function effectively.

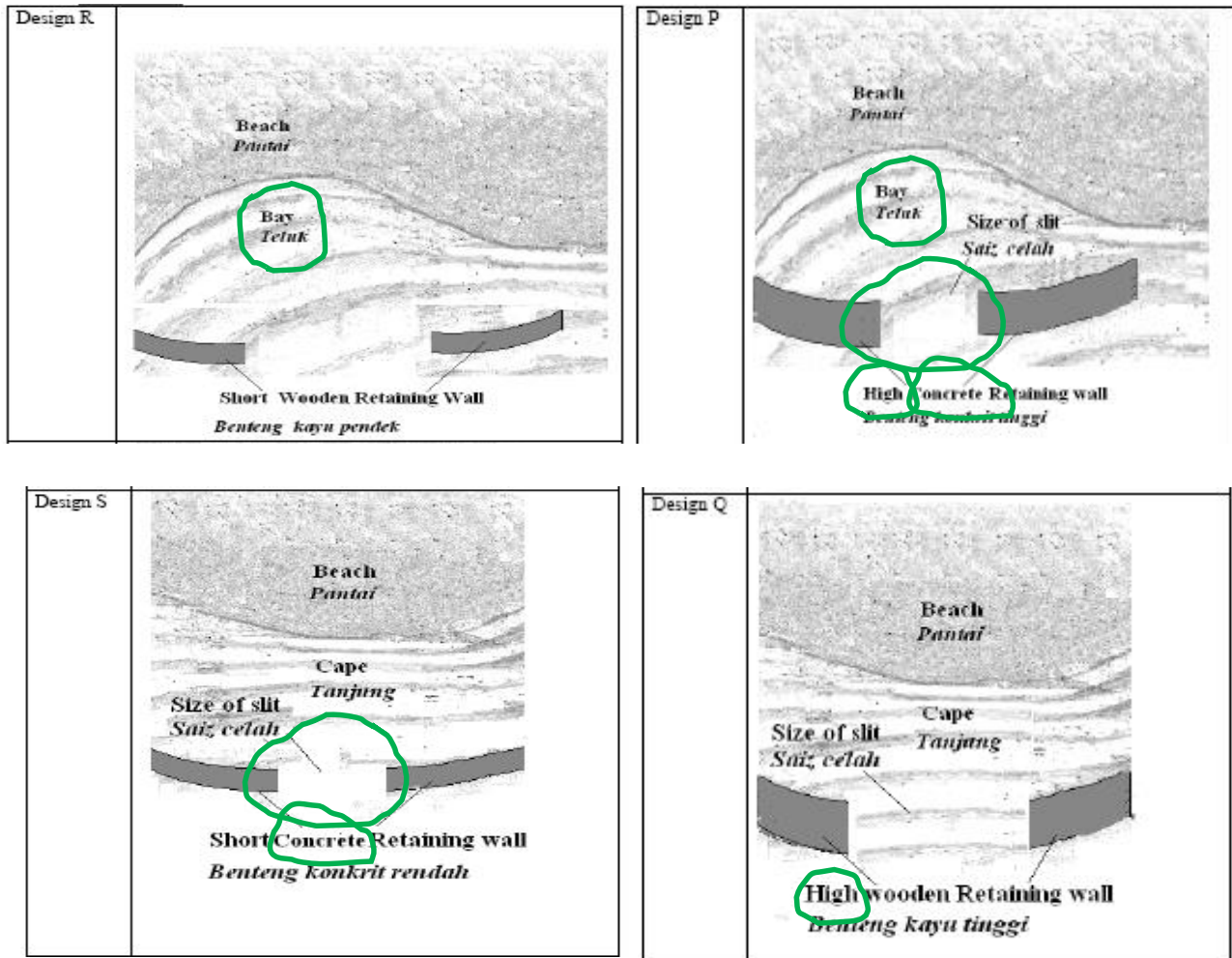
Answer:

Characteristic	Explanation
Rotating linear.	Foods can be cooked or heated up evenly.
Use Glass as material of the linear.	To prevent sparks.
Use step up transformer.	To increase to voltage supply to the oven.
Small hole metal mesh door.	To prevent the leakage of microwave.

Microwave oven R is the most suitable because it has Rotating linear, use Glass as material of the linear, use step up transformer and small hole metal mesh door.

112. You are assigned to investigate the design for the location to keep the boats and the characteristics of the retaining wall as shown in Diagram based on the following aspects:
- the location to keep the boat
 - material used for the retaining wall
 - the height of retaining wall
 - size of slit

Explain the suitability of the location and the characteristics of the retaining wall and determine the most suitable design to keep the boat safely.



Answer:

Characteristic	Reasons
Bay	Wave is calmer
Concrete retaining wall	Stronger/ / lasting
High wall	Prevent high wave
Smaller opening/aperture / slit of retaining wall	Diffraction obvious //low wave energy

Design P is the most suitable because it is at bay area, with Concrete retaining wall, with high wall and smaller size of slit.

F4 Chapter 6: Light

113. Table shows 5 materials which can be used to make an optical fibre. You are asked to investigate the characteristics of the materials in the Table which could be used to make the optical fibre. Explain the suitability of **each** characteristic and hence, determine the most suitable material to be used to make the optical fibre. Give a reason for your choice.

Material	Refractive index	% of light energy absorbed	Elasticity	Strength
P	1.70	2 %	High	Low
Q	1.80	10 %	Low	High
R	1.75	2 %	High	High
S	1.52	3 %	High	High
T	1.48	10 %	Low	Low

Answer:

Characteristic	Explanation
High refractive index	Easy for total internal reflection to occur
Small % of light energy absorbed	More light can pass through and produce brighter and clearer image
High elasticity	The optical fibre can be bent easily
High strength	Not easily break and last longer

Material R is chosen because it has high refractive index, small % of light energy absorbed, high elasticity and high strength.

114. Diagram shows an astronomical telescope to be used to view distant objects.



Telescope	Type of lens	Focal length of objective lens	Power of objective lens	Diameter of lens
S	Convex	40	10	5.0
T	Concave	10	40	5.0
U	Convex	10	40	2.5
V	Concave	40	10	2.5

Explain the suitability of each characteristic of the telescope and determine the most suitable telescope to be used to observe very far object. Give reason for your choice.

Answer:

Characteristics	Reason
Use convex lens	To converge light to form image at focal point
Focal length of objective lens must be long	To produce large magnification of image.
Low power of objective lens	To produce high magnification of image
Diameter of lens must be big	To allow more light to enter the telescope and produced a brighter and clearer image.

Telescope S is the most suitable because it uses convex lens, focal length of the objective lens is long, power of the lens is low and the diameter of the lens is big.

115. Diagram shows a car is parked under the hot Sun.

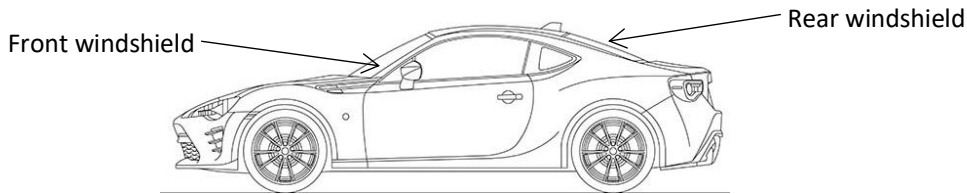


Table shows the characteristics of four tint films.

Tint films	Ability to block ultraviolet	Ability to block infrared	Ability to block visible light	Fitting
P	High	High	High	Outer side of window
Q	High	High	Low	Inner side of window
R	Low	Low	Low	Outer side of window
S	Low	Low	High	Inner side of window

Choose the most suitable tint film to be fitted on the car front and rear windows to overcome the problems.

Answer:

Characteristics	Reason
<i>High ability to block ultraviolet.</i>	<i>To reduce harmful ultraviolet from entering the car.</i>
<i>High ability to block infrared.</i>	<i>To reduce the heat from entering the car and the inner car becomes cooler.</i>
<i>Low ability to block visible light.</i>	<i>Allow more light to penetrate and give a good vision for the driver.</i>
<i>Fitted on the inner side of window.</i>	<i>To avoid wear and tear due to rain and physical contact.</i>

Tint film Q is the most suitable because it has *high ability to block ultraviolet, high ability to block infrared, low ability to block visible light and fitted to the inner side of window.*

F5 Chapter 1: Forces and Motion II

116. Diagram shows four flag poles P, Q, R and S with different specifications mounted on the ground.

<p>P</p> <p>String Tali</p> <p>Ground Tanah</p> <p>1 m 1 m</p>	<p>Maximum tension of string = 1 000 N Ketegangan maksimum tali</p> <p>Density of pole = 1 500 kg m⁻³ Ketumpatan tiang</p> <p>Flexibility of pole = Low Keterlenturan tiang Rendah</p>
<p>Q</p> <p>String Tali</p> <p>Ground Tanah</p> <p>1 m 1 m</p>	<p>Maximum tension of string = 2 000 N Ketegangan maksimum tali</p> <p>Density of pole = 900 kg m⁻³ Ketumpatan tiang</p> <p>Flexibility of pole = High Keterlenturan tiang Tinggi</p>
<p>R</p> <p>String Tali</p> <p>Ground Tanah</p> <p>1 m 1 m</p>	<p>Maximum tension of string = 1 000 N Ketegangan maksimum tali</p> <p>Density of pole = 900 kg m⁻³ Ketumpatan tiang</p> <p>Flexibility of pole = High Keterlenturan tiang Tinggi</p>
<p>S</p> <p>String Tali</p> <p>Ground Tanah</p> <p>1 m 1 m</p>	<p>Maximum tension of string = 2 000 N Ketegangan maksimum tali</p> <p>Density of pole = 1 500 kg m⁻³ Ketumpatan tiang</p> <p>Flexibility of pole = Low Keterlenturan tiang Rendah</p>

Diagram 11.2

You are required to determine the most suitable of the flag pole that can withstand strong wind.

Answer:

Characteristics	Reason
High maximum tension of string	It does not break easily
Low density of pole	Light and can be easily carried
High flexibility of pole	Not easily break under strong wind
The string is tied at higher point on the pole	More stability and the pole will not easily fall

Pole Q is the most suitable because it has high maximum tension of string, low density of pole, high flexibility of pole and the string is tied at higher point on the pole.

117. Diagram shows a traffic light with mass of 15 kg is hung by using two cables in front of a tunnel.

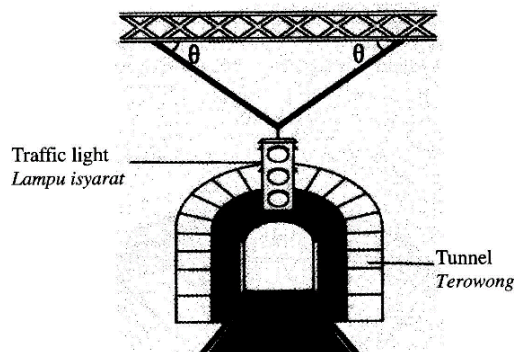


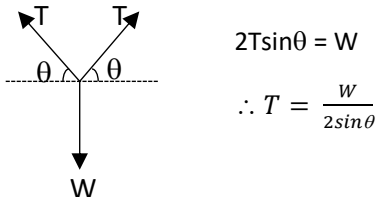
Diagram 11.2

Cable Kabel	P	Q	R	S
Angle, θ Sudut, θ	30°	60°	60°	30°
Maximum tension Tegangan maksimum	80 N	80 N	90 N	90 N
Material of cable Bahan kabel	steel ketuli	iron besi	steel ketuli	iron besi
Rate of oxidation Kadar pengoksidaan	low rendah	high tinggi	low rendah	high tinggi

Table 4

Determine the most suitable cable to be used so that the cable would not break easily when supporting the traffic light

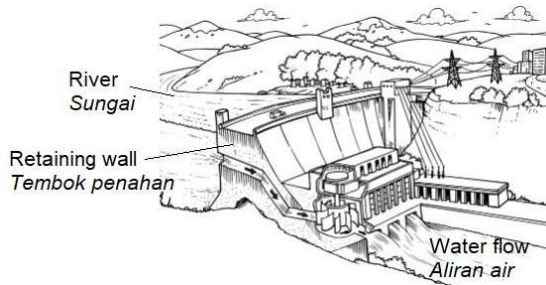
Answer:

Characteristic	Reason
Large angle , θ	The larger the angle θ , the smaller the tension in the cable 
Large maximum tension	Not easily break
Use steel as material of cable	Steel is stronger than iron and not easily break
Low rate of oxidation	Not easily rust and last longer

Cable R is the most suitable because it has large angle, θ , large maximum tension, use steel as material and low in rate of oxidation.

F5 Chapter 2: Pressure

118.



Dam	Height of the retaining wall	Type of the material of wall	The thickness of the wall at the bottom	Shape of wall
J	Low	Wood	Small	Not curved with even surface
K	High	Wood	Big	Not curved with even surface
L	High	Concrete	Big	Curved with uneven surface
M	Low	Concrete	Small	Curved with uneven surface

Study the characteristics of the dam that is safe. Explain the suitability of the characteristics and determine the most suitable dam.

Answer:

Characteristic	Reasons
High height of retaining wall.	Can retain more water.
Concrete type of wall.	Strong and not easily break, can withstand high water pressure.
Large thickness of bottom wall.	Can withstand high water pressure at the bottom.
Curved with uneven surface shape of wall.	Can withstand large force and also reduce reflection of water waves.

Dam L is the most suitable because it has high height of retaining wall, concrete type of wall, large thickness of bottom wall and Curved with uneven surface shape of wall.

119. Table shows the characteristics of five types of materials that can be used for making the soles of the trekking shoes. You are asked to study the characteristics of the materials shown in Table. Explain the suitability of each characteristics in Table and then determine the most suitable material to be used. Give a reason for your choice.

Type of material	Density (Kg/m ⁻³)	Studs	Expansion effect	Ability to stretch
P	820	Without	Low	Good
Q	700	With	Low	Good
R	720	Without	Medium	Average
S	750	Without	High	Poor
T	880	With	High	Poor

Answer:

Characteristic	Reasons
Low density	Small in mass and light
With studs	For good gripping on ground
Expansion effect is low	Always fits/Does not loosen when hot.
Ability to stretch is good	Less stress on the feet/Can walk on uneven surface.

Material Q is chosen because it has low density, with studs, low in expansion and good in ability to stretch.

120. You are required to build a hydrometer that can be used to measure densities of a concentrated acids. Table shows the characteristics of 4 types of hydrometers L, M, N and O. Decide which hydrometer is most suitable and give reasons.

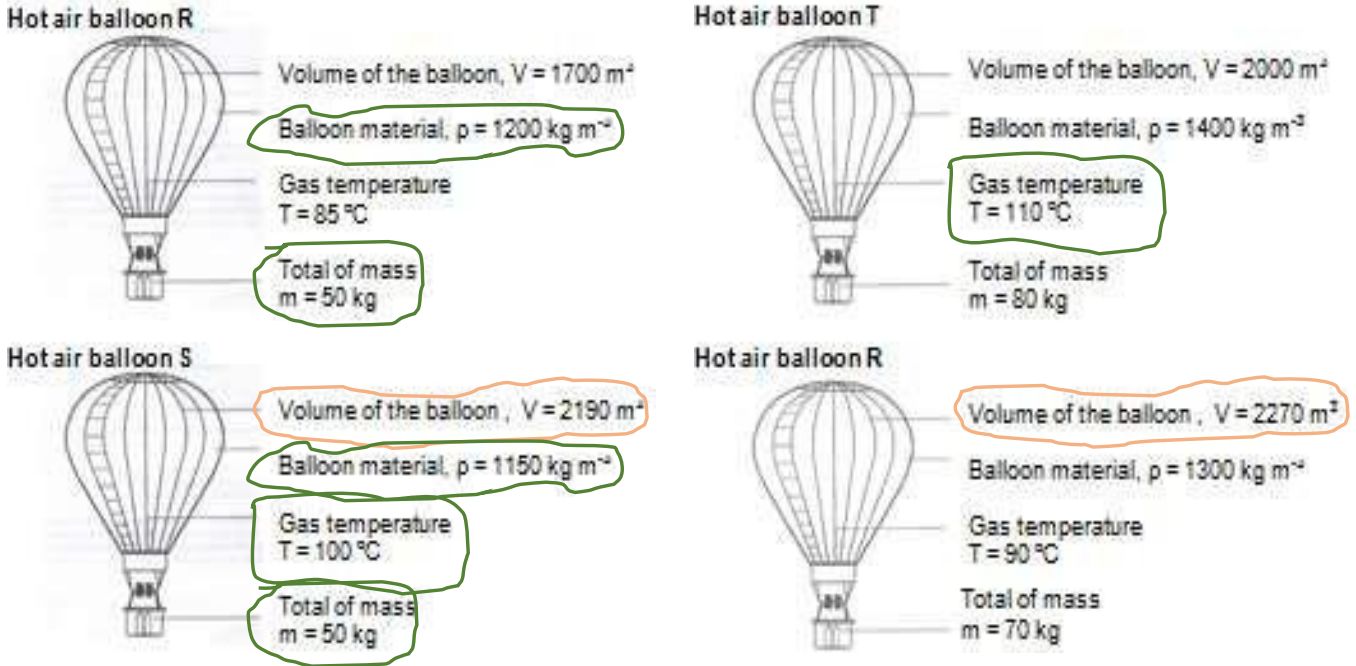
Hydrometer	Type of material of hydrometer	Diameter of capillary tube/ cm	Density of shots/ kgm ⁻³	Diameter of bottom bulb/ cm
L	Plastic	0.5	1000	1.0
M	Plastic	2.0	1300	3.0
N	Glass	0.5	9800	3.0
O	Glass	2.0	8000	1.0

Answer:

Characteristic	Explanation
Material made from glass	Glass does not corrode by petroleum base liquid
Small diameter of capillary tube	To increase the sensitivity of the hydrometer
High density of shots	Makes the hydrometer stays upright when floating in liquid
Big diameter of bottom bulb	To gain more buoyant force in order to be able to float

Hydrometer N is chosen because it is glass type of material, has small diameter capillary tube, has high density of shots and big diameter of bottom bulb

121. You are asked to investigate the characteristics of hot air balloon as below. Explain the suitability for each characteristic for the hot air balloons and then determine which hot balloon will move up the fastest into the air. Give a reason for your choice



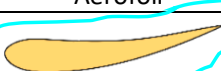



Answer

Characteristic	Reason
Large volume of the balloon	Able to displace larger amount of air to gain enough buoyant force to rise.
Density of the balloon material is low	Balloon is light and easily rise
Gas temperature is high	To produce maximum expansion of balloon and reduce the density of air in the balloon
Total of mass is low	Upwards resultant force is higher and balloon can move upwards faster.

Hot air balloon S is chosen because it has large volume balloon, low density of balloon material, high gas temperature and low in total mass.

122. Diagram shows four racing cars, P, Q, R and S, with different specifications.

Car	Spoiler Shape	Ridges on tyre	Engine power	Material for the car body
P	 Aerofoil	Yes	518 kW	Heavy and elastic
Q	 Aerofoil	None	745 kW	Light and stiff
R	 Inverted Aerofoil	Yes	518 kW	Heavy and elastic
S	 Inverted Aerofoil	None	745 kW	Light and stiff





You are required to investigate the specifications given so that the car can run very fast. Determine the most suitable car and justify your choice.

Answer:

Characteristics	Reason
Inverted aerofoil shape of spoiler	To produce downward force and prevent skidding
No ridge on tyre	provide better gripping on dry road
High engine power	Produce large acceleration
Light and stiff material for the car body	Not heavy to move and can withstand larger force

Car S is the most suitable because it has inverted aerofoil spoiler, no ridge on tyres, engine power is big and material of body is light and stiff.

123. You are asked to investigate the characteristics of four submarines shown in Table.

Shape of submarine	Volume of ballast tank	Number of air tank	Maximum pressure to be tolerated
P 	3 000 litre	15	4.5 atm
Q 	2 500 litre	30	6.0 atm
R 	350 litre	3	6.1 atm
S 	400 litre	1	2.0 atm

Explain the suitability of each characteristic of the submarines and determine the submarine which can travel faster, stay longer in deeper sea water and able to carry more crew. Give reasons for your choice.

Answer:

Characteristics	Reason
Streamline shape of submarine	Reduce water resistance and the submarine can move faster.
Large Volume of ballast tank	Can displace more water and thus gains more buoyant force
Use more air tank	Can trap more air to gain more buoyant
Can tolerate high pressure	Can submerge deeper and not easily crush due water pressure

Submarine Q is the most suitable because it has streamline shape, high volume of ballast tank with more air tanks, can tolerate higher pressure

124. You are asked to investigate the characteristics of each backhoes in Table and choose a backhoe that can do heavy works.



Explain the suitability of the characteristics each backhoes. Determine the most suitable backhoe. Give reason for your choice

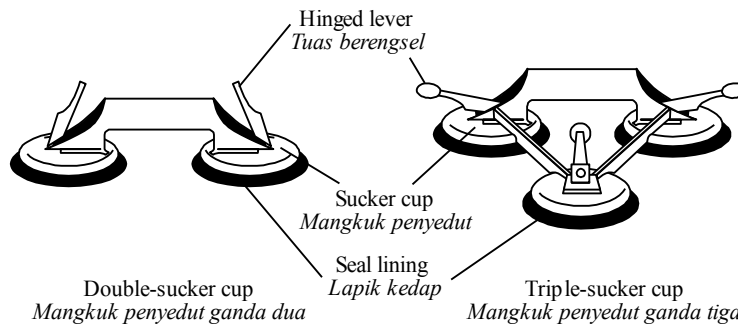
Type of Backhoe	Size of tyre	Fluid used in hydraulic system	Mass	Centre of gravity
P	Large	Liquid	Large	Low
Q	Small	Gas	Small	Low
M	Large	Gas	Large	High
N	Small	Liquid	Small	High

Answer:

Characteristics	Reason
Large size tyre	To prevent the backhoe from sinking into soft ground
Liquid type fluid in hydraulic system	Liquid has very low compressibility and liquid pressure can be transmitted equally in all direction
Large mass	The backhoe will be stable even when the bucket is full of load
Low centre of gravity	More stable not easily tumble

Backhoe P is the most suitable because it has large tyre, fluid used in hydraulic system is liquid, has large mass, large base area and has low centre of gravity.

125. Diagram below shows two different glass lifters which are used to lift heavy glass panels.



Type of glass lifter <i>Jenis pengangkat kaca</i>	Pressure in cup after hinged lever is pressed down <i>Tekanan dalam mangkuk selepas tuas berengsel ditolak ke bawah</i>	Diameter of cup <i>Diameter mangkuk</i>	Seal lining <i>Lapik kedap</i>	Number of cups <i>Bilangan mangkuk</i>
W	$6.47 \times 10^4 \text{ Pa}$	120mm	Plastic <i>Plastik</i>	Three <i>Tiga</i>
X	$6.47 \times 10^4 \text{ Pa}$	105mm	Rubber <i>Getah</i>	Two <i>Dua</i>
Y	$2.06 \times 10^4 \text{ Pa}$	120mm	Rubber <i>Getah</i>	Three <i>Tiga</i>
Z	$2.06 \times 10^4 \text{ Pa}$	105mm	Plastic <i>Plastik</i>	Two <i>Dua</i>

You are required to determine the most suitable glass lifter that can be used for lifting large and heavier pieces of glass safely .

Answer:

Characteristic	Explanation
<i>Low pressure in cup after hinged level is pressed down.</i>	<i>To produce higher difference in pressure where high atmospheric pressure presses the cups tightly onto the glass.</i>
<i>Big diameter of cups.</i>	<i>To produce higher force acting on the cup and press the cups tightly onto the glass.</i>
<i>Rubber seal lining.</i>	<i>Easily compressed and seal the cup, the cups become air tight.</i>
<i>With three cups.</i>	<i>To produce larger force and can lift a bigger piece of class.</i>

Glass lifter Y is the most suitable because it has low pressure in cup after hinged level is pressed down, big diameter of cups, used rubber seal lining and with thre cups.

126. Diagram below shows the air balloon which is used as a weather balloon to carry a radiosonde instrument for collecting data about the atmosphere.

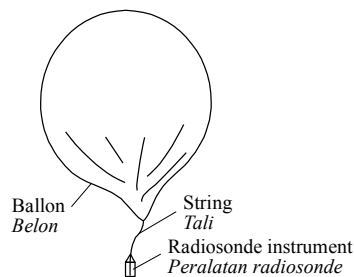


Table (b) shows the characteristics of four weather balloons,P,Q,R and S.

Balloons	Characteristics of balloons

	Size of balloon <i>Saiz belon</i>	Density of filled gas in the balloon <i>Ketumpatan gas yang diisi dalam belon / kgcm^{-3}</i>	Type of balloon fabric <i>Jenis fabric belon</i>	Mass of radiosonde <i>Jisim radiosonde</i>
P	Big <i>Besar</i>	0.090	Canvas <i>Kanvas</i>	4.5
Q	Small <i>Kecil</i>	0.178	Synthetic nylon <i>Nilon sintetik</i>	3.0
R	Big <i>Besar</i>	0.178	Synthetic nylon <i>Nilon sintetik</i>	0.5
S	Medium <i>sederhana</i>	1.429	Canvas <i>Kanvas</i>	0.4

You are required to determine the most suitable weather balloons which is able to carry the instrument to a higher altitude in a shorter time.

Answer:

Characteristic	Explanation
<i>Big size of balloon.</i>	<i>To produce large buoyant force to lift the balloon.</i>
<i>Low density of gas filled in the balloon.</i>	<i>Light and the balloon can easily lift in air.</i>
<i>Synthetic nylon type of balloon.</i>	<i>Light- weight, strong and air-proof material.</i>
<i>Low mass of radiosonde instrument.</i>	<i>Light and the balloon can easily lift in air.</i>

Balloon R is the most suitable because it has big balloon, low density of gas filled in the balloon, synthetic nylon type of balloon and low mass of radiosonde instrument.

127. Diagram (a) shows an aeroplane. Diagram (b) shows a cross section of the aeroplane's wing.

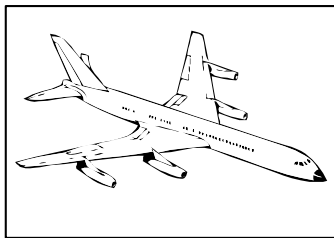


Diagram (a)
Rajah (a)

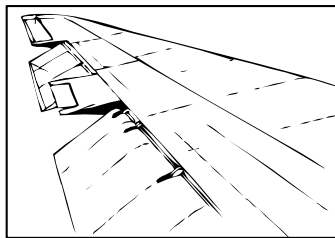

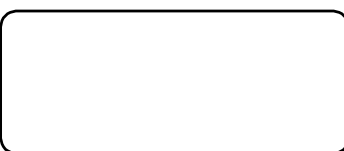


Diagram (b)
Rajah (b)

Table below shows characteristic of four designs of the aeroplane wings.

Design	Shape of cross section of wing	Area of wing/ m^2	Density of wing material/ kgm^{-3}	Difference in speed of air above and below the wing/ ms^{-1}
W		38.0	2400	0.0
X		39.7	2300	21.8

Y		60.5	2000	20.0
Z		40.5	2050	15.5

You are requested to choose the most suitable wing to be installed to the body of an aeroplane.

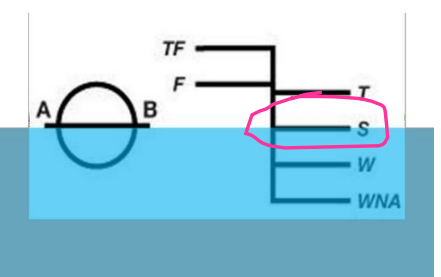
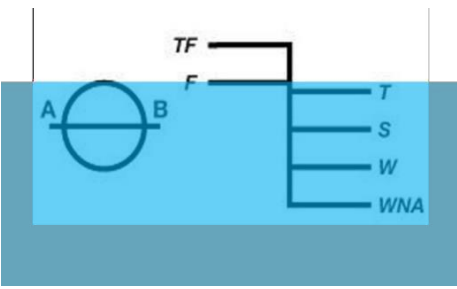
Answer:

Characteristic	Explanation
Aerofoil shape of cross section of wing.	To produce high speed air flow above the wing to create low pressure.
Large the area of the wing.	To produce large lifting force.
Low density of the wing materials.	Less weight//produce more upward resultant force.
Large difference in speed of air above and below the wing.	The produce large lifting force.

Design Y is the most suitable because it has aerofoil shape of cross section of wing, large the area of the wing, low density of the wing materials and large difference in speed of air above and below the wing.

128. Table 11 shows the characteristics of a loaded cargo ship in America.

Jadual 11 menunjukkan ciri-ciri kapal barang yang dimuatkan dengan barang di Amerika.

Cargo ship Kapal barang	Plimsoll line Garis Plimsoll	Volume Isipadu	Density of material used for cargo ship Ketumpatan bahan yang digunakan untuk membuat kapal barang	Shape Bentuk
P		Large Besar	Low Rendah	Hydrodynamics Hidrodinamik
Q		Large Besar	High Tinggi	Aerodynamics Aerodinamik

R		Small Kecil	Low Rendah	Hydrodynamics Hidrodinamik
S		Small Kecil	High Tinggi	Aerodynamics Aerodinamik

Table 11/ Jadual 11

Explain the suitability of each characteristic of the loaded cargo ship.

Determine the most suitable cargo ship which can carry more load at a time and is able to move quickly in water from America to the Strait of Malacca.

Answer:

Characteristic	Explanation
Water level at S to the plimsoll line.	To ensure that the ship will not sink too low when it passes into tropical region in Malaysia (less dense).
Largr volume.	To displace more water and produce large buoyant force.
Low density material for the cargo ship.	Less weight//produce more upward resultant force.
Hydrodynamic shape.	To reduce water resistance so the ship can move faster in water.

Cargo ship P is the most suitable because it has water level at S to the plimsoll line, largr volume, low density material for the cargo ship and hydrodynamic shape.

F5 Chapter 3: Electricity

129. As a researcher, your duty is to study the characteristics of a material to make a water heater. You are given four choices of metal type T, U, V and W. The table below shows the characteristics of the four metals. Determine the most suitable metal to be used as the material to make the heater and give your reasons.

Metal	The cross sectional area	Melting Point	Specific Heat Capacity	Length
T	Smaller	Low	High	Long
U	Larger	High	High	Short
V	Smaller	High	Low	Long
W	Larger	Low	Low	Short

Answer:

Characteristic	Explanation
Smaller cross sectional area	Has high resistance to produce more heat
High melting point	Not easy to melt and can last longer
Low specific heat capacity	The heater will be heated up faster
Long metal wire	To increase the resistance of the heating element and produce more heat

Metal V is chosen because it has smaller cross sectional area, high melting point, low specific heat capacity and long wire.

130. A student plans to fix a lamp in his room. Table shows the features of 4 different types of lamps. Explain the suitability of **each** feature in the table and then determine the most suitable lamp to be used. Give a reason for your choice

Type of lamp	Power	Efficiency	Life Span	Price
Compact fluorescent lamp	18 W	50 %	7000 hours	High
Filament lamp	75 W	12 %	1000 hours	Low
Long fluorescent lamp	20 W	45 %	14000 hours	Low
Round fluorescent lamp	24 W	40 %	10000 hours	High

Answer

Characteristic	Explanation
Low power lamp	Safe energy consumption, safe cost
High efficiency	Less power lost and more electrical energy converted into light energy
Long life span	No need to replace often
Low price	Save money and economical

Long fluorescent lamp is the most suitable because it has low power, more efficient, long life span and low in price.

131. You are required to determine the most suitable hairdryer for drying hair quickly and safely.

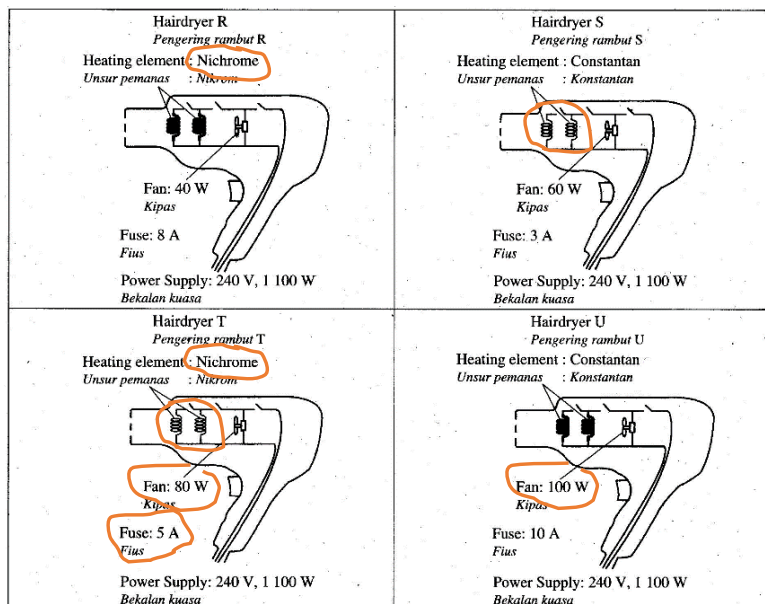


Diagram 12.3 / Rajah 12.3

Answer:

Specification	Reason
Nichrome as heating element	High resistance and produce more heat
Thin wire heating element	High resistance and produce more heat
High power fan	Can blow more air
Use 5 A fuse	Current flows in the fan $I = \frac{P}{V} = \frac{1100}{240} = 4.58 \text{ A}$

Hairdryer T is the most suitable because it has nichrome as heating element, thin wire heating element, high power fan and use 5 A fuse.

132. Table shows the specifications of a few metals to be used as a fuse wire.

Metal	Melting point /°C	Specific heat capacity / J kg ⁻¹ °C ⁻¹	Diameter	Resistivity
W	1100	900	Big	Low
X	600	900	Small	High
Y	1100	240	Big	Low
Z	700	240	Small	High

Explain the suitability of each characteristic of the four metals and determine the most suitable metal to be used as the fuse wire. Give reasons for your choice.

Answer:

Characteristics	Reason
<i>The melting point must be low</i>	<i>Easily melt when hot</i>
<i>Specific heat capacity must be low</i>	<i>Faster getting hot</i>
<i>The diameter of metal must be small</i>	<i>Has high resistance which can convert current to heat</i>
<i>The resistivity must be high</i>	<i>Produces high resistance</i>

Metal Z is chosen because it has low melting point, low specific heat capacity, small diameter and high resistivity.

133. Table shows the specifications of five fuses that can be used to protect a semiconductor device.



Fuse	Thickness of fuse wire	Cartridge type	Rating	Melting point
P	Thick	Plastic	10 A	Medium
Q	Thin	Glass	10 A	Low
R	Thin	Glass	13 A	Low
S	Thick	Plastic	13 A	High

Determine the most suitable fuse to protect a 240V, 2000 W semiconductor material device.

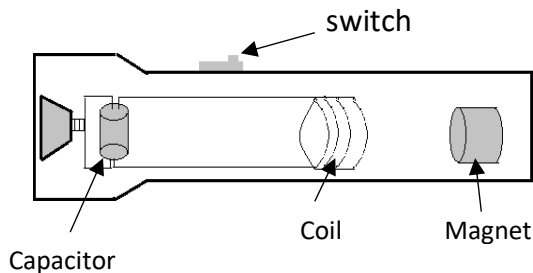
Answer:

Characteristics	Reason
<i>The thickness of fuse wire is thin</i>	<i>Has higher resistance which can be heated up faster</i>
<i>The cartridge type must be glass</i>	<i>Can see whether a fuses is broken or not</i>
<i>The fuse rating is 10 A</i>	<i>Enough to break down the 240V, 2000 W semiconductor device which needs only a current of 8.33 A</i>
<i>The melting point must be low</i>	<i>Easily melt and break the circuit when the circuit is overheated</i>

Fuse Q is the most suitable because it has thin wire fuse, cartridge type is made of glass, fuse rating is 10 A and low melting point.

##Remember: The fuse must be easily getting hot with high resistance, can easily melt so that the circuit is broken and thus protect the electrical components from getting burnt.

134. Diagram 12.3 shows a simple shake flashlight.



Shake flashlight	Number of turns of coils	Number of magnet	Ability to store energy	Type of bulb
M	Low <i>Rendah</i>	Less <i>Sedikit</i>	Large <i>Besar</i>	Filament <i>Filamen</i>
N	High <i>Tinggi</i>	More <i>Banyak</i>	Small <i>Kecil</i>	LED <i>LED</i>
O	High <i>Tinggi</i>	More <i>Banyak</i>	Large <i>Besar</i>	LED <i>LED</i>
P	High <i>Tinggi</i>	Less <i>Sedikit</i>	Small <i>Kecil</i>	Filament <i>Filamen</i>

Determine the most suitable shake flashlight model that can function efficiently during emergency.

Answer:

Characteristic	Explanation
High number of turns of coils.	More induced current is produces.
More number of magnet.	High magnetic field strength to produce more induced current.
Large ability to store energy.	Can store more charge and can be use longer.
LED type of bulb.	Less power consumption and produce brighter light.

Shake flashlight O is the most suitable because it has High number of turns of coils, More number of magnet, Large ability to store energy and use LED type of bulb.

F5 Chapter 4: Electromagnet

135. The transmission of electricity over the National Grid Network uses high voltage cables. You are assigned to study the characteristics of cables which could be used as transmission cable. Table shows the characteristics of four transmission cables. Determine the most suitable transmission cable to be used and give reasons for your choice.

Cable	Resistivity / Ωm^{-1}	Density / kg m^{-3}	Cost	Rate of thermal expansion
P	3.0×10^{-7}	5×10^5	Low	High
Q	1.8×10^{-8}	2×10^3	Low	Low
R	7.5×10^{-7}	8×10^2	High	Low
S	7.0×10^{-8}	4×10^3	High	High

Answer:

Characteristic	Explanation
Low resistivity	To reduce power/heat loss in the cables
Low density	The cables will be lighter and reduce sagging
Low cost	Cost of project will be lower
Low rate of thermal expansion	The cables will not expand and sag under hot weather

Cable Q is the most suitable because it has low resistivity, low density, low cost and low rate of thermal expansion

136. Diagram shows the cross-section of a fast train.

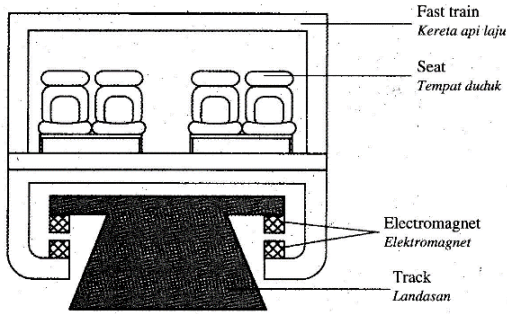


Diagram 11.2

Fast train Kereta api laju	Material to build the body of the fast train Bahan untuk membina badan kereta api laju	Side view of the shape of the fast train Pandangan sisi bentuk kereta api laju	Material to make the electromagnet at the base of the fast train Bahan yang digunakan untuk membuat elektromagnet pada kereta api laju	Number of coach of the fast train Bilangan gerabak pada kereta api laju
J	low density ketumpatan rendah	Pentagon Pentagon	superconductor superkonduktor	one long coach satu gerabak panjang
K	high density ketumpatan tinggi	Aerodynamic Aerodinamik	soft-iron core teras besi lembut	8 short coaches 8 gerabak pendek
L	low density ketumpatan rendah	Aerodynamic Aerodinamik	superconductor superkonduktor	8 short coaches 8 gerabak pendek
M	high density ketumpatan tinggi	Pentagon Pentagon	soft-iron core teras besi lembut	one long coach satu gerabak panjang

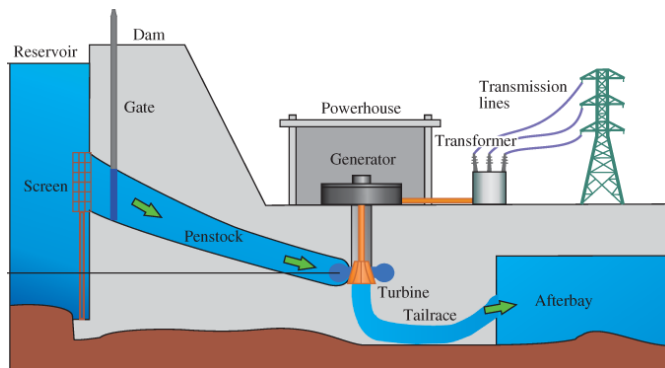
Determine the most suitable fast train which can move with highest speed.

Answer:

Aspect	Reason
Use low density material to build the body of the fast train	Light and able to move faster
Aerodynamic shape of fast train	Reduce air resistance and the train can move faster
Use superconductor as the material to make the electromagnet	Superconductor has zero resistance, so a very high strength electromagnet can be produced
Use 8 short coaches	Small in mass and the train has small inertia, so the train can start up or slow down in a very short time

Fast train L is the most suitable because it has low density material, aerodynamic shape, use superconductor to make electromagnet and has 8 short coaches

137. Diagram 12.1 shows the building structure of construction of a hydro power generating plant.



You are required to determine the most suitable transformer to be used in hydro power generating plant, Explain the suitability of the characteristics of the transformer. Choose the most suitable transformer.

Transformer	Ratio number of primary coil to number of secondary coil	Type of iron core	Thickness laminated iron core/mm	Shape of iron core
P	100 : 200	Steel	2.0	O
Q	200 : 100	Soft iron	1.0	U
R	20000 : 200	Steel	0.5	U
S	200 : 20000	Soft iron	0.2	O

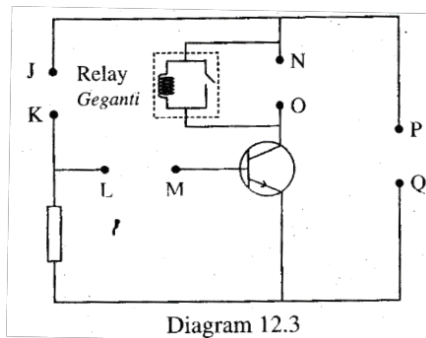
Answer:

Characteristic	Reason
Ration $N_p : N_s$ is 200 : 20000	To step up the output voltage as transmission of electricity under high voltage can reduce power lost.
Soft iron type of iron core.	Easily magnetised and demagnetized to produce high induced current.
Thin laminated iron core.	To reduce eddy current.
O shape of iron core.	To reduce leakage of magnetic field.

Transformer S is the most suitable because it has Ration $N_p : N_s$ is 200 : 20000, Soft iron type of iron core, Thin laminated iron core and O shape of iron core.

F5 Chapter 5: Electronic

138. You are required to determine the most suitable set of electronic components that can cause the fire alarm system to function



Set of electronic component Set komponen elektrik	Terminal JK	Terminal LM	Terminal NO	Terminal PQ
W	LED	Capacitor Kapastor	Alarm Penggera	Cell 1 Sel 1
X	Thermistor Termistor	Resistor Perintang	Alarm Penggera	Cell 2 Sel 2
Y	Thermistor Termistor	Capacitor Kapastor	LED	Cell 2 Sel 2
Z	LED	Resistor Perintang	LED	Cell 1 Sel 1

Table 12

Explain the suitability of each electronic component and then determine the most suitable set of electronic component

Answer

Component	Reason
Terminal JK: Thermistor is connected	As a potential divider. When temperature increases, voltage in the base circuit increases.
Terminal LM: A resistor is connected	To control and limit base current
Terminal NO: An alarm is connected	To produce loud alarm sound to warn the public
Terminal PQ: Cell 2 is connected	Negative terminal of the cell must be connected to the emitter terminal of the transistor

Set electric component X is the most suitable because it has thermistor in terminal JK, resistor in terminal LM, an alarm in terminal NO and cell 2 in terminal PQ.

F5 Chapter 6: Nuclear Physics

139. Table shows the characteristics of five radioisotopes P, Q, R, S and T. As a factory engineer, you are required to determine the most suitable radioisotope that can be used by the system to ensure the volume of guava juice is uniform. Study the characteristics of all 5 radioisotopes and explain the suitability of the aspects. Determine the most suitable radioisotope and give the reason for your choice.

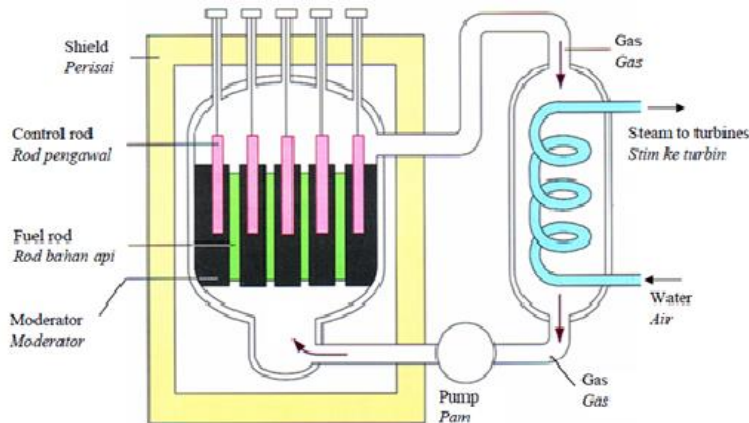
Radioisotope	Half life	Types of ray	State of matter	Ionising power
P	7 hours	Alpha	Solid	High
Q	10 days	Beta	Liquid	High
R	100 days	Gamma	Solid	Low
S	10 years	Gamma	Liquid	Low
T	30 years	Beta	Solid	Low

Answer:

Characteristics	Explanation
Has a long half-life	Can be used for a long time hence save cost
Emits beta ray	Has medium penetrating power
In solid state	Easy to handle and will not spill
Low ionising power	Does not change the state and taste of juice.

Radioisotope T is the most suitable because it has long half-life, emits beta ray, in solid state and low ionizing power.

140. Diagram shows the schematic diagram of a nuclear reactor at a nuclear power station.



You are required to determine the most suitable design of nuclear reactor so that the nuclear energy can be used efficiently and safely in the generation of electricity. Determine the most suitable design and justify your choice.

Design	Type of reaction	Half-life of nuclear fuel	Specific heat capacity of gas	Material of shield
P	Fusion	Long	Low	Brick
Q	Fission	Short	High	Concrete
R	Fission	Long	Low	Concrete
S	Fusion	Short	High	Brick

Answer:

Characteristics	Reason
Type of reaction is fission	Reaction can easily occur at low temperature
Half-life of nuclear fuel must be long	Can be used for longer time with the least of replacement
Specific heat capacity of gas must be low	Heated up faster
Material of shield must be concrete	Prevent leakage of radiation

Design R is the most suitable because its type of reaction is fission, half-life of the fuel is long, specific heat capacity of gas is low and material of the shield is concrete.