3.3 Physics: Forces and Energy: 2-hour Pack

ISEB CE 13+ Science (Physics) · Calculator allowed · about 120 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 What is the unit of mass?

- [ ] A) joule (J)
- [ ] B) kilogram (kg)
- [ ] C) hertz (Hz)
- [ ] D) degree Celsius
- [ ] E) watt (W)

---

2 A car of mass 1200 kg speeds up from 10 m/s to 20 m/s. Calculate its kinetic energy at 20 m/s using KE = 0.5 x mass x speed^2.

(1)

---

3 A spring has a natural length of 15 cm. A force of 2 N extends it by 0.8 cm. Calculate the total length of the spring under a force of 8 N (within the limit of proportionality), in cm.

- [ ] A) 18.2 cm
- [ ] B) 21.4 cm
- [ ] C) 21 cm
- [ ] D) 3.2 cm
- [ ] E) 15.8 cm

---

4 A see-saw is balanced. Ella (weight 550 N) sits 2 m from the pivot. Aisha sits 5.5 m from the pivot on the other side. Calculate Aisha's weight in N.

- [ ] A) 1100 N
- [ ] B) 6050 N
- [ ] C) 200 N
- [ ] D) 1512.5 N
- [ ] E) 550 N

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5 An appliance of power 50 W transfers 2000 J of energy. Calculate the time taken in s.

- [ ] A) 100000 s
- [ ] B) 400 s
- [ ] C) 0.025 s
- [ ] D) 40 s
- [ ] E) 1950 s

---

6 A crate rests on the ground and presses down with a force of 2 N on an area of 0.1 m^2. Calculate the pressure on the ground in N/m2.

- [ ] A) 1.9 N/m2
- [ ] B) 0.2 N/m2
- [ ] C) 200 N/m2
- [ ] D) 0.05 N/m2
- [ ] E) 20 N/m2

---

7 A horse pulls with a constant force of 60 N through a distance of 25 m. Calculate the work done in kJ.

- [ ] A) 1500000 kJ
- [ ] B) 15 kJ
- [ ] C) 0.15 kJ
- [ ] D) 1.5 kJ
- [ ] E) 1500 kJ

---

8 What is the name of the force between two magnets?

- [ ] A) magnetic force
- [ ] B) air resistance
- [ ] C) weight
- [ ] D) tension
- [ ] E) upthrust

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9 A force of 200 N does 4000 J of work on an object. Calculate the distance moved in the direction of the force, in m.

- [ ] A) 800000 m
- [ ] B) 200 m
- [ ] C) 3800 m
- [ ] D) 0.05 m
- [ ] E) 20 m

---

10 What is the useful energy transfer in a solar cell?

- [ ] A) electrical to kinetic
- [ ] B) electrical to sound
- [ ] C) light to electrical
- [ ] D) sound to electrical
- [ ] E) electrical to thermal

---

11 What is the unit of frequency?

- [ ] A) hertz (Hz)
- [ ] B) ampere (A)
- [ ] C) newton (N)
- [ ] D) degree Celsius
- [ ] E) ohm

---

12 A ball of mass 0.5 kg is thrown upwards at a speed of 4 m/s. Use the equation: kinetic energy (KE) = 0.5 x mass x speed^2. Calculate the ball's kinetic energy.

(1)

---

13 A force of 30 N acts at a perpendicular distance of 3 m from a pivot. Calculate the moment in N m.

- [ ] A) 0.1 N m
- [ ] B) 10 N m
- [ ] C) 90 N m
- [ ] D) 33 N m
- [ ] E) 27 N m

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14 An appliance transfers 200 J of energy in 5 s. Calculate its power in W.

- [ ] A) 195 W
- [ ] B) 0.025 W
- [ ] C) 400 W
- [ ] D) 1000 W
- [ ] E) 40 W

---

15 A concrete block rests on the ground and presses down with a force of 1000 N on an area of 0.2 m². Calculate the pressure on the ground in N/m2.

- [ ] A) 500 N/m2
- [ ] B) 5000 N/m2
- [ ] C) 200 N/m2
- [ ] D) 50000 N/m2
- [ ] E) 999.8 N/m2

---

16 A parcel that weighs 100 N on Earth, where the gravitational field strength is 10 N/kg. Calculate its mass in kg.

- [ ] A) 100 kg
- [ ] B) 1 kg
- [ ] C) 1000 kg
- [ ] D) 10 kg
- [ ] E) 0.1 kg

---

17 A crane pulls with a constant force of 800 N through a distance of 15 m. Calculate the work done in kJ.

- [ ] A) 12000 kJ
- [ ] B) 120 kJ
- [ ] C) 12000000 kJ
- [ ] D) 1.2 kJ
- [ ] E) 12 kJ

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18 What is the useful energy transfer in a toaster?

- [ ] A) electrical to thermal
- [ ] B) electrical to sound
- [ ] C) kinetic to electrical
- [ ] D) sound to electrical
- [ ] E) chemical to electrical

---

19 An appliance transfers 5000 J of energy in 10 s. Calculate its power in W.

- [ ] A) 5000 W
- [ ] B) 0.002 W
- [ ] C) 500 W
- [ ] D) 50000 W
- [ ] E) 4990 W

---

20 A crate rests on the ground and presses down with a force of 20 N on an area of 0.2 m^2. Calculate the pressure on the ground in N/m2.

- [ ] A) 19.8 N/m2
- [ ] B) 100 N/m2
- [ ] C) 4 N/m2
- [ ] D) 1000 N/m2
- [ ] E) 0.01 N/m2

---

21 Nina has a mass of 105 kg. The gravitational field strength on the Moon is 1.6 N/kg. Calculate the weight on the Moon in N.

- [ ] A) 168 N
- [ ] B) 1680 N
- [ ] C) 105 N
- [ ] D) 1050 N
- [ ] E) 65.625 N

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22 A motor pulls with a constant force of 500 N through a distance of 5 m. Calculate the work done in kJ.

- [ ] A) 0.1 kJ
- [ ] B) 2500 kJ
- [ ] C) 2.5 kJ
- [ ] D) 2500000 kJ
- [ ] E) 25 kJ

---

23 Which quantity is measured in the volt?

- [ ] A) mass
- [ ] B) potential difference
- [ ] C) force
- [ ] D) resistance
- [ ] E) temperature

---

24 A student pushes a heavy box across the classroom with a constant force of 38 N over a horizontal distance of 8 m. Calculate the work done on the box. Use the equation: work done = force x distance.

(1)

---

25 A spring extends by 5 cm under a force of 5 N. Assuming it obeys Hooke's law, calculate its extension under a force of 3 N, in cm.

- [ ] A) 0.3 cm
- [ ] B) 6 cm
- [ ] C) 1.5 cm
- [ ] D) 30 cm
- [ ] E) 3 cm

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26 A 50 W appliance is switched on for 2 minutes. Calculate the energy transferred in J.

- ☐ A) 600 J
- ☐ B) 100 J
- ☐ C) 6000 J
- ☐ D) 170 J
- ☐ E) 60000 J

---

27 A metal block rests on the ground and presses down with a force of 2.5 N on an area of 0.01 m^2. Calculate the pressure on the ground in N/m2.

- ☐ A) 250 N/m2
- ☐ B) 2.49 N/m2
- ☐ C) 2500 N/m2
- ☐ D) 0.004 N/m2
- ☐ E) 0.025 N/m2

---

28 In a gymnastics routine, an elastic band is pulled with a force of 320 N to the left and an opposing force of 180 N to the right along the same straight line. Calculate the resultant force acting on the elastic band.

(1)

---

29 Leah holds an object of mass 250 g on Earth, where the gravitational field strength is 10 N/kg. Calculate its weight in N.

- ☐ A) 25 N
- ☐ B) 2.5 N
- ☐ C) 2500 N
- ☐ D) 0.25 N
- ☐ E) 0.025 N

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30 A machine does 240 J of work moving an object 4 m in the direction of the force. Calculate the force in N.

- [ ] A) 244 N
- [ ] B) 600 N
- [ ] C) 960 N
- [ ] D) 60 N
- [ ] E) 236 N

---

31 What is the unit of potential difference?

- [ ] A) hertz (Hz)
- [ ] B) ampere (A)
- [ ] C) newton (N)
- [ ] D) degree Celsius
- [ ] E) volt (V)

---

32 A person weighing 500 N is standing on a single wooden plank. Use the equation: pressure = force / area. The area of the plank in contact with the ground is 0.4 m^2. Calculate the pressure exerted on the ground.

(1)

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33 A see-saw is balanced. Chloe (weight 600 N) sits 2 m from the pivot. Tara sits 2.4 m from the pivot on the other side. Calculate Tara's weight in N.

- [ ] A) 500 N
- [ ] B) 600 N
- [ ] C) 1200 N
- [ ] D) 720 N
- [ ] E) 2880 N

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34 An appliance transfers 2400 J of energy in 8 s. Calculate its power in W.

- [ ] A) 3000 W
- [ ] B) 30 W
- [ ] C) 300 W
- [ ] D) 2392 W
- [ ] E) 19200 W

---

35 The pressure on a surface is 1000 N/m2 and the area is 0.1 m². Calculate the force in N.

- [ ] A) 10 N
- [ ] B) 100 N
- [ ] C) 1000 N
- [ ] D) 10000 N
- [ ] E) 1000.1 N

---

36 A tractor pulls with a constant force of 60 N through a distance of 25 m. Calculate the work done in J.

- [ ] A) 35 J
- [ ] B) 2.4 J
- [ ] C) 15000 J
- [ ] D) 85 J
- [ ] E) 1500 J

---

37 A spring extends by 10 cm under a force of 20 N. Assuming it obeys Hooke's law, calculate its extension under a force of 40 N, in cm.

- [ ] A) 30 cm
- [ ] B) 20 cm
- [ ] C) 5 cm
- [ ] D) 200 cm
- [ ] E) 80 cm

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38 Which quantity is measured in the ampere?

- [ ] A) force
- [ ] B) electric current
- [ ] C) frequency
- [ ] D) resistance
- [ ] E) potential difference

---

39 A spring stretches by 6 cm when a force of 6 N is applied (it has not passed its limit of proportionality). Calculate the force needed per centimetre of extension, in N/cm.

- [ ] A) 12 N/cm
- [ ] B) 36 N/cm
- [ ] C) 0.1 N/cm
- [ ] D) 1 N/cm
- [ ] E) 10 N/cm

---

40 A see-saw is balanced. Omar (weight 300 N) sits 1.5 m from the pivot. George sits 0.9 m from the pivot on the other side. Calculate George's weight in N.

- [ ] A) 300 N
- [ ] B) 405 N
- [ ] C) 500 N
- [ ] D) 180 N
- [ ] E) 450 N

---

41 A 200 W appliance is switched on for 30 s. Calculate the energy transferred in J.

- [ ] A) 6000 J
- [ ] B) 0.15 J
- [ ] C) 60000 J
- [ ] D) 600 J
- [ ] E) 230 J

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42 A concrete block rests on the ground and presses down with a force of 2500 N on an area of 0.5 m². Calculate the pressure on the ground in N/m2.

- [ ] A) 500 N/m2
- [ ] B) 5000 N/m2
- [ ] C) 2499.5 N/m2
- [ ] D) 50000 N/m2
- [ ] E) 1250 N/m2

---

43 Tara has a mass of 10 kg. The gravitational field strength on the Moon is 1.6 N/kg. Calculate the weight on the Moon in N.

- [ ] A) 16 N
- [ ] B) 100 N
- [ ] C) 0.16 N
- [ ] D) 10 N
- [ ] E) 6.25 N

---

44 Kofi lifts a box of mass 15 kg through a height of 10 m at a steady speed. The gravitational field strength is 10 N/kg. Calculate the work done against gravity in J.

- [ ] A) 3000 J
- [ ] B) 15 J
- [ ] C) 150 J
- [ ] D) 1500 J
- [ ] E) 15000 J

---

45 What is the unit of pressure?

- [ ] A) hertz (Hz)
- [ ] B) newton (N)
- [ ] C) pascal (Pa)
- [ ] D) degree Celsius
- [ ] E) kilogram (kg)

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46 A force of 200 N is applied at a perpendicular distance of 10 cm from a pivot. Calculate the moment in N m.

- [ ] A) 2000 N m
- [ ] B) 2 N m
- [ ] C) 200 N m
- [ ] D) 200.1 N m
- [ ] E) 20 N m

---

47 A spring is 25.8 cm long under a 2 N load and 27 cm long under a 5 N load (within its limit of proportionality). Calculate its natural length (with no load) in cm.

- [ ] A) 24.6 cm
- [ ] B) 23.8 cm
- [ ] C) 25.8 cm
- [ ] D) 1.2 cm
- [ ] E) 25 cm

---

48 A see-saw is balanced. Aisha (weight 300 N) sits 1.5 m from the pivot. Nina (weight 100 N) sits on the other side. Calculate Nina's distance from the pivot in m.

- [ ] A) 3 m
- [ ] B) 4.5 m
- [ ] C) 0.5 m
- [ ] D) 1.5 m
- [ ] E) 450 m

---

49 A 60 W appliance is switched on for 5 minutes. Calculate the energy transferred in J.

- [ ] A) 360 J
- [ ] B) 300 J
- [ ] C) 180000 J
- [ ] D) 18000 J
- [ ] E) 0.2 J

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50 A crate rests on the ground and presses down with a force of 100 N on an area of 2 m². Calculate the pressure on the ground in N/m2.

- [ ] A) 50 N/m2
- [ ] B) 500 N/m2
- [ ] C) 200 N/m2
- [ ] D) 98 N/m2
- [ ] E) 0.02 N/m2

---

51 A parcel that weighs 800 N on Earth, where the gravitational field strength is 10 N/kg. Calculate its mass in kg.

- [ ] A) 800 kg
- [ ] B) 8000 kg
- [ ] C) 80 kg
- [ ] D) 160 kg
- [ ] E) 8 kg

---

52 A tractor pulls with a constant force of 20 N through a distance of 15 m. Calculate the work done in kJ.

- [ ] A) 0.3 kJ
- [ ] B) 3 kJ
- [ ] C) 300 kJ
- [ ] D) 0.03 kJ
- [ ] E) 300000 kJ

---

53 Food stores energy as

- [ ] A) gravitational potential energy
- [ ] B) elastic potential energy
- [ ] C) thermal energy
- [ ] D) light energy
- [ ] E) chemical energy

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54 In a tug of war, Team A pulls with a force of 850 N and Team B pulls with a force of 720 N in the opposite direction, along the same straight line.

(a) Calculate the resultant force acting on the rope. **(2)**

.....

(b) State which team will win the tug of war, and in which direction the rope will accelerate. **(1)**

---

55 Which of these describes tension?

- ☐ A) the pull of the Earth on an object
- ☐ B) the upward force of water on a floating object
- ☐ C) the force that opposes motion between two touching surfaces
- ☐ D) the pulling force in a stretched rope
- ☐ E) the force of air on a moving object

---

56 In which device is the main useful energy transfer electrical to light (and heat)?

- ☐ A) microphone
- ☐ B) filament lamp
- ☐ C) torch battery
- ☐ D) solar cell
- ☐ E) generator

---

57 What is the unit of electric current?

- ☐ A) joule (J)
- ☐ B) hertz (Hz)
- ☐ C) watt (W)
- ☐ D) ampere (A)
- ☐ E) degree Celsius

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58 In a horse-pulling competition, a cart is pulled by a horse with 1500 N while a resistance force of 800 N acts against it. Calculate the resultant force.

(1)

---

59 A spring extends by 8 cm under a force of 16 N. Assuming it obeys Hooke's law, calculate its extension under a force of 6 N, in cm.

- ☐ A) 12 cm
- ☐ B) 30 cm
- ☐ C) 6 cm
- ☐ D) 0.3 cm
- ☐ E) 3 cm

---

60 An appliance transfers 480 J of energy in 8 s. Calculate its power in W.

- ☐ A) 60 W
- ☐ B) 3840 W
- ☐ C) 600 W
- ☐ D) 6 W
- ☐ E) 472 W

---

61 A crate rests on the ground and presses down with a force of 2 N on an area of 0.01 m^2. Calculate the pressure on the ground in N/m2.

- ☐ A) 0.005 N/m2
- ☐ B) 200 N/m2
- ☐ C) 2000 N/m2
- ☐ D) 1.99 N/m2
- ☐ E) 0.02 N/m2

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62 An object weighs 2.5 N on Earth, where the gravitational field strength is 10 N/kg. Calculate its mass in grams.

- ☐ A) 2500 g
- ☐ B) 25 g
- ☐ C) 25000 g
- ☐ D) 250 g
- ☐ E) 0.25 g

---

63 A shopping trolley of mass 25 kg is pushed by Aisha with a resultant force of 40 N. Use the equation: force = mass x acceleration.

(a) Calculate the acceleration of the trolley. **(2)**

.....

(b) Aisha then loads the trolley with shopping, doubling its total mass to 50 kg, but keeps pushing with the same resultant force of 40 N. Calculate the new acceleration. **(2)**

.....

(c) State what your answers to (a) and (b) show about the relationship between mass and acceleration when the resultant force stays the same. **(1)**

---

64 Which of these is a non-contact force?

- ☐ A) tension
- ☐ B) upthrust
- ☐ C) gravity
- ☐ D) a push
- ☐ E) reaction force

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65 A ball held above the ground stores energy as

- [ ] A) elastic potential energy
- [ ] B) kinetic energy
- [ ] C) thermal energy
- [ ] D) sound energy
- [ ] E) gravitational potential energy

---

66 In which device is the main useful energy transfer light to electrical?

- [ ] A) solar cell
- [ ] B) filament lamp
- [ ] C) toaster
- [ ] D) torch battery
- [ ] E) electric motor

---

67 Which quantity is measured in the joule?

- [ ] A) temperature
- [ ] B) force
- [ ] C) energy
- [ ] D) mass
- [ ] E) resistance

---

68 A boulder has a mass of 250 kg. Calculate its weight on Earth. Use the equation: weight = mass x gravitational field strength, and take gravitational field strength g = 10 N/kg.

(1)

---

69 A spring extends by 4 cm under a force of 8 N. Assuming it obeys Hooke's law, calculate its extension under a force of 24 N, in cm.

- [ ] A) 20 cm
- [ ] B) 120 cm
- [ ] C) 16 cm
- [ ] D) 12 cm
- [ ] E) 48 cm

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70 A see-saw is balanced. Priya (weight 150 N) sits 1.5 m from the pivot. Dev (weight 750 N) sits on the other side. Calculate Dev's distance from the pivot in m.

- [ ] A) 7.5 m
- [ ] B) 0.3 m
- [ ] C) 225 m
- [ ] D) 1.5 m
- [ ] E) 0.2 m

---

71 An appliance transfers 10800 J of energy in 3 minutes. Calculate its power in W.

- [ ] A) 6 W
- [ ] B) 3600 W
- [ ] C) 1944000 W
- [ ] D) 600 W
- [ ] E) 60 W

---

72 A paving slab rests on the ground and presses down with a force of 10 N on an area of 0.01 m^2. Calculate the pressure on the ground in N/m2.

- [ ] A) 0.001 N/m2
- [ ] B) 10000 N/m2
- [ ] C) 1000 N/m2
- [ ] D) 0.1 N/m2
- [ ] E) 9.99 N/m2

---

73 An astronaut leaves a toolbox that weighs 192 N on the Moon, where the gravitational field strength is 1.6 N/kg. Calculate its mass in kg.

- [ ] A) 19.2 kg
- [ ] B) 307.2 kg
- [ ] C) 192 kg
- [ ] D) 1200 kg
- [ ] E) 120 kg

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74 A tractor pulls with a constant force of 40 N through a distance of 8 m. Calculate the work done in J.

- [ ] A) 0.2 J
- [ ] B) 5 J
- [ ] C) 48 J
- [ ] D) 320 J
- [ ] E) 32 J

---

75 Which of these is a non-contact force?

- [ ] A) a push
- [ ] B) magnetic force
- [ ] C) tension
- [ ] D) reaction force
- [ ] E) friction

---

76 A stretched elastic band stores energy as

- [ ] A) elastic potential energy
- [ ] B) kinetic energy
- [ ] C) thermal energy
- [ ] D) gravitational potential energy
- [ ] E) chemical energy

---

77 What is the name of the upward push of a table on a book resting on it?

- [ ] A) tension
- [ ] B) reaction force
- [ ] C) weight
- [ ] D) air resistance
- [ ] E) friction

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78 In which device is the main useful energy transfer electrical to sound?

- [ ] A) filament lamp
- [ ] B) solar cell
- [ ] C) loudspeaker
- [ ] D) microphone
- [ ] E) torch battery

---

79 Which quantity is measured in the pascal?

- [ ] A) mass
- [ ] B) power
- [ ] C) electric current
- [ ] D) pressure
- [ ] E) energy

---

80 A spring is 11 cm long under a 1 N load and 13 cm long under a 3 N load (within its limit of proportionality). Calculate its natural length (with no load) in cm.

- [ ] A) 10 cm
- [ ] B) 2 cm
- [ ] C) 100 cm
- [ ] D) 11 cm
- [ ] E) 9 cm

---

81 A force of 20 N acts at a perpendicular distance of 1.5 m from a pivot. Calculate the moment in N m.

- [ ] A) 300 N m
- [ ] B) 21.5 N m
- [ ] C) 0.075 N m
- [ ] D) 18.5 N m
- [ ] E) 30 N m

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82 A uniform beam is pivoted at its centre. A force of 60 N pushes down on the beam at a distance of 0.5 m from the pivot, on the left-hand side.

(a) Calculate the force, F, that must be applied at a distance of 0.3 m from the pivot on the right-hand side for the beam to balance. Use the equation: moment = force x distance from pivot. **(3)**

.....

(b) State the rule (law of moments) used to answer part (a). **(1)**

---

83 An appliance of power 60 W transfers 2400 J of energy. Calculate the time taken in s.

- ☐ A) 2340 s
- ☐ B) 0.025 s
- ☐ C) 144000 s
- ☐ D) 400 s
- ☐ E) 40 s

---

84 A paving slab rests on the ground and presses down with a force of 25 N on an area of 0.5 m². Calculate the pressure on the ground in N/m2.

- ☐ A) 12.5 N/m2
- ☐ B) 24.5 N/m2
- ☐ C) 50 N/m2
- ☐ D) 500 N/m2
- ☐ E) 0.02 N/m2

---

85 A parcel that weighs 900 N on Earth, where the gravitational field strength is 10 N/kg. Calculate its mass in kg.

- ☐ A) 9000 kg
- ☐ B) 90 kg
- ☐ C) 9 kg
- ☐ D) 900 kg
- ☐ E) 100 kg

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86 Marcus lifts a box of mass 40 kg through a height of 5 m at a steady speed. The gravitational field strength is 10 N/kg. Calculate the work done against gravity in J.

- [ ] A) 2000 J
- [ ] B) 200 J
- [ ] C) 400 J
- [ ] D) 20000 J
- [ ] E) 80 J

---

87 A falling apple is gaining

- [ ] A) gravitational potential energy
- [ ] B) sound energy
- [ ] C) elastic potential energy
- [ ] D) kinetic energy
- [ ] E) thermal energy

---

88 What is the name of the force that opposes motion between two touching surfaces?

- [ ] A) upthrust
- [ ] B) tension
- [ ] C) friction
- [ ] D) reaction force
- [ ] E) air resistance

---

89 What is the useful energy transfer in a torch battery?

- [ ] A) chemical to electrical
- [ ] B) electrical to light (and heat)
- [ ] C) electrical to kinetic
- [ ] D) sound to electrical
- [ ] E) kinetic to electrical

---

90 A power drill develops 500 W of power. Calculate how long it would take to do 12500 J of work. Use the equation: power = work done / time taken.

(1)

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91 Priya and Tom sit on a seesaw that is pivoted at its centre. Priya has a weight of 400 N and sits 1.5 m from the pivot. Tom has a weight of 500 N.

(a) Calculate the distance from the pivot at which Tom must sit for the seesaw to balance. **(4)**

(b) Tom then moves to sit 1.4 m from the pivot, without changing his weight. State, with a calculation, what will happen to the seesaw. **(1)**

---

92 A spring extends by 4 cm under a force of 20 N. Assuming it obeys Hooke's law, calculate its extension under a force of 75 N, in cm.

- ☐ A) 59 cm
- ☐ B) 15 cm
- ☐ C) 150 cm
- ☐ D) 375 cm
- ☐ E) 55 cm

---

93 An appliance transfers 5000 J of energy in 5 s. Calculate its power in W.

- ☐ A) 10000 W
- ☐ B) 1000 W
- ☐ C) 0.001 W
- ☐ D) 25000 W
- ☐ E) 4995 W

---

94 A force of 10000 N produces a pressure of 5000 N/m2. Calculate the area in m2.

- ☐ A) 50000000 m^2
- ☐ B) 0.5 m^2
- ☐ C) 20 m^2
- ☐ D) 0.2 m^2
- ☐ E) 2 m^2

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95 An object weighs 25 N on Earth, where the gravitational field strength is 10 N/kg. Calculate its mass in grams.

- [ ] A) 2500 g
- [ ] B) 250000 g
- [ ] C) 250 g
- [ ] D) 2.5 g
- [ ] E) 25000 g

---

96 A horse pulls with a constant force of 100 N through a distance of 8 m. Calculate the work done in J.

- [ ] A) 108 J
- [ ] B) 12.5 J
- [ ] C) 0.08 J
- [ ] D) 800 J
- [ ] E) 92 J

---

97 Which of these is NOT a contact force?

- [ ] A) upthrust
- [ ] B) tension
- [ ] C) reaction force
- [ ] D) friction
- [ ] E) gravity

---

98 A spring stretches by 4 cm when a force of 16 N is applied (it has not passed its limit of proportionality). Calculate the force needed per centimetre of extension, in N/cm.

- [ ] A) 12 N/cm
- [ ] B) 4 N/cm
- [ ] C) 64 N/cm
- [ ] D) 20 N/cm
- [ ] E) 0.25 N/cm

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99 A see-saw is balanced. Nina (weight 250 N) sits 2 m from the pivot. Ella sits 1 m from the pivot on the other side. Calculate Ella's weight in N.

- [ ] A) 5000 N
- [ ] B) 250 N
- [ ] C) 50 N
- [ ] D) 500 N
- [ ] E) 125 N

---

100 Olivia wants to find the density of a small stone. The stone has a mass of 45 g.

(a) Describe how Olivia could use a measuring cylinder of water to find the volume of the stone. **(2)**

(b) The initial volume of water was 40 cm^3. After lowering the stone in, the new volume was 55 cm^3. Calculate the volume of the stone. **(1)**

(c) Calculate the density of the stone, giving your answer in g/cm^3. Use the equation: density = mass / volume. **(2)**

---

101 A metal block rests on the ground and presses down with a force of 12.5 N on an area of 0.25 m^2. Calculate the pressure on the ground in N/m2.

- [ ] A) 50 N/m2
- [ ] B) 3.125 N/m2
- [ ] C) 0.02 N/m2
- [ ] D) 12.25 N/m2
- [ ] E) 500 N/m2

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102 A parcel that weighs 40 N on Earth, where the gravitational field strength is 10 N/kg. Calculate its mass in kg.

- [ ] A) 0.4 kg
- [ ] B) 0.25 kg
- [ ] C) 40 kg
- [ ] D) 400 kg
- [ ] E) 4 kg

---

103 A machine does 120 J of work moving an object 2 m in the direction of the force. Calculate the force in N.

- [ ] A) 240 N
- [ ] B) 118 N
- [ ] C) 122 N
- [ ] D) 60 N
- [ ] E) 600 N

---

104 A compressed spring stores energy as

- [ ] A) elastic potential energy
- [ ] B) light energy
- [ ] C) chemical energy
- [ ] D) gravitational potential energy
- [ ] E) thermal energy

---

105 What is the name of the pulling force in a stretched rope?

- [ ] A) upthrust
- [ ] B) tension
- [ ] C) weight
- [ ] D) reaction force
- [ ] E) magnetic force

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106 In which device is the main useful energy transfer kinetic to electrical?

- [ ] A) electric motor
- [ ] B) microphone
- [ ] C) generator
- [ ] D) torch battery
- [ ] E) solar cell

---

107 An elevator does 96000 J of work lifting passengers 20 seconds. Calculate the power output of the elevator motor. Use the equation: power = work done / time taken.

(1)

---

108 A spring extends by 5 cm under a force of 12.5 N. Assuming it obeys Hooke's law, calculate its extension under a force of 22.5 N, in cm.

- [ ] A) 10 cm
- [ ] B) 56.25 cm
- [ ] C) 9 cm
- [ ] D) 15 cm
- [ ] E) 90 cm

---

109 A force of 150 N acts at a perpendicular distance of 3 m from a pivot. Calculate the moment in N m.

- [ ] A) 450 N m
- [ ] B) 50 N m
- [ ] C) 147 N m
- [ ] D) 0.02 N m
- [ ] E) 153 N m

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110 A toaster has a power of 2.5 kW and is used for 5 minutes. Calculate the energy transferred in kJ.

- [ ] A) 7500 kJ
- [ ] B) 750 kJ
- [ ] C) 12500 kJ
- [ ] D) 750000 kJ
- [ ] E) 12.5 kJ

---

111 The pressure on a surface is 50 N/m2 and the area is 0.05 m². Calculate the force in N.

- [ ] A) 1000 N
- [ ] B) 25 N
- [ ] C) 0.001 N
- [ ] D) 2.5 N
- [ ] E) 50.05 N

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Mark scheme · 3.3 Physics: Forces and Energy: 2-hour Pack

Question 1

B (kilogram (kg)) **B1**

Answer: B) kilogram (kg)

Question 2

240000 J (oe) **B1**

Answer: 240000 J

Question 3

A (18.2 cm) **B1**

Answer: A) 18.2 cm

Question 4

C (200 N) **B1**

Answer: C) 200 N

Question 5

D (40 s) **B1**

Answer: D) 40 s

Question 6

E (20 N/m2) **B1**

Answer: E) 20 N/m2

Question 7

D (1.5 kJ) **B1**

Answer: D) 1.5 kJ

Question 8

A (magnetic force) **B1**

Answer: A) magnetic force

Question 9

E (20 m) **B1**

Answer: E) 20 m

Question 10

C (light to electrical) **B1**

Answer: C) light to electrical

Question 11

A (hertz (Hz)) **B1**

Answer: A) hertz (Hz)

Question 12

4 J (oe) **B1**

Answer: 4 J

Question 13

C (90 N m) **B1**

Answer: C) 90 N m

Question 14

E (40 W) **B1**

Answer: E) 40 W

Question 15

B (5000 N/m2) **B1**

Answer: B) 5000 N/m2

Question 16

D (10 kg) **B1**

Answer: D) 10 kg

Question 17

E (12 kJ) **B1**

Answer: E) 12 kJ

Question 18

A (electrical to thermal) **B1**

Answer: A) electrical to thermal

Question 19

C (500 W) **B1**

Answer: C) 500 W

Question 20

B (100 N/m2) **B1**

Answer: B) 100 N/m2

Question 21

A (168 N) **B1**

Answer: A) 168 N

Question 22

C (2.5 kJ) **B1**

Answer: C) 2.5 kJ

Question 23

B (potential difference) **B1**

Answer: B) potential difference

Question 24

304 J (oe) **B1**

Answer: 304 J

Question 25

E (3 cm) **B1**

Answer: E) 3 cm

Question 26

C (6000 J) **B1**

Answer: C) 6000 J

Question 27

A (250 N/m2) **B1**

Answer: A) 250 N/m2

Question 28

140 N (oe) **B1**

Answer: 140 N

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Question 29

B (2.5 N) **B1**

Answer: B) 2.5 N

Question 30

D (60 N) **B1**

Answer: D) 60 N

Question 31

E (volt (V)) **B1**

Answer: E) volt (V)

Question 32

1250 Pa (oe) **B1**

Answer: 1250 Pa

Question 33

A (500 N) **B1**

Answer: A) 500 N

Question 34

C (300 W) **B1**

Answer: C) 300 W

Question 35

B (100 N) **B1**

Answer: B) 100 N

Question 36

E (1500 J) **B1**

Answer: E) 1500 J

Question 37

B (20 cm) **B1**

Answer: B) 20 cm

Question 38

B (electric current) **B1**

Answer: B) electric current

Question 39

D (1 N/cm) **B1**

Answer: D) 1 N/cm

Question 40

C (500 N) **B1**

Answer: C) 500 N

Question 41

A (6000 J) **B1**

Answer: A) 6000 J

Question 42

B (5000 N/m2) **B1**

Answer: B) 5000 N/m2

Question 43

A (16 N) **B1**

Answer: A) 16 N

Question 44

D (1500 J) **B1**

Answer: D) 1500 J

Question 45

C (pascal (Pa)) **B1**

Answer: C) pascal (Pa)

Question 46

E (20 N m) **B1**

Answer: E) 20 N m

Question 47

E (25 cm) **B1**

Answer: E) 25 cm

Question 48

B (4.5 m) **B1**

Answer: B) 4.5 m

Question 49

D (18000 J) **B1**

Answer: D) 18000 J

Question 50

A (50 N/m2) **B1**

Answer: A) 50 N/m2

Question 51

C (80 kg) **B1**

Answer: C) 80 kg

Question 52

A (0.3 kJ) **B1**

Answer: A) 0.3 kJ

Question 53

E (chemical energy) **B1**

Answer: E) chemical energy

Question 54

(a) 850 - 720 **M1**

(a) 130 N, cao **A1**

(a) Answer: 130 N

(b) Team A, and the rope accelerates towards Team A, because their pulling force is larger, oe **B1**

(b) Answer: Team A will win; the rope accelerates towards Team A because their force is larger.

Question 55

D (the pulling force in a stretched rope) **B1**

Answer: D) the pulling force in a stretched rope

Question 56

B (filament lamp) **B1**

Answer: B) filament lamp

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Question 57

D (ampere (C)) **B1**

Answer: D) ampere (A)

Question 58

700 N (oe) **B1**

Answer: 700 N

Question 59

E (3 cm) **B1**

Answer: E) 3 cm

Question 60

A (60 W) **B1**

Answer: A) 60 W

Question 61

B (200 N/m2) **B1**

Answer: B) 200 N/m2

Question 62

D (250 g) **B1**

Answer: D) 250 g

Question 63

(a) a = F / m, so 40 / 25 **M1**

(a) 1.6 m/s^2, cao **A1**

(a) Answer: 1.6 m/s^2

(b) a = 40 / 50 **M1**

(b) 0.8 m/s^2, cao **A1**

(b) Answer: 0.8 m/s^2

(c) for a constant resultant force, acceleration decreases as mass increases (acceleration is inversely proportional to mass), oe **B1**

(c) Answer: Acceleration decreases as mass increases; acceleration is inversely proportional to mass for a fixed resultant force.

Question 64

C (gravity) **B1**

Answer: C) gravity

Question 65

E (gravitational potential energy) **B1**

Answer: E) gravitational potential energy

Question 66

A (solar cell) **B1**

Answer: A) solar cell

Question 67

C (energy) **B1**

Answer: C) energy

Question 68

2500 N (oe) **B1**

Answer: 2500 N

Question 69

D (12 cm) **B1**

Answer: D) 12 cm

Question 70

B (0.3 m) **B1**

Answer: B) 0.3 m

Question 71

E (60 W) **B1**

Answer: E) 60 W

Question 72

C (1000 N/m2) **B1**

Answer: C) 1000 N/m2

Question 73

E (120 kg) **B1**

Answer: E) 120 kg

Question 74

D (320 J) **B1**

Answer: D) 320 J

Question 75

B (magnetic force) **B1**

Answer: B) magnetic force

Question 76

A (elastic potential energy) **B1**

Answer: A) elastic potential energy

Question 77

B (reaction force) **B1**

Answer: B) reaction force

Question 78

C (loudspeaker) **B1**

Answer: C) loudspeaker

Question 79

D (pressure) **B1**

Answer: D) pressure

Question 80

A (10 cm) **B1**

Answer: A) 10 cm

Question 81

E (30 N m) **B1**

Answer: E) 30 N m

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Question 82

(a) moment of 60 N force = 60 x 0.5 (= 30 Nm) **M1**

(a) set the two moments equal, F x 0.3 = 30, and rearrange for F **dM1**

(a) 100 N, cao **A1**

(a) Answer: 100 N

(b) for a beam in equilibrium (balanced), the total clockwise moment about the pivot equals the total anticlockwise moment, oe **B1**

(b) Answer: When a beam is balanced, the sum of the clockwise moments about the pivot equals the sum of the anticlockwise moments.

Question 83

E (40 s) **B1**

Answer: E) 40 s

Question 84

C (50 N/m2) **B1**

Answer: C) 50 N/m2

Question 85

B (90 kg) **B1**

Answer: B) 90 kg

Question 86

A (2000 J) **B1**

Answer: A) 2000 J

Question 87

D (kinetic energy) **B1**

Answer: D) kinetic energy

Question 88

C (friction) **B1**

Answer: C) friction

Question 89

A (chemical to electrical) **B1**

Answer: A) chemical to electrical

Question 90

25 s (oe) **B1**

Answer: 25 s

Question 91

(a) Priya's moment = 400 x 1.5 (= 600 Nm) **M1**

(a) set up Tom's moment equal to Priya's, 500 x d = 600 **M1**

(a) rearrange, d = 600 / 500 **dM1**

(a) 1.2 m, cao **A1**

(a) Answer: 1.2 m

(b) Tom's side goes down, because his new moment (500 x 1.4 = 700 Nm) is now greater than Priya's moment (600 Nm), ft **B1**

(b) Answer: Tom's side goes down, since his new moment, 500 N x 1.4 m = 700 Nm, is now greater than Priya's 600 Nm.

Question 92

B (15 cm) **B1**

Answer: B) 15 cm

Question 93

B (1000 W) **B1**

Answer: B) 1000 W

Question 94

E (2 m^2) **B1**

Answer: E) 2 m^2

Question 95

A (2500 g) **B1**

Answer: A) 2500 g

Question 96

D (800 J) **B1**

Answer: D) 800 J

Question 97

E (gravity) **B1**

Answer: E) gravity

Question 98

B (4 N/cm) **B1**

Answer: B) 4 N/cm

Question 99

D (500 N) **B1**

Answer: D) 500 N

Question 100

(a) partly fill the measuring cylinder with water and record the initial volume reading, oe **B1**

(a) carefully lower the stone into the water so it is fully submerged, record the new (higher) volume reading, and subtract the initial reading from the new reading to find the volume of the stone (displacement method), oe **B1**

(a) Answer: Record the initial volume of water in the cylinder, lower the stone in until fully submerged, record the new volume, then subtract the initial volume from the new volume to find the volume of the stone.

(b) 15 cm^3, cao **B1**

(b) Answer: 15 cm^3

(c) 45 / their (b) **M1**

(c) 3 g/cm^3, cao, ft from (b) **A1**

(c) Answer: 3 g/cm^3

Question 101

A (50 N/m2) **B1**

Answer: A) 50 N/m2

Question 102

E (4 kg) **B1**

Answer: E) 4 kg

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Question 103

D (60 N) **B1**

Answer: D) 60 N

Question 104

A (elastic potential energy) **B1**

Answer: A) elastic potential energy

Question 105

B (tension) **B1**

Answer: B) tension

Question 106

C (generator) **B1**

Answer: C) generator

Question 107

4800 W (oe) **B1**

Answer: 4800 W

Question 108

C (9 cm) **B1**

Answer: C) 9 cm

Question 109

A (450 N m) **B1**

Answer: A) 450 N m

Question 110

B (750 kJ) **B1**

Answer: B) 750 kJ

Question 111

D (2.5 N) **B1**

Answer: D) 2.5 N

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