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Work, Energy, Power

Exam — Work, Energy & Power

60 no-calculator Pre-med/IB-style questions that build from definitions and units to work signs, conservative vs non-conservative forces, energy conservation, springs, friction, force–distance graphs, efficiency, and power reasoning.

60 items — Printable Exam

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1 A constant force F acts on an object that undergoes a displacement d . The angle between the force and the displacement is θ . Which expression gives the work done by this force?



- A** $W = F/d$
- B** $W = Fd \cos \theta$
- C** $W = Fd \sin \theta$
- D** $W = F + d$
- E** $W = Fd/2$ (always)

2 Which of the following is the SI unit of work (and energy)?



- A** Watt (W)
- B** Newton (N)
- C** Joule (J)
- D** Pascal (Pa)
- E** Coulomb (C)

3 A student pushes hard on a wall for 10 seconds, but the wall does not move. The work done by the student on the wall is:



- A** Positive because a force was applied
- B** Negative because the wall pushes back
- C** Zero because the displacement is zero
- D** Equal to the student's weight times 10 s
- E** Impossible to determine without knowing the force magnitude





4 A force acts on an object while the object's displacement is in the same direction as the force. The work done by the force is:



- A Always negative
- B Always zero
- C Positive
- D Positive only if the object speeds up
- E Zero unless the force is friction

5 A force acts on an object, but the displacement is opposite the direction of the force. The work done by the force is:



- A Positive
- B Negative
- C Zero
- D Always equal to the kinetic energy
- E Cannot be determined

6 A force is always perpendicular to an object's displacement. The work done by that force is:



- A Maximum and positive
- B Maximum and negative
- C Zero
- D Equal to Fd





- E Equal to the object's potential energy

7 Which statement is the work–energy theorem?



- A Net work equals the change in momentum
- B Net work equals the change in kinetic energy
- C Work equals power divided by time
- D Work equals mass times velocity
- E Net work is always zero

8 If the net work done on an object is negative, what must be true about its kinetic energy?



- A It increases
- B It decreases
- C It stays the same
- D It becomes zero
- E It becomes negative

9 Which best defines power?



- A Force multiplied by displacement
- B Energy stored in a system





- C Rate at which work is done (or energy is transferred)
- D Change in momentum per unit time
- E Force divided by acceleration

10 Which is the correct SI unit equivalence for power?



- A $1 \text{ W} = 1 \text{ N}$
- B $1 \text{ W} = 1 \text{ J}$
- C $1 \text{ W} = 1 \text{ J/s}$
- D $1 \text{ W} = 1 \text{ N} \cdot \text{s}$
- E $1 \text{ W} = 1 \text{ kg} \cdot \text{m}$

11 A machine does the same amount of work in half the time. Its average power is:



- A Half
- B The same
- C Twice
- D Four times
- E Zero

12 Two students lift the same box to the same height. Student A takes 10 s; student B takes 5 s. Ignoring losses, which is correct?





- A A does more work because it takes longer
- B B does more work because it is faster
- C They do the same work, but B has greater average power
- D A has greater power because the force is larger
- E Work is zero because the box starts and ends at rest

13 If an object's speed doubles, its kinetic energy becomes:



- A Half as large
- B Twice as large
- C Four times as large
- D Eight times as large
- E Unchanged

14 Two objects have the same speed. Object B has twice the mass of object A. Compared to A, B's kinetic energy is:



- A Half
- B The same
- C Twice
- D Four times
- E Eight times





15 Two objects have the same momentum magnitude p but different masses. Which one has the larger kinetic energy?

- A The larger mass
- B The smaller mass
- C They have the same kinetic energy
- D The one moving slower
- E Cannot be determined without knowing their speeds



16 Two objects have the same kinetic energy K but different masses. Which one has the larger momentum magnitude?

- A The larger mass
- B The smaller mass
- C They have the same momentum
- D The one moving faster
- E Cannot be determined without g



17 A block slides on a rough horizontal floor and slows down. The work done by friction on the block is best described as:

- A Positive, because friction is a force
- B Zero, because friction is internal
- C Negative, converting mechanical energy into thermal energy
- D Negative, converting thermal energy into mechanical energy
- E Positive, increasing the block's kinetic energy





18 A block slides along a straight horizontal surface. Which force does zero work on the block during this motion (assuming the surface is horizontal and the block stays in contact)?



- A** Kinetic friction
- B** Applied push along the motion
- C** Normal force from the surface
- D** Air resistance opposite motion
- E** Any force always does work if the object moves

19 A block slides down a smooth (frictionless) incline. Which statement about the normal force from the incline on the block is correct?



- A** It does positive work because it helps the block slide
- B** It does negative work because it opposes motion
- C** It does zero work because it is perpendicular to the motion along the surface
- D** It does work equal to mgh
- E** It does more work on steeper inclines

20 A rock is carried horizontally at constant speed across level ground. The work done by gravity on the rock during this horizontal motion is:



- A** Positive
- B** Negative
- C** Zero





- D Equal to mgh
- E Equal to mg times the horizontal distance

21 A book is lifted straight up by height h at constant speed. The work done by gravity on the book is:



- A $+mgh$
- B $-mgh$
- C 0
- D $+mg/h$
- E Depends on how fast it is lifted

22 A book is lowered straight down by height h at constant speed. The work done by gravity on the book is:



- A $+mgh$
- B $-mgh$
- C 0
- D $+mg/h$
- E Depends on the book's mass only, not h

23 Two different paths take a hiker from the same start point to the same higher end point (height gain h). Ignoring friction/air resistance, the work done against gravity is:





- A Greater for the longer path because distance is larger
- B Greater for the steeper path because it feels harder
- C The same for both paths because it depends only on height gained
- D Zero because gravity is conservative
- E Impossible to compare without time taken

24 Which force is non-conservative in the usual high-school physics model (so the work depends on the path taken)?



- A Gravity near Earth
- B Spring force (ideal)
- C Kinetic friction
- D Electrostatic force between charges (ideal)
- E All forces are conservative

25 A cart rolls down a frictionless track from height h and reaches the bottom. If released from rest, its speed at the bottom depends primarily on:



- A The cart's mass
- B The track's length
- C The vertical drop h
- D The time taken to descend
- E The color of the cart





26 Two carts of masses m and $2m$ roll down the same frictionless track from the same height, starting from rest. At the bottom, their speeds are:

- A The heavier cart is faster
- B The lighter cart is faster
- C The same
- D The heavier cart has half the speed
- E Impossible to compare without friction data



27 A ball is thrown straight up (ignore air resistance). Which energy change is correct as it rises?

- A Kinetic energy increases and gravitational potential energy decreases
- B Kinetic energy decreases and gravitational potential energy increases
- C Both kinetic and gravitational potential energy increase
- D Both kinetic and gravitational potential energy decrease
- E Energy is not conserved in vertical motion



28 A ball is thrown upward and returns to the launch height. If air resistance is significant, the speed when it returns is:

- A Greater than the launch speed
- B Equal to the launch speed
- C Less than the launch speed
- D Zero
- E Impossible because it cannot return





29 A spring is compressed by distance x . If it is compressed to $2x$ instead, the elastic potential energy stored becomes:



- A 2 times larger
- B 3 times larger
- C 4 times larger
- D 8 times larger
- E $1/4$ as large

30 An ideal spring launches a cart from rest on a frictionless track. If the spring's initial compression is increased, what happens to the cart's launch speed?



- A It decreases because the spring resists more
- B It increases because more elastic potential energy becomes kinetic energy
- C It stays the same because the cart's mass is unchanged
- D It becomes zero because energy is stored, not transferred
- E It depends only on track length

31 A constant force F acts over a displacement d . On a force–displacement (F – x) graph, the work done is equal to:



- A The slope of the graph
- B The area under the graph between the two positions
- C The maximum value of the force
- D The time taken





E The average speed

32 A force increases linearly from 0 to F as an object moves a distance d in the same direction. What is the work done by this force?



- A Fd
- B $2Fd$
- C $(1/2)Fd$
- D F/d
- E 0

33 An object moves with constant speed in a circle. Which statement about the net work done on the object over one full circle is correct?



- A Net work is positive because it keeps moving
- B Net work is negative because the direction keeps changing
- C Net work is zero because kinetic energy is unchanged
- D Net work equals the centripetal force times the circumference
- E Net work is undefined for circular motion

34 Instantaneous power delivered by a force to a moving object is best given by:



- A $P = F/d$
- B $P = Fv \cos \theta$ (where θ is angle between F and v)





- C $P = mv$
- D $P = (1/2)mv^2$
- E $P = F + v$

35 A force acts on an object, but at that instant the force is perpendicular to the object's velocity. The instantaneous power delivered by that force is:



- A Maximum and positive
- B Maximum and negative
- C Zero
- D Equal to Fv
- E Equal to the object's kinetic energy

36 A motor lifts a load of weight W upward at constant speed v . Ignoring losses, the power output is best expressed as:



- A $P = W/v$
- B $P = Wv$
- C $P = W + v$
- D $P = W - v$
- E $P = Wt$





37 Two identical motors lift identical loads through the same height. Motor A takes 4 s; motor B takes 2 s. Which statement is correct?

- A** Motor A does twice the work
- B** Motor B does half the work
- C** They do the same work, but motor B's average power is twice
- D** They do different work because time is different
- E** Motor B does negative work because it is faster



38 A sled is pulled at constant speed across level ground by a horizontal force. Ignoring air resistance, which energy statement is best?

- A** The pull does no work because speed is constant
- B** The pull does positive work that is converted into thermal energy by friction
- C** Friction does positive work to keep it moving
- D** Kinetic energy must increase because there is a pull
- E** Total work must be positive because the sled moves



39 A box slides to rest due to kinetic friction on a horizontal surface. If the initial speed is doubled and the friction force magnitude stays the same, the stopping distance becomes:

- A** Twice
- B** Four times
- C** Half
- D** One quarter
- E** Unchanged





40 A car's brakes provide approximately the same average braking force each time. If the car's speed is increased by a factor of 3, the braking distance to stop becomes:



- A 3 times
- B 6 times
- C 9 times
- D 1/3 as large
- E 1/9 as large

41 A machine has efficiency 40%. This means:



- A 40% of the input energy is destroyed
- B 40% of the input energy becomes useful output; the rest becomes other forms (like heat)
- C 40% of the input energy becomes kinetic; the rest disappears
- D The machine must run at 40 W
- E Efficiency depends only on mass, not design

42 A device takes in 200 J of electrical energy and delivers 50 J of useful mechanical work. Its efficiency is:



- A 25%
- B 50%
- C 75%
- D 150%





E 0%

43 A motor has constant power output. If it lifts the same mass through the same height but in half the time, what changes?



- A The work decreases
- B The work increases
- C The required power increases
- D The required power decreases
- E Nothing changes because height is the same

44 A student says: "A bigger force always means more work." Which is the best correction?



- A Correct: work depends only on force
- B Incorrect: work depends on force, displacement, and the angle between them
- C Incorrect: work depends only on time
- D Incorrect: work depends only on speed
- E Correct only if friction is present

45 A person carries a heavy suitcase at constant speed up a flight of stairs. Ignoring losses, the work done by the person on the suitcase is approximately:



- A 0 because speed is constant





- B mgh where h is the vertical height climbed
- C mg times the horizontal distance walked
- D Equal to the suitcase's kinetic energy
- E Negative because gravity is downward

46 A rock falls from rest from height h with no air resistance. Just before hitting the ground, its kinetic energy is approximately:



- A 0
- B mgh
- C $2mgh$
- D $mgh/2$
- E Depends on the path taken

47 A roller coaster car starts from rest at height h . At a point where its height is $h/2$ (ignore friction), which statement is correct?



- A It has lost all potential energy, so kinetic energy is maximum
- B Its kinetic energy equals its remaining potential energy
- C Its kinetic energy is zero because it is still above the ground
- D Its potential energy is negative, so it must stop
- E Energy is not conserved on tracks





48 A student says: "Gravitational potential energy is always positive." Which is correct?

- A** True, because height is always positive
- B** False: the zero of potential energy is a chosen reference; only changes in potential energy are physically meaningful
- C** True only on Earth
- D** False because potential energy must equal kinetic energy
- E** True because g is positive



49 A block is pulled up a frictionless incline from height 0 to height h . Compared to lifting it straight up vertically the same height, the required work done against gravity is:

- A** Larger on the incline because the distance is longer
- B** Smaller on the incline because the force is smaller
- C** The same, equal to mgh
- D** Zero on the incline because gravity is perpendicular
- E** Impossible to compare



50 A block is pushed up a rough incline at constant speed. Compared with the frictionless case, the work done by the applied force is:

- A** Less because friction helps
- B** The same because height gained is the same
- C** More because it must supply mgh plus energy lost to friction
- D** Zero because speed is constant
- E** Negative because friction is negative





51 A constant force F is applied to an object, but the object's speed remains constant while it moves. Which statement must be true?



- A** The net force must be zero, so there is another force balancing F
- B** The work done by F must be zero
- C** The kinetic energy must be increasing
- D** The object must be moving in a circle
- E** Energy is not conserved

52 A stone is thrown upward. At the very top of its path (ignoring air resistance), which is true?



- A** Kinetic energy is maximum and potential energy is minimum
- B** Kinetic energy is zero and potential energy is maximum (relative to launch height)
- C** Both kinetic and potential energies are zero
- D** Total mechanical energy is zero
- E** Acceleration is zero, so energy is not defined

53 If the net work on an object over a time interval is zero, which statement must be true?



- A** The object must be at rest at the end
- B** The object's speed at the end equals its speed at the start
- C** The object's direction of motion must be unchanged
- D** No forces acted during the interval





- E The object's displacement must be zero

54 A block moves in a circle at constant speed on a frictionless table attached to a string (tension provides centripetal force). The work done by the tension force over any small segment of motion is approximately:



- A Positive
- B Negative
- C Zero
- D Equal to the block's kinetic energy
- E Equal to mv^2/r

55 A motor delivers constant power P to a cart on a frictionless track. As the cart speeds up, the driving force provided by the motor (in the direction of motion) tends to:



- A Increase
- B Stay constant
- C Decrease
- D Become negative
- E Become equal to mg

56 A device outputs 100 W of useful power while taking in 250 W of electrical power. Its efficiency is:





- A 10%
- B 25%
- C 40%
- D 60%
- E 250%

57 A pendulum swings through its lowest point. Ignoring air resistance, which statement is correct about energies at the lowest point compared to the highest point?



- A Potential energy is maximum and kinetic energy is minimum
- B Potential energy is minimum and kinetic energy is maximum
- C Both energies are maximum
- D Both energies are zero
- E Energy is not conserved in pendulum motion

58 A student claims: "If a force acts, the object must gain energy." Which statement best refutes this?



- A Any force always increases speed
- B A force can do negative work (like friction), reducing kinetic energy
- C Forces cannot do work
- D Energy can only change with gravity
- E Energy is never conserved





59 Which statement about energy conservation is most correct in real situations?



- A** Energy is conserved only if there is no friction
- B** Energy is never conserved because friction destroys energy
- C** Total energy is conserved, but mechanical energy may decrease as it transforms into thermal/internal energy
- D** Mechanical energy is always conserved, even with friction
- E** Only kinetic energy is conserved in all processes

60 A constant braking force brings a moving object to rest. If the object's mass is doubled but its initial speed is unchanged, the stopping distance (with the same braking force) becomes:



- A** Half
- B** The same
- C** Twice
- D** Four times
- E** One quarter







#	Ans	Answer Text
	B	
2	C	Joule (J)
	C	
4	C	Positive
	B	
6	C	Zero
	B	
8	B	It decreases
	C	
10	C	$1 \text{ W} = 1 \text{ J/s}$
	C	
12	C	They do the same work, but B has greater average power
	C	
14	C	Twice
	B	
16	A	The larger mass
	C	
18	C	Normal force from the surface
	C	
20	C	Zero
	B	
22	A	$+mgh$
	C	
24	C	Kinetic friction
	C	
26	C	The same
	B	
28	C	Less than the launch speed
	C	
30	B	It increases because more elastic potential energy becomes kinetic energ...
	B	
32	C	$(1/2)Fd$
	C	
34	B	$P = Fv \cos \theta$ (where θ is angle between F and v)
	C	
36	B	$P = Wv$
	C	
38	B	The pull does positive work that is converted into thermal energy by fri...



