Energy revision questions NI 1-33 Answers

1. Any **three** from: coal, oil, (natural) gas, lignite, peat (turf).
2. Sound, electricity and heat are energy forms. The others are not forms of energy.
3. Hydroelectricity, wind and tides are renewable. Gas, oil and coal are non-renewable.
4. The solar cells change **light** energy into **electrical energy**. The battery stores **chemical** energy. As the propellers turn they change **electrical** energy into useful **kinetic** energy. As the model aircraft gains height, it gains **gravitational potential** energy. The model aircraft crashes into the ground. As it does so, it produces wasted heat and **sound** energy.
5. Renewable resources are in limitless supply because they are replaced by nature in less than a human lifetime.
6.
   - Both use water to produce steam which drives a turbine.
   - A nuclear power station uses fission of uranium to produce heat and the waste products are dangerously radioactive.
   - A fossil fuel power station burns fossil fuels to produce heat. One of the waste products, carbon dioxide, is a major contributor to global warming.
7. The waste will be dangerously radioactive for a very long time and there can be no guarantee that it will not leak. There is also the possibility of seismic activity (earthquakes) bringing it to the surface.
8. Carbon dioxide.
9. Prevailing winds blow sulphur dioxide from Britain to Norway.
10. See table and text on pages 39–40.
11. See table and text on pages 39–40.
12. Open-cast mining for lignite would ruin the beauty of a naturally very attractive area.
13. See text on pages 37 and 40.
14. Conserve fossil fuels, wind is renewable, less atmospheric pollution leading to global warming.
15. The materials used to generate electricity (fossil fuels and uranium) themselves produce very polluting waste products.
16.

Device/situation	**Input energy form**		**Useful output energy form**
Microphone	sound energy	→	electrical energy
Electric smoothing iron	**electrical** energy	→	**heat** energy
Loudspeaker	**electrical** energy	→	**sound** energy
Coal burning in an open fire	**chemical** energy	→	**heat** energy
A weight falling towards the ground	**gravitational potential** energy	→	**kinetic** energy
A candle flame	**chemical** energy	→	**heat** energy and **light** energy
Battery-powered electric drill	**chemical** energy →	electrical energy →	**kinetic** energy

17. work (in J) = Force (in N) x distance (in m) = (100 x 10)N x 5.5m = 5500J
18. work (in J) = Force (in N) x distance (in m) = 60N x 20m = 1200J
19. **a)** $\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} = \frac{750}{1000} = 0.75$

    b) Heat is lost to the metal of the boiler, to the surroundings and in the hot smoke through the chimney. Sound is lost to the environment.

20. $\text{efficiency} = \dfrac{\text{useful energy output}}{\text{total energy input}}$

Since, by the Law of Conservation of Energy, energy is neither created nor destroyed, the useful energy output can never be greater than the total energy input.

21. $\text{efficiency} = \dfrac{\text{useful energy output}}{\text{total energy input}}$

$0.28 = \dfrac{140\,000}{\text{total energy input}}$

$\text{total (chemical) energy input} = \dfrac{140\,000}{0.28} = 500\,000\text{kJ}$

22. energy (in J) = power (in W) x time (in s) = 3600W x (5 x 60)s
= 1 080 000 J

23. a) weight = mg = 1500kg x 10N/kg = 15 000N

b) work = force x distance = 15 000N x 12m = 180 000J

c) $\text{time (in s)} = \dfrac{\text{work (in J)}}{\text{power (in W)}} = \dfrac{180000}{3000} = 60\text{s}$

d) $\text{speed (in m/s)} = \dfrac{\text{distance (in m)}}{\text{time (in s)}} = \dfrac{12}{60} = 0.2\text{m/s}$

24. a) work (in J) = force (in N) x distance (in m) = 1000N x 0.4m = 400J

b) $\text{efficiency} = \dfrac{\text{useful energy output}}{\text{total energy input}} = \dfrac{400}{1200} = 0.33$

25. KE = ½ mv^2 = ½ x 120 x 3000^2 = 540 000 000 J

26. GPE of rubber = mgh = 0.050 kg x 10 N/kg x 280 m = 140 J
KE of shell = ½ mv^2 = 0.5 x 0.010 x 150^2 = 112.5 J
Comment: if energy losses are ignored, KE of shell is less than that of rubber as it hits the ground.

27. KE of tanker = ½ mv^2
200 000 000 = 0.5 x 100 000 000 x v^2
$v^2 = 4$
v = 2 m/s

28.

Height above ground in m	Gravitational potential energy in J	Kinetic energy in J	Total energy in J	Speed in m/s
5.0	**100**	0	100	0
4.0	**80**	**20**	**100**	4.47
3.2	64	**36**	**100**	**6.0**
1.8	**36**	64	**100**	**8.0**
0.0	0	**100**	**100**	**10.0**

29. KE of car = ½ mv^2
160 000 = 0.5 x 800 x v^2
$v^2 = 400$
v = 20 m/s = (20 x 60) metres/min = 1.2 km/min = 1.2 x 60 km/hr = 72 km/hr

30. GPE = mass x gravitational field strength x height
176 = 2 x g x 10
g = 176 ÷ 20 = 8.8 N/kg
By inspection of the table, the planet was Venus.

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31. a) KE (in J) as ball rises from ground = GPE of ball at its maximum height
10 J = 0.2 kg x 10 N/kg x height in metres
Height = 10 ÷ 2 = 5 metres

b) In practice, energy is lost as heat and sound against air resistance as the ball rises. So, not all of the KE of the ball is converted into GPE.

32. a) $\text{efficiency} = \dfrac{\text{useful energy output}}{\text{total energy input}} = \dfrac{(25-20)}{25} = 0.2$

b) The principle of Conservation of Energy.

33. a) useful energy output = efficiency x total energy input = 0.3 x 2000 = 600 J

b) total wasted energy = 2000 – 600 = 1400 J
wasted heat energy = 0.9 x total wasted energy = 0.9 x 1400 = 1260 J
percentage of the input energy lost as heat = (1260 ÷ 2000) x 100% = 63%